PROGRAM SELF-STUDY REPORT

FOR

ENVIRONMENTAL ENGINEERING

School of Civil Engineering and Environmental Science
College of Engineering
University of Oklahoma

Submitted to:

Accreditation Director
Accreditation Board for Engineering and Technology
111 Market Place, Suite 1050
Baltimore, MD 21202-401

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Acronyms

ABET- Accreditation Board for Engineering and Technology
ADA- Advising and Degree Audit
ASCE- American Society of Civil Engineers
CAB- Capstone Advisory Board
CDRP- Campus Departmental Review Panel
CE- Civil Engineering
CEC- Carson Engineering Center
CEES- School of Civil Engineering and Environmental Science
CoE- College of Engineering
ESSA- Environmental Science Student Association
FTE- Full-Time Equivalent
IDP- Instructional Development Program
OU- University of Oklahoma
PEOs- Program Educational Objectives
SPRC- Student Performance Review Committee
SRF- Salary Release Funds
SRI- Sponsored Research Incentive
TA- Teaching Assistantship
TSRC- Technology and Software review Committee
UC- University College
VC- Visiting Council
WSSC- Williams Student Services Center

PROGRAM SELF-STUDY REPORT FOR ENVIRONMENTAL ENGINEERING

A. BACKGROUND INFORMATION

1. Degree Titles

The Bachelor of Science in Environmental Engineering.

2. Program Modes

The program is primarily offered as on-campus day courses. However, select professional electives are offered at night and are also available via Intersession (compressed two to three week, 8-hour courses).

3. Actions to Correct Previous Deficiencies

During the 2000 review, one program concern was identified in Criterion 8. In the initial statement – " *The environmental program criteria required the program to demonstrate that graduates have a knowledge of fundamental concepts of a number of areas including: waste minimization and pollution prevention; an earth science; solid waste management; hazardous waste management; atmospheric systems and air pollution control; environmental and occupational health; and concepts of professional practice including the importance of professional registration and continuing education. There is no evidence that students are required to take any course work in these areas, and coverage of these topics in other courses is minimal or non-existent."*

The School of Civil Engineering and Environmental Science (CEES) was afforded 14 days to respond to the draft deficiency statement. CEES's response action was to modify the curriculum to require specific courses. In our response we noted that the curriculum in Environmental Engineering is structured to provide students with "breadth" and "depth". The breadth in environmental training is provided by the core engineering science courses and specific environmental engineering courses, predominantly CE 3213 – Water Resources Engineering, CE 3243 – Water and Wastewater Treatment, CE 4114 – Aquatic Chemistry, CE 4234 – Applied Environmental Microbiology, and CE 4903 – Capstone. The two environmental engineering courses (CE 3213 and CE 3243) attempt to provide introductory information on three critical areas, including most of those specified in the Program Criteria for Environmental Engineering. Depth in environmental training is provided through the technical electives courses available in CEES.

Our action plan to correct the missing gaps in curriculum was to require an additional core course: CE 4263 – Hazardous and Solid Waste Management. The content of the new required course was derived from two previous graduate level courses. CE 4263 ensures that students are exposed to waste minimization and pollution prevention (e.g., recycling, resource recovery, source reduction), solid waste management (e.g., collection, separation, deposal, regulations), hazardous waste management (e.g., identification, handling, treatment, disposal), atmospheric and air pollution control (e.g., atmospheric fate and transport, combustion, incineration), and environmental and occupational health (e.g., transport and fate in soils, toxicology).

In the final statement, it was noted that "*This part of the deficiency has been satisfied*" within the 14-day response period.

In addition to the program deficiency, the ABET reviewers noted four program concerns. The first concern related to the Program Educational Objectives. ABET noted, "*The program educational objectives are clearly defined in the self-study report and have been added to the Undergraduate Handbook. However, they cannot be found in the university General Catalog, the program's Web page, or in any of the program's recruiting literature*".

This concern was addressed by updating the recruiting literature as well as continually updating the CEES web-page (cees.ou.edu). CEES has developed a specific ABET web-page that clearly lists the school's program educational objectives and program outcomes.

The second concern related to the emphasis that CEES places on life-long learning. In the initial statement, "*Engineering programs must demonstrate that their graduates have recognition of the need for, and an ability to engage in life-long learning. There is no evidence in the Self-Study Report or in discussion with students that students receive any recognition of the need for life-long learning.*"

Through the efforts of the Accelerated BS/MS program as well as the intensity in which CEES faculty members pursue undergraduate research opportunities with students both regionally (Undergraduate Research Opportunities Program) and nationally (NSF's Research Experience for Undergraduates), it is difficult to understand how our aggressive program to encourage life-long learning was not conveyed by the group of students interviewed. CEES has maintained a high level of undergraduate research to encourage life-long learning, as well as expending some seminar time to provide students with announcements and advisories regarding graduate school opportunities. In addition, CEES requires that all undergraduate environmental engineering students take the Fundamentals of Engineering (FE) examination as a graduation requirement. Passing the FE is the first in a series of steps toward becoming a licensed Professional Engineer. This requirement certainly reinforces the importance we place on life-ling learning for our students.

The third concern related to the environmental teaching laboratory. The initial statement provided by ABET reviewers was that "*the Kerr undergraduate teaching laboratory, while providing much space, is poorly designed for a teaching lab and should be upgraded. In addition, the laboratory equipment in the Kerr lab consists almost entirely of previously discarded, salvaged equipment. Much of is antiquated or non-functional. Students are not provided the opportunity to use modern analytical equipment. This is a major point of concern by students, as evidenced by discussions with them and from reviewing their exit interviews. The laboratory technician is highly talented and creative in obtaining and refurbishing this equipment, but the student should have access to modern, functional laboratory equipment*." This concern combined with the final program concerned, noted in the initial statement "*The laboratories are adequate for instruction, but it appears this is only because faculty use resources that are intended for research in order to purchase and maintain teaching laboratories equipment. This is also true for funding for teaching assistants, travel, and new faculty start-up packages. Little institutional support is provided."*

As noted in our previous response, the absence of a budget line for laboratories acquisitions and operation has been a chronic concern for CEES. This concern has been relayed to the upper administrations of the University. In an effort to provide some support for teaching laboratories, CEES has continued its internal policy of returning a portion of indirect costs and all salary release funds to the faculty. These returned funds can be used to upgrade and support teaching laboratories. In addition, a portion of the computing course fees are now returned to the schools within the College of Engineering (CoE). These course fees are used to upgrade and maintain computing resources within CEES. Also, the Director of CEES uses funds from his endowed professorship to upgrade computing and laboratory resources in CEES.

Other Changes

In response to a directive from the Dean of the CoE, CEES revamped the undergraduate Environmental Engineering curriculum (Attachment 1) in the Fall of 2002. The impetus for curriculum reform and the process used are described in Appendix II.

B. ACCREDITATION SUMMARY

1. Students

Admission

All freshmen entering the University of Oklahoma (OU), including those with a declared major in Engineering, are first admitted to University College (UC), a non-degree granting college that specializes in advising first-year students and assisting with a successful transition from high school to college. OU Scholars advisers provide specialized advising to freshmen who are National Scholars, OU Scholars, and Honors College participants. The Director of the Williams Student Services Center (WSSC) meets with OU Scholars and UC staff monthly to be sure advisers are kept informed of issues related to advising CoE majors. UC and OU Scholars both host summer enrollment programs for incoming freshmen, and WSSC advisers participate in the designated Engineering enrollment sessions. Although freshman engineering majors are advised by UC and OU Scholars advisers, students are invited and encouraged to meet with WSSC advisers if they have questions or concerns; both UC and OU Scholars advisers frequently refer student questions directly to WSSC advisers. When a student has completed a minimum of 24 credit hours (excluding credit by advanced standing) with a 2.0 GPA or higher, and has officially declared an Engineering major, the student's records are transferred to CoE and the student is advised in the CoE. Orientation sessions are held each semester for students who will be advised in the CoE for the first time for the purpose of answering questions and explaining procedures and requirements.

All new freshmen with a declared major in Engineering are required to take ENGR 1410 and ENGR 1420 during their first year. These courses are also open to students with an interest in studying engineering but who may not yet have declared an engineering major. Students are provided with an extensive introduction to the engineering profession and to each of the engineering disciplines. This is for the purpose of helping students make a well-informed decision about a specific area of study and also to help them learn more about each of the engineering disciplines, and how each area of study can contribute to multidisciplinary problem-solving. ENGR 1410 and 1420 also have mentoring components in which every new freshman is assigned to a mentoring team led by an upperclass CoE student. These mentoring teams meet every week in the fall semester, as part of ENGR 1410, and a minimum of once a month during the spring semester. ENGR 1410 and 1420 also provide the opportunity for WSSC advisers to frequently interact with new engineering majors early in their student career.

Transfer Students

Students admitted to OU as transfer students (7 or more hours completed at another college or university after graduating from high school) who have fewer than 24 credit hours, are admitted to UC and advised as freshmen until they are eligible for admission to the CoE. Transfer students admitted to OU with 24 or more credit hours and a declared major in Engineering are admitted

directly to the CoE. Oklahoma residents are eligible for admission to the CoE upon admission to OU; nonresidents of Oklahoma must have a 3.0 GPA or higher to be admitted directly to the CoE. Each incoming transfer student meets first with a WSSC adviser to discuss general CoE academic policies and procedures; how their transfer credit has been evaluated; OU's General Education requirements, and to answer any questions related to their transition to OU and the College. Students are then referred to the School in which they have declared a major for more specific advising related to selecting engineering courses and pursuing a degree in a specific program.

New CoE transfer students are required to take ENGR 3410 during their first semester, which is intended to provide much of the same information as ENGR 1410 and ENGR 1420, but is designed for the more experienced college or university student. Topics include programs and opportunities specific to OU; undergraduate research opportunities; resumes and career services, and engagement in the CoE as an upperclass student. ENGR 3410 also has a mentoring component, with mentoring teams led by upperclass students who were themselves transfer students and who have a personal interest in helping transfer students successfully transition to OU.

Students who transfer to CoE from other OU degree-granting colleges also meet with WSSC advisers the first time they are advised in Engineering for the purpose of covering academic policies and practices specific to CoE. The OU transfer student admission requirements are: (a) 2.50 GPA required for 7-59 semester hours attempted, (b) 2.00 GPA required for 60 or more semester hours attempted and (c) 3.0 GPA required for non-resident engineering majors.

Transfer Credit Evaluation

Most of the transfer work presented for credit in the CoE is work taken at one of the Oklahoma State System of Higher Education member institutions. Most of the courses that can be taken at the freshman and sophomore levels in the State of Oklahoma have been evaluated and are regularly reviewed by the appropriate academic department. Courses determined to be equivalent to a specific OU course are posted on-line and are incorporated in to the automated Advising and Degree Audit (ADA) system for use in advising. Course equivalency lists are regularly reviewed and updated and are the responsibility of the OU Office of Admissions through the coordination and guidance of the Oklahoma State Regents for Higher Education. Coursework from other institutions is evaluated by the appropriate academic unit (Department of Physics evaluates physics classes, Chemistry evaluates chemistry courses, etc.) on a case-by-case basis. Qualified substitutions are indicated on the individual student's ADA and if the Department so indicates, the course can be added to the course equivalency tables and applied to all students taking that specific class. The Provost's Advisory Committee on General Education Oversight determines if coursework meets the State Regents' General Education requirements. Engineering coursework that is submitted for credit evaluation is reviewed by the respective School within the CoE. The Director of the WSSC organizes the CoE's Transfer Advising Conference each summer to meet with faculty and advisers from Oklahoma two- and four-year colleges and universities on issues related to transfer students and credit evaluation. CoE faculty and department representatives also participate in the meeting and play an important role in helping transfer institutions understand content, objectives, and intended outcomes.

Advising

All undergraduate students in the CoE are advised by faculty members in their area of study. Enrollment blocks are set up each semester to prevent students from registering for classes until they

can demonstrate they have met with a faculty adviser. The faculty advising process is supported by WSSC in that WSSC maintains academic records, provides advising and information related to general University policies and procedures, including General Education requirements, and maintains the ADA system that helps each student and faculty adviser track the student's progress toward meeting graduation requirements. Each semester, in preparation for advising and registration, an advising packet (Attachment 2) is prepared for each student by WSSC and includes the following:

1. CoE "blue sheet" on which advisers, both faculty and WSSC, chronologically document the results of each advising session, as well as any change in the student's status in the College, e.g., academic contract or probation, and any approved course substitution. The "blue sheet" is kept in the student's permanent advising folder. When it is returned to WSSC, the student's enrollment block is removed and the student is allowed to register for classes.
2. Transfer credit evaluation records.
3. An OU Advisory, which lists coursework taken and completed in a semester-by-semester format.
4. A current ADA printout. The ADA is specific to each student and shows the curriculum requirements for that student's degree program and how each course requirement is satisfied. The ADA functions as an on-going "graduation check," as it clearly marks the courses the student still needs to take and is organized in a semester-by-semester format that takes pre-requisites and sequential courses into account, and indicates courses satisfied by advanced placement as well as transfer credit.
5. General instructions for advising and registration and the official Academic Calendar.

Students pick up their advising packets in WSSC, use them to prepare to meet with their faculty adviser, and return their "blue sheet" to WSSC.

Students are advised to complete and submit a Graduation Self-Check to WSSC during the semester prior to the one in which they intend to graduate. A designated WSSC adviser will review the student's records, as well as the courses they intend to take in future terms, for the purpose of identifying any potential challenges or problems to be resolved before graduation, and communicate the results of this review with the student.

Students must maintain a 2.0 OU GPA and a combined (OU and transfer work) GPA of 2.0 in order to remain in good standing in the CoE. Any student whose overall GPA falls below a 2.0 is placed on Academic Contract by WSSC, and the contract outlines the specific conditions for returning to good standing in the CoE. This typically includes improving their GPA within one or two semesters and working directly with the WSSC retention adviser to identify other strategies for improving their academic performance. Students who do not meet the conditions of their contract, or whose grades do not improve to meet minimum requirements, are "stopped out" of the CoE and not allowed to continue their engineering coursework. The WSSC retention adviser also monitors students who make a "D" or "F" in any required course, as a "C" or better is required for all required coursework. Students are placed on Academic Warning and are required to repeat the course at the earliest possible opportunity, and if the course in which they received a D or F is a pre-requisite for a course, they are prevented from taking that course. CoE students are given three opportunities to successfully complete any required course with a C or better, or they are also subject to being stopped out of the CoE.

Advising of students within CEES is conducted through a group advising process. Each student majoring in Environmental Engineering is required to attend one of several group advising sessions. Three or more group advising sessions are held during the pre-enrollment period each semester. The Director and multiple faculty advisors from all areas of environmental engineering attend each group advising session to provide course-selection advice to the students. These sessions allow the majority of students to be advised, and subsequently enrolled, in a timely manner.

All students in CEES are also assigned an individual faculty academic advisor by the CEES office. To the extent possible, students are assigned an advisor within their area of interest (e.g., environmental, geotechnical, structures). As students progress in their studies, faculty advisors may be reassigned to match changing student interests. Students wishing to meet with their faculty advisor on an individual basis may schedule an appointment once they have attended group advising. Students who do not wish to attend group advising may schedule a meeting with their advisor following completion of the pre-enrollment period.

Students wishing to be advised outside of the designated pre-enrollment period (e.g., during summer session) must schedule an appointment with their faculty advisor or be advised by the Director of CEES or other available faculty member.

For students transferring into the department from other Oklahoma colleges, WSSC maintains a list of selected equivalent courses which is used to assign transfer credit. For students transferring from other colleges, or for courses not on the WSSC list, credit for transfer courses is assigned through individual assessment of course equivalency by the faculty advisor through examination of course syllabi and consultation with CEES faculty who teach the equivalent CEES course.

Assessment of advising procedures is conducted annually through CEES student exit interviews, which specifically request student comments on advising processes, within both the School of CEES and WSSC. Comments are reviewed annually at the CEES spring faculty retreat and necessary changes are implemented at the first faculty meeting of the subsequent Fall semester.

2. Program Educational Objectives

Constituents

The Program Educational Objectives and Outcomes were developed to meet the needs of the constituencies of CEES. The primary constituents of CEES programs are the students, both during their academic careers and later as alumni. Other constituencies of CEES programs include industries and governmental agencies that employ our graduates, and the faculty and staff who work in the CEES department.

Mission Statements

The mission statement for the OU reads as follows:

> *The mission of the University of Oklahoma is to provide the best possible educational experience for our students through excellence in teaching, research and creative activity, and service to the state and society*.

The following vision statement for the CoE was extracted from the College Strategic Plan (see Appendix II):

To produce graduates and knowledge sought first in tomorrow's technology-driven world.

The following departmental Mission Statement, Program Educational Objectives and Program Outcomes have been added to the CEES Undergraduate Student Handbook (Attachment 3), which is provided to each student majoring in Environmental Engineering. The mission statement for the School of Civil Engineering and Environmental Science was extracted from the CEES Strategic Plan (Attachment 4).

> *The mission of the School of Civil Engineering and Environmental Science is to provide a high-quality educational experience for undergraduate and graduate students in the areas of architectural, environmental, geotechnical, structural, and transportation engineering and environmental science. The educational experience is accomplished through innovative classroom instruction aided by computer and multimedia-based instruction, laboratory experiences and student mentoring. The products of this experience are engineers and scientists capable of critical thinking, devoted to a lifetime of learning, and highly sought after by employers.*

Program Educational Objective 1: The Environmental Engineering Bachelor of Science alumni will have embarked on successful careers in areas associated with the development, implementation, and management of environmental engineering systems.

> *Program Outcome 1.1:* graduating seniors will be technically competent in core areas within environmental engineering and related sciences and mathematics
>
> *Program Outcome 1.2:* graduating seniors will be able to work within a team and communicate effectively
>
> *Program Outcome 1.*3: graduating seniors will be able to synthesize diverse information to develop creative and ethically sound design solutions

Program Educational Objective 2: The Environmental Engineering Bachelor of Science alumni will advance in their careers and continue their professional development through continuing education and lifelong learning.

> *Program Outcome 2.1:* graduating seniors will be able to function in an evolving engineering practice
>
> *Program Outcome 2.2:* graduating seniors will understand the importance of continuing education, professional registration, and ethical responsibilities
>
> *Program Outcome 2.*3: graduating seniors will be able to work within a team, develop project management skills and communicate effectively

Development of Program Educational Objectives

The PEOs are reviewed annually as part of our overall assessment process shown in Attachment 5. CEES initially instituted a program outcomes-based assessment plan for Civil Engineering in the Fall of 1992 in response to a mandate from the State Board of Regents for Higher

Education. The mandate required departments to: (a) measure how well students were meeting institutional program goals and objectives; (b) identify instruments for assessing the skills and abilities of graduates; (c) assess higher level thinking skills in applying learned information; and (d) demonstrate that the instruments were reliable and valid. The outcome assessment plan for Environmental Engineering was implemented in 2000.

CEES initially chose to use the following instruments for developing quantitative measures of student performance: (a) the capstone design course (i.e., CE 4903); (b) nationally-normed instruments (e.g., Fundamentals of Engineering exam and Graduate Record Examination); and (c) selected required design courses. In addition, quantitative and qualitative measures of program effectiveness are obtained through "exit" interviews with all graduating seniors, alumni surveys (two years after graduation), and employer surveys. The plan was fully implemented in the fall of 2000 and has been updated yearly, as needed. The latest assessment report based on our previous plan is given as Attachment 6. The current plan includes extensive evaluation of coverage of the Criterion 3 "a to k" criteria.

At the end of each Spring semester, CEES faculty participate in a faculty retreat where student exit interviews, course evaluations and input from the assessment committees are discussed and reviewed. As a result of these discussions, updates and strategic actions are suggested. During the Fall semester, the CEES faculty decide which corrective actions need to be implemented. As a result of this feedback process, CEES has recently updated the Program Educational Objectives.

During the Spring 2004 faculty retreat, CEES discussed changes in both the CEES strategic plan and the CoE strategic plan. In the Fall of 2004, CEES utilized student, alumni and employer feedback to establish the two Program Educational Objectives and respective program outcomes.

The revised Program Educational Objectives and Outcomes were presented to the CEES alumni advisory board (a.k.a., CEES Visiting Council) prior to their Fall 2004 meeting. Written comments were solicited from Visiting Council (VC) members and the Program Educational Objectives and Outcomes were allocated time for discussion during the campus meeting. The CEES Director and the ABET Committee Chair solicited feedback from the VC during the fall meeting. The Program Educational Objectives, Program Outcomes and supporting materials were again revised based on input from the VC.

Final draft Program Educational Objectives and Outcomes were distributed to the CEES faculty late in the fall semester. Copies of the final draft statements and supporting materials were also mailed to the CEES VC members prior to their Spring 2005 campus visit. The Program Educational Objectives and Outcomes were again allocated time for discussion during the Spring 2005 CEES VC campus meeting.

Evaluation Process

The major components of each Program Educational Objective are depicted in Attachment 7. A series of desired outcomes has been identified for each Program Educational Objective. Collectively, these desired Outcomes encompass all of the ABET Criterion 3 "a to k" criteria

CEES has identified a list of activities designed to help achieve each desired Outcome; this list includes ongoing activities and some recently instituted actions. Most of the actions address curriculum and course content issues. The Strategies and Actions are the essential components of the process used to assure that graduates achieve each stated program outcome. The Results are the quantifiable results expected from these strategies and actions.

The final three columns in Attachment 7 identify the ABET Criterion 3 "a to k" criteria,

along with the assessment method employed and expected feedback from the respective assessment method. The ABET Criterion 3 "a to k" criteria addressed by each course are delineated on the course descriptions included in Appendix IB.

3. Program Outcomes Assessment

Assessment Process

The CEES Program Educational Objectives and Program Outcomes Assessment process is illustrated in Attachment 5. The main components of this process are the information collected (i.e., Assessment), how the information is processed (Reporting), and how the information is used to demonstrate desired outcomes and continually improve the process itself (Review and Feedback). Each of these components is discussed in detail below.

Assessment Methods

As shown in Attachment 5, the Assessment Plan is divided into primary assessment methods, faculty evaluations, capstone evaluation, and other assessment methods. The Assessment Plan is designed to get input from our constituents (students, employers, and faculty) in a number of different ways. The assessment tools used in our Assessment Plan are described below.

Primary Assessment Methods

1. Student Exit Interviews - Each student completing the baccalaureate program in CEES must schedule and attend an exit interview with a member of the CEES VC during the semester in which they plan to graduate. Students fill out a questionnaire (Attachment 8) prior to attending the oral exit interview. Student responses during the oral exit interview are recorded on a separate form (Attachment 9). The results of the oral exit interviews are compiled for use in developing the annual Outcomes Assessment Report. These results are also shared with the CEES faculty during the annual faculty retreat and any improvements/modifications needed for the curricula are discussed.

2. Alumni Surveys - Every year, an anonymous Web-based survey (Attachment 10) is used to solicit input from all CEES alumni. The availability of the Web-based survey is publicized through our email database as well as through the CEES newsletter (*Communiqué*). The alumni are also given an option to return the survey form attached to the *Communiqué* through regular mail. The alumni survey responses are compiled for use in developing the annual Outcomes Assessment Report.

3. Employer Surveys - Every year, an anonymous Web-based survey (Attachment 11) is used to solicit input from all alumni identified employers who have hired recent (graduated within the last five years) CEES BS graduates. The results of the employer survey responses are compiled for use in developing the annual Outcomes Assessment Report.

4. FE Examination - Students in CEES are required to attempt the FE examination. Record of attempting the FE examination is a department requirement for graduation. In

exchange for a "good faith" effort on the FE examination, the CEES department pays the first examination fee for each student. CEES faculty also teach FE examination review sessions free of charge. The performance of CEES students for select topics on the FE examination is monitored and compared to national averages. The examination results are reported and analyzed in the annual Outcomes Assessment Report.

5. Course Grades - In addition to ensuring that the students make a grade of "C" or better in all engineering courses, course grades are monitored for selected design courses. Statistical results of the grades in the selected design courses are reported and analyzed in the annual Outcomes Assessment Report.

6. Technology and Software Review Committee (TSRC) Annual Report– The proposed TSRC committee will consist of one CEES faculty coordinator and members of the Visiting Council. The TSRC is tasked with reviewing software and other tools used in all CEES courses to ensure that they meet state of the art/practice standards. In order to review the tools used in a course, the TSRC may follow a number of different approaches. These approaches include visiting in-class demonstrations, interviewing faculty members and students, and requesting a demonstration from a faculty member teaching a particular course. The TSRC will prepare an annual report documenting its findings. These findings will be documented in the annual Outcomes Assessment Report and reviewed with the faculty during annual evaluations and at the annual faculty retreat

7. Student Performance Review Committee (SPRC) Annual Report– The proposed SPRC committee will consist of three CEES faculty members (one each from structures, geotechnical, and environmental). The role of the SPRC will be to independently evaluate selected student lab reports and other written submittals. The SPRC will review three different courses annually. Although the courses selected may change, they will all be core courses and include one each from the sophomore, junior and senior years of the curriculum. Within each course, the instructor will select a single laboratory experiment. The instructor will forward the high, medium and low performance submissions to the committee for review. The SPRC will prepare an annual report documenting students' abilities to conduct experiments, analyze and interpret data, and communicate effectively through writing. The findings of the SPRC will be documented in the annual Outcomes Assessment Report and reviewed with the faculty during annual evaluations and at the annual faculty retreat.

Faculty Evaluations Methods

CEES annual faculty evaluations are an important part of our assessment plan. CEES uses a peer evaluation process. Each January, faculty are required to prepare a 1-page mini-vitae and 2-pages of supplemental information documenting their accomplishments during the previous calendar year in teaching, research and creative activity, and service, along with a statement of their goals for the coming year. In support of preparation of these documents, the Director of CEES compiles and distributes data on:

1. Research expenditures
2. Research proposals submitted
3. Research proposals funded
4. Publication citations from the ISI Web of Science database
5. Composited course evaluation (i.e., teaching) scores
6. Student comments (anonymous) from the course evaluations

The composited course evaluation scores are derived from the evaluation form distributed in each course near the end of the semester (Attachment 12). CEES use weighted responses for questions 3, 4 and 8 to develop Individual to Department (I/D) and Individual to College (I/C) ratios.

The Director of CEES shares all of the mini-vitae and supplemental information documents with each CEES faculty member. Each faculty member is requested to evaluate all other faculty members and the Director. These peer evaluations are composited and provided to Committee A (a three-member advisory committee to the Director). The Director and Committee A consider the peer evaluation scores and supporting documents in developing draft final evaluations scores. The draft evaluation scores are provided individually to each faculty member. Each faculty member is allowed an opportunity meet with the Director and Committee A to discuss the evaluations scores. The Director and Committee then forward the mini-vitae and the final annual evaluation scores to the Dean of the College of Engineering.

Capstone Evaluation Methods

Each year in the capstone course (CE 4903), students complete a major comprehensive design project. The evaluation of this course and the design project is a major part of our Assessment Plan.

1. Capstone Advisory Board (CAB) review – The CAB is made up of three to five professional engineers. Board members are selected from a broad base of candidates that include alumni, industry contacts or state/local governmental agencies. Each CAB member agrees to review three written submittals and attend three oral presentations. The CAB is an integral part of the Capstone experience starting with the initial meeting for workplan review through final product submission. The CAB completes the first review at mid-semester (50% review). At this review, the CAB provides feedback regarding project focus and direction and evaluates students' oral presentations (Attachment 13). The CAB also reviews the project reports and final presentations at the end of the semester (Attachment 14). The findings of the CAB are reported and analyzed in the annual Outcomes Assessment Report.

2. Peer Evaluations – Throughout the curriculum, courses with team or group assignments utilize peer evaluations (Attachment 15). These evaluations primarily help instructors identify individual contributions toward completing the project. The findings of the peer evaluations are reviewed with the faculty at the annual faculty retreat

Other Assessment Methods

1. Visiting Council (VC) evaluation – Every year, during the fall VC meeting, the Director presents a State of the School Report. The VC also gets to hear from students about their activities such as the ASCE concrete canoe and steel bridge competitions. At the end of these meetings, the VC provides the Director with feedback based on its observations. During the Fall 04 and Spring 05 meetings, VC members were provided with the CEES ABET materials (e.g., Program Educational Objectives, Program Outcomes, Strategies and Actions, etc.) and asked to provide feedback.

2. Student Advising – Student advising described in Section 1 of the Accreditation Summary Section is used to ensure that courses are taken in proper order, the students are making a grade of "C" or better in all engineering courses, an appropriate number of professional electives are taken, and that the students enroll in at least one CEES course every year.

3. CEES Seminar – This zero credit hour course (CE 1000) is offered every semester starting from the first semester of the sophomore year. The students are required to take a minimum of four semesters of CE 1000. This course is used to introduce students to professional practice issues through guest lectures from practicing engineers. In addition, this course provides a mechanism to introduce students to issues that span more than one course, such as the Sooner City project. The course is also designed to increase student awareness regarding student activities such as the concrete canoe and steel bridge competitions. Finally, at least one meeting each semester is devoted to informing students about curriculum requirements (e.g., must take FE exam, etc.) and departmental processes and procedures (e.g., group advising, etc.),

4. University of Oklahoma ASCE Student Chapter (OU-ASCE) Annual Report – The annual report prepared by the OU-ASCE student chapter is used to document speakers, topics of presentations, and student attendance at meetings. This report is also used to document student activities such as the concrete canoe and steel bridge competitions.

5. Oklahoma City ASCE Branch (OKC-ASCE) attendance statistics – These statistics are used to document CEES student participation at these professional meetings.

6. ABET Review – The external ABET review conducted every six years is used as an assessment tool.

7. Reflective Writing – Reflective writing is used as a tool in two CEES courses (CE 3213 and CE 4803) to make students aware of the need for life long learning. Students are requested to self assess their career goals and need for advanced degrees and professional registration.

Reporting

The assessment results are documented in five reports. Three of these reports, Outcomes Assessment Report, Unit Evaluation Report, and State-of-School Report, are prepared every year.

The Campus Departmental Review Panel (CDRP) report is prepared every 5 years and the ABET Self Study report is prepared every 6 years.

1. Annual Outcomes Assessment Report – This report is required by the OU Office of Assessment and the Office of Institutional Research. All of the assessment results, except faculty evaluations, are documented in this report (Attachment 6).

2. Annual Unit Evaluation Report – This is a report submitted by the Director of CEES to the Dean of the CoE, which documents departmental performance (e.g., research expenditures, publications, citations), faculty evaluations, and faculty and student awards (Attachment 16).

3. Annual State-of-the-School Report – This is a report presented by the Director to the CEES VC and documents departmental performance and faculty and student awards (Attachment 17).

4. Campus Departmental Review Panel (CDRP) Report – OU requires that a campus-wide CDRP Committee review all academic programs every 5 years. This detailed report documents CEES's strategic plan, progress, achievements, and needs. A summary of the most recent CDRP is included in Attachment 18. The full CDRP report will be available for review at the time of the ABET campus visit.

5. ABET Self Study – This comprehensive report prepared in connection with the site visit from the ABET review team documents all the educational program objectives, program outcomes, assessment plans and results.

Review and Feedback

The Review and Feedback component of the assessment process describes how information gathered from some of the assessment methods is analyzed and interpreted. Data analysis and interpretation focus on identifying any problem areas. Potential response actions are also delineated.

1. Student Exit Interviews - The information derived from the student exit interviews is summarized in the annual Outcomes Assessment Report. This information is used to assess almost all facets of the CEES educational enterprise. The information is distributed to the CEES faculty for review and discussion during the annual faculty retreat. Strategies to address problem areas are devised during the spring retreat and implemented in the subsequent fall semester. More commonly, the student exit interviews are used in developing award nominations for outstanding faculty and staff. As noted in the vitae in Appendix IC, CEES faculty have won numerous national awards and almost every conceivable on campus award for excellence in teaching.

2. Alumni and Employer Surveys - The information derived from alumni and employer surveys is summarized in the annual Outcomes Assessment Report. The information is distributed to the CEES faculty for review and discussion during the annual faculty retreat.

3. FE Examination - The performance of CEES students for select topics on the FE examination is compiled and reported in the annual Outcomes Assessment Report. Student performance is compared to national averages and analyzed for trends over time. The information is distributed to the CEES faculty for review and discussion during the annual faculty retreat. The results of the FE examination are also reported to the CEES VC each fall. If students are found to be performing consistently below the national average in a particular topic, then the contents of the course that covers that particular topic are carefully reviewed. It is important to note that CEES students have been performing above the national level, in overall pass rate, for the past few years (see Attachment 6).

4. Design Course Grades - Grade distributions for the design courses are compiled and reported in the annual Outcomes Assessment Report. The average grade in each course is compiled and plotted over time. Grade distributions are compared between courses. Anomalies in grade distributions for a course can trigger a review of course content and or pedagogy. The information is distributed to the CEES faculty for review and discussion during the annual faculty retreat.

5. Course Evaluations - The results of the course evaluations are tabulated and statistically analyzed. Numerical statistics (e.g., mean, standard deviation) are compiled for each question. The results are compiled for each individual course, for each department, and for the CoE as a whole. In addition, free form comments are solicited from each student. Student course evaluation statistics and associated student comments are integral parts of the CEES annual faculty performance evaluation process. Extreme scores identified during the evaluation process are noted and addressed by Committee A. Extremely poor scores are discussed with the individual faculty member and methods/resources available for pedagogical improvement are recommended. Extremely good scores (more the norm in CEES) are used in developing recommendations for faculty awards. The course evaluations are also used to assess student satisfaction with contents of a course. Negative and positive student comments about content of a course are also discussed with the faculty during annual evaluations.

Document Changes

Since the last ABET review, there have been only four significant changes in the Environmental Engineering program. As noted previously, in response to a directive from the Dean of the CoE, CEES revamped the undergraduate environmental engineering curriculum in the Fall of 2002. The impetus for curriculum reform and the process used are described in Appendix II.

Also noted previously, CEES revamped the Program Educational Objectives and Outcomes in the Fall of 2004. This was in direct response to updated definitions of the terms “objectives” and “outcomes” put forth by ABET. The current Program Outcomes are essentially identical to the previous 1999 Program Objectives. The outcomes assessment process has remained consistent except for two proposed additional steps.

As part of the curriculum revamping process, CEES faculty reviewed the comments from the student exit interviews from the previous three years. The consensus derived from the student

comments was that CEES needed to offer more professional electives classes. As a result, each faculty group (i.e., environmental, geotechnical, structural) met and developed three- and five-year proposed teaching schedules. These schedules now ensure that multiple electives are offered in each area during both the Fall and Spring semesters.

The last significant change in the Environmental Engineering program since the last review is the change in the capstone course content and sequencing. Feedback from the student exit interviews clearly indicated that the time commitment for a one-semester capstone design experience was excessive. In response to this feedback, CEES revised the curriculum to include a two-semester capstone course sequence. Students now take ES 4813 (Professional Practice) in the fall semester, followed by CE 4903.002 (Environmental Capstone Design) in the spring semester. The Professional Practice course covers some of the non-technical aspects of engineering practice (e.g., ethics, professional registration, project management, cost estimating, technical communications) and introduces the design project for the following semester. The Capstone Design course is devoted to completing the assigned design project and developing technical reports and an oral presentation to be evaluated by the CAB.

Materials Available for Review

1. 2004-2005 Course syllabi, homework and tests.
2. Undergraduate Student Handbook (Attachment 3)
3. CEES Strategy for Excellence (Attachment 4)
4. 2004 Outcomes Assessment Report.(Attachment 6)
5. 2004 Unit Evaluation Report (Attachment 16)
6. 2004 State-of-School Report (Attachment 17)
7. 2004 Campus Departmental Review Panel Report (available during campus visit)
8. 2004-2005 Student Exit Interview Results (available during campus visit)
9. 2004-2005 Alumni Survey Results (available during campus visit)
10. 2004-2005 Employer Survey Results (available during campus visit)

4. Professional Component

The undergraduate Environmental Engineering curriculum is shown in Table 1 of Appendix IA. The curriculum exceeds the minimum ABET degree requirements for Math and Basic Sciences and Engineering Topics. The undergraduate Environmental Engineering curriculum requires coursework from four broad areas of environmental engineering: Environmental Science (mass balance and fate processes - 6 credits), Environmental Chemistry (organic chemistry -3 credits, physical chemistry - 3 credits, and aquatic chemistry -4 credits) Environmental Microbiology (4-credits), Environmental processes (water resources - 3 credits, water and wastewater treatment - 3 credits, and hazardous and solid waste - 3 credits), plus 6 credits of professional electives (all in environmental engineering except in unusual circumstances).

The General Education requirements at the OU, along with the faculty advising system, guarantee that each student will have breadth and depth in their education. Two courses are required in the social sciences. Humanities are divided into three areas: "understanding artistic forms" (3 credits, one course); "western civilization and culture" (6 credits, two courses); and "non-western culture" (3 credits, one course). Faculty advisors emphasize the depth requirement which is also

discussed in CEES Undergraduate Student Handbook (Attachment 3).

Design concepts, methodology and teamwork are incorporated throughout the Environmental Engineering curriculum, beginning with the first year (CE 1111). Currently, the curriculum culminates in a major capstone experience (ES 4813 and CE 4903). The Professional Practice (ES 4813) course addresses professional and management issues. The Capstone (CE 4903) course addresses a practitioner- guided, real world design problem using multidisciplinary teams comprised of civil and environmental engineers along with environmental scientists. Prior to enrolling in CE 4903, students must have completed or be currently enrolled in five of the following six courses - Aquatic Chemistry, Applied Environmental Microbiology, Water Resources, Water and Wastewater Treatment, Hazardous and Solid Waste Management, and Technical Writing. Since the capstone course is taught only once each year (i.e., Spring semester), students are allowed to enroll only when they are within two semesters (<30 hours) of graduating.

The design component has been integrated throughout the entire curriculum with implementation of the Sooner City concept, in which components of a fictitious city are designed in designated courses (soil mechanics, water resources, water and wastewater treatment, etc.). Sooner City courses in the curriculum function using a format of teamwork, written and oral presentations, and practitioner involvement; the final product is a student design portfolio at the end of their studies. The Sooner City concept was initiated in the summer of 1997 using a grant from the National Science Foundation. The Sooner City plan is summarized in a conference proceedings paper entitled: "The Sooner City Project: A 5-Year Update" (Attachment 19).

Courses in the Environmental Engineering curriculum have varying laboratory components, oral/written communications, computer usage, teamwork and design projects. The content of each course is summarized on the course syllabi in Appendix IB.

The course and section size summary for Environmental Engineering is shown in Table 2 of Appendix IA.

5. Faculty

Competency

CEES has traditionally hired high-quality faculty members (see Appendix IC for vitae). Because of retirements and replacements, we have hired six new faculty since 1999, and they have received their Ph.D. degrees from excellent schools (i.e., McMaster University, University of California at Davis, Columbia University, University of Connecticut, University of Michigan, University of Massachusetts at Amherst). A search has been initiated to fill the last open position in Structural Engineering. This position is expected to be filled before the start of the 2006-2007 academic year. In addition, the President of OU has provided funds for a new faculty position in radar hydrology, as part of the campus wide radar meteorology initiative. This position is also expected to be filled before the start of the 2006-2007 academic year.

CEES has a total of 18 faculty members; ten have a focus area in either environmental engineering (Drs. Butler, Kibbey, Knox, Kolar, Sabatini, Strevett and Vieux) or environmental science (Drs. Meo, Nairn, Nanny); six have focus areas in geotechnical and transportation engineering (Drs. Abousleiman, Cerato, Hatami, Miller, Muraleetharan, Zaman); and two have focus areas in structural engineering (Drs., Mish and Pei). One geotechnical faculty member (Dr. Hatami) has a strong background in structural mechanics and teaches structural engineering courses. Three faculty members (Drs. Abousleiman, Meo and Nanny) have joint appointments in Petroleum and

Geological Engineering, Science and Public Policy, and/or the Sarkeys Energy Center. They each teach one course per semester in CEES. Currently, eight faculty members are Registered Professional Engineers, and one faculty is a Registered Geotechnical Engineer in California (the highest level of registration for a Geotechnical Engineer in the US). CEES requires that faculty teaching design-oriented courses pursue registration as a Professional Engineer. Six of the junior faculty members have received the prestigious Faculty Early Career Development (CAREER) Award from the National Science Foundation.

CEES faculty are excellent teachers as evidenced by their various teaching awards: National -- Dow Teaching Award, John Fluke Award for Excellence in Laboratory Development, Fred Merryfield Design Award, and NSPE Engineering Education Excellence Award; Regional -- American Society of Engineering Education Midwest Section Outstanding Teaching Awards; University -- David Ross Boyd Professorship, Regents' Award for Superior Teaching, UOSA Outstanding Engineering Faculty Awards, and Presidential Professorships.

Teaching both graduate and undergraduate students through research is an important objective of our faculty. Our success toward this goal can be observed through our external research expenditures, number of graduate degrees conferred, publication record, and journal citations. During FY04, our total research expenditures exceeded $3.76 million ($250,000 per FTE). The University has recognized our research efforts by bestowing faculty awards such as the Regents' Award for Superior Research, Presidential Professorships and numerous Junior Summer Faculty Research Awards. Faculty have also won national and professional awards for research excellence: the Walter L Huber Research Award from ASCE, the IACMAG Award for Significant Contributions on Constitutive Laws, a named Fellow at the ORSTOM French Hydrology Laboratory in Montpellier, France, a lecturing and research award under the Fulbright Scholar's Program, and an Iowa State University Outstanding Young Alumnus Award.

CEES faculty also participate in numerous multidisciplinary research institutes across campus including the Environmental and Ground Water Institute, Cooperative Institute for Mesoscale Meteorological Studies, Center for Restoration of Ecosystems and Watersheds, Center for Analysis and Prediction of Storms, Institute for Applied Surfactant Research, Institute for Energy and the Environment, Institute for Oklahoma Technology Applications, Integrated Petroleum Environmental Consortium, International Center for Hazards and Natural Disasters Research, Oklahoma Transportation Center, Poromechanics Institute, Science and Public Policy, and Intelligent Vehicle Bridge System. CEES faculty also hold co-appointments or are adjunct faculty in the Mewbourne School of Petroleum Engineering, Chemical Biological and Materials Engineering, the Sarkeys Energy Center, Chemistry and Biochemistry, Botany and Microbiology, and Zoology.

CEES faculty have also developed international collaborations in research and education. We currently have formal exchange agreements with Chulalongkorn University in Thailand and Blaise-Pascal in France. CEES faculty have also developed collaborative relationships with researchers at universities in Germany (University of Tuebingen) and the Peoples Republic of China.

CEES faculty are also very active in professional service at the national and international levels. Our faculty regularly serve on NRC and NSF review panels and as editors and reviewers for numerous refereed journals.

In 2001, CEES conducted a national search for a new Director. The CoE supplemented the position with the John A. Myers endowed professorship. Dr. Knox was named the Director and now occupies the Myers professorship. In 2003, CEES was instructed to fill the vacant Sun Oil Endowed Chair position with an internal candidate. Dr. Sabatini was selected for the position. Also in 2003, Dr. Younane Abousleiman, was named to fill the Larry Brummett/ ONEOK Chair in the Sarkey's

Energy Center. In 2004, CEES received a bequest which was used to establish the Aaron Alexander endowed professorship now occupied by Dr. Zaman. The three remaining full professors (Drs. Mish, Vieux, and Muraleetharan) all currently hold university Presidential Professorships.

Service and Professional Development

CEES aggressively encourages student professional development through participation in student organizations, interaction with professionals, and also by serving as role models. A high percentage of CEES faculty members are registered Professional Engineers and have significant professional experience, which allows them to bring professional issues to the attention of the students through various forums. CEES encourages all faculty members to seek professional registration. CEES faculty are also active in professional and technical societies. In addition, CEES faculty are encouraged to apply for sabbatical leaves every five years in order to maintain their research programs. Table 4 of Appendix IA lists and assesses each member of the faculty based on their years of experience, professional registration and level of activities (e.g., professional, research and consulting).

The Instructional Development Program (IDP) offers a series of semester-long seminars that address various topics associated with teaching (e.g., course materials, course content, delivery, etc.). IDP also provides guidance on various tools (e.g., mid-semester evaluations) that faculty can use to assess teaching performance and effectiveness.

Size

The size of the CEES faculty is sufficient relative to the undergraduate enrollment. The current undergraduate student/faculty ratio is 10:1. Current undergraduate engineering enrollment is 185. The departmental goal is to reach an undergraduate enrollment of 200 by year 2008.

Workload

CEES defines a fully-obligated faculty member (1 FTE) as being involved in an appropriate level of research and service, plus three courses per year. Faculty members in CEES are expected to teach at least one course per semester. The following typical distribution of activities would be assumed by 1 FTE:

Semester 1		Semester 2	
Course 1	0.25 FTE	Course 1	0.25 FTE
Course 2	0.25 FTE	Contract & Grant	0.25 FTE
Prof. & Univ. Serv.	0.05 FTE	Prof. & Univ. Serv.	0.05 FTE
Research & Scholarly Act.	0.45 FTE	Research & Scholarly Act.	0.45 FTE
TOTAL	1.00 FTE	TOTAL	1.00 FTE

This model implies that each faculty member will generate, at a minimum, one quarter of their academic salary for one semester (i.e., 0.125 of their annual salary).

The primary measure of research and scholarly activity is articles in archival journal publications or the equivalent (e.g., refereed conference proceedings, book chapters, or other refereed forums) annually. In addition, proposals must be written and submitted. For service, faculty must participate in the academic life of the university and also play an active role in professional

organizations at the national level (e.g., reviewing articles and proposals, serving on technical, conference, and editorial committees, and editing archival publications).

If an appropriate level of output from service, research and scholarly activity is deemed inadequate to comprise 0.50 FTE, additional teaching responsibilities are assigned. A faculty member without research and scholarly activity can be required to teach up to four courses per semester as a 1.0 FTE obligation.

Table 3 of Appendix IA summarizes recent faculty workloads in CEES. Curriculum vitae for the CEES faculty can be found in Appendix IC.

Student-Faculty Interaction

The American Society of Civil Engineers Student Chapter at the OU (www.ou.edu/asce) has assisted CEES in the development of civil and environmental engineering students capable of professional practice. Students are acquainted with team working skills, and opportunities for networking with practicing engineers are provided. There are three major emphases in OU-ASCE:

1. Activities like the student faculty olympics and the faculty roast promote good fellowship between the faculty and the students, and allow the students and faculty to get to know each other much better. This helps both the students and faculty understand each other and work together better on research projects and other cooperative efforts

2. Through projects like the concrete canoe and the steel bridge, the students gain practical experience in many facets of environmental engineering practice, including project management, technical writing, and oral presentation.

3. Through faculty participation at both the OU-ASCE and OKC-ASCE meetings, students are informed of issues facing engineers and advances in environmental engineering disciplines. In addition, the students make contacts that will be useful to them in the search for jobs.

Faculty Interaction with Practicing Profession

CEES faculty interact regularly with practicing professionals. The most notable example is the practitioner-directed multidisciplinary capstone courses. The instructors for these courses solicit real world projects from local practitioners. In addition, each capstone course has a Capstone Advisory Board made up of local practitioners well-versed in the subject area. Several CEES faculty regularly provide consulting services to local engineering firms. Also, four CEES faculty own private engineering firms. These firms occasionally hire graduates from CEES.

6. Facilities

Summary

CEES is primarily housed in the Carson Engineering Center (CEC), although some faculty with co-appointments have offices in the Sarkey's Energy Center. Classroom instruction is primarily conducted in one of three buildings: CEC, Felgar Hall and Sarkey's Energy Center; however, classes with large sections (e.g., Statics and Dynamics) are often scheduled in larger classrooms across the campus.

The university provides classroom facilities for all lecture classes. The CoE has upgraded several classrooms with capabilities to support high levels of computer-interactive courses. Classroom facilities provided by the university are sufficient to support CEES lecture classes. New wireless classrooms can support the use of laptops in nearly all classrooms on the main campus. In addition to traditional lecture rooms, the university provided three computer laboratories with multi-media capabilities. CEC 205/206 accommodates 60 students with a Pentium processor are each station. The laboratories each include an instructional podium with computer monitor, microphones and projection equipment. Students can access this facility any time when lectures are not scheduled. CEC S19 is a 15-station classroom with Pentium processors. Two additional computer laboratories are located in Felgar Hall providing nearly 100 additional platforms for student project work.

As depicted in the course syllabi (Appendix IB), courses in the Environmental Engineering curriculum have varying laboratory components and computer usage. Summarized below are the laboratories and computer facilities used for instruction related to the Environmental Engineering program.

Modern Engineering Tools

To facilitate technology in learning, Engineering Computer Services - Information Technology (ECS-IT) provides CEES, along with the CoE, with extensive computer lab facilities. The college computing resources are detailed in Appendix II.

Over the past six years, CEES has developed two computer laboratories independent of the CoE facilities. CEES shares the TEAM Autocad laboratory (S23) with Industrial Engineering (IE). The TEAM Autocad laboratory includes seven desk top computers with Autocad software, a color laser plotter, a black and white plotter and two printers. The facility is reserved for the CEES capstone courses and graduate classes in CEES and IE. The CEES study lounge (S20) has seven desk top computers and two printers. The facility also includes circular tables with power outlets and network ports for students using their personal laptop computers. The CEES study lounge is heavily used by students for group study and team meetings. The facility has portable partitions that provide offices for student technical (i.e., ASCE, ESSA) and honor (i.e., Chi Epsilon) societies.

Students are also exposed to advanced instrumentation via six teaching laboratory experiences. The various facilities and equipment that students utilize during the undergraduate Environmental Engineering curriculum are discussed below.

1. Kerr Environmental Teaching Laboratory (CEC S11): This laboratory is used for CE 3234-Water and Waste Treatment, CE/ES 4114/5114-Aquatic Chemistry, ES 4324/5324-Environmental Biology and Ecology, and CE 4903/ES 4913-Environmental Engineering and Science Capstone Experience. In addition, the attached lecture area is used for ES 4813-Professional Practice. The laboratory has the equipment, glassware, chemicals, and supplies needed for routine analysis of water and wastewater, including alkalinity, hardness, dissolved oxygen, BOD_5, and nutrients (nitrate, nitrite, phosphate, ammonia, etc.) The laboratory also contains the equipment needed for routine microbiological measurements such as plate counts and biological growth studies. Soil analyses such as moisture content and bulk density are also performed in this laboratory. Field monitoring kits for pH, dissolved oxygen, conductivity, alkalinity, and hardness are stored, tested, and maintained in this laboratory. This laboratory helps achieve our PEOs by preparing students for careers in environmental engineering that may involve laboratory and field measurements of soil,

water, and waste characteristics (PEO 1). PEO 2 is also achieved via introducing students to the principles of scientific and engineering laboratory investigations, including team work, experimental setup, maintaining laboratory records, equipment use and troubleshooting, and data analysis and interpretation.

2. TEAM AutoCAD Design Room (CEC S23): This computer laboratory is used for the senior level ES 4813-Professional Practice and CE 4903/ES 4913-Environmental Engineering and Science Capstone Experience courses. The laboratory has eight dedicated desktop computers, a printer, a black and white plotter and a color laser plotter. The desktop computers are loaded with Autocad, in addition to traditional office software. This laboratory helps achieve our PEOs by exposing students to industry standard software (PEO 1). PEO 2 is also achieved via introducing students to the principles of engineering design, including team work, project management, design drawings and engineering practice.

3. CEES Study Laboratory (CEC S20): This computer laboratory is used for the senior level ES 4813-Professional Practice and CE 4903/ES 4913-Environmental Engineering and Science Capstone Experience courses. The laboratory has eight dedicated desktop computers, two printers, and laptop-friendly tables with power ports. The room is also used extensively for project team meetings for design course throughout the curriculum. S20 also has portable partitions that form small (100 sq.ft.) offices for student technical (e.g., ASCE, ESSA) and honor (e.g., Chi Epsilon) societies. This laboratory also helps achieve our PEO's by exposing students to industry standard software (PEO 1). PEO 2 is achieved via introducing students to the principles of engineering design, including team work, project management, design drawings and engineering practice.

4. Soils Laboratory (CEC 329): This laboratory is used for instruction in CE 3364 - Soil Mechanics and CE 5404 - Soil Stabilization. The laboratory includes equipment to measure consistency, permeability, gradation and compaction. Strength testing equipment consists of unconfined compression, motorized direct shear and one cylindrical triaxial device, and the lab contains three consolidometers for determining compressibility. The laboratory also houses a model to simulate seepage through earth dams and equipment for determining soil-water characteristic curves and permeability of unsaturated soils. The use of soil laboratories helps achieve our PEOs by preparing students for careers in civil engineering that may involve laboratory measurements of soil mechanics (PEO 1).

Students are also exposed to advanced instrumentation via several research laboratories. The various facilities and equipment that students utilize during the undergraduate Environmental Engineering curriculum are discussed below.

1. Environmental Modeling and Geographic Information Systems Laboratory: This laboratory is used for CE 5020, Geographical Information Systems, CE 5853, Groundwater and Seepage and CE 5873, Water Quality Management. The laboratory has capabilities to handle GIS data structures for surface water, groundwater, landfill siting, and natural resource applications. Finite element modeling capabilities for environmental applications are also available.

2. Center for Restoration of Ecosystems and Watersheds Laboratory Facility: This facility is used for CE 4323, Applied Environmental Microbiology, CE 5624, Biological and Industrial Waste Treatment, ES4324/ES5324 Biological Aspects of Environmental Science and ES2323 Environmental Science II. This facility focuses on inorganic and organic analyses of natural waters, soils and sediments. The facility also includes equipment for standard microbiological characterization and evaluation of microkinetics.

7. Institutional Support and Financial Resources

Budget Process

CEES is allocated an annual State maintenance and operations (M&O) budget and funds to cover a limited number of teaching assistantships (TA's). Both the M&O budget and the graduate TA fund are grossly underfunded and continue to be augmented by faculty sponsored research incentive (SRI) funds. Using research-generated funding to meet day-to-day expenses provides a strong disincentive for obtaining external research funds. Note that only 35% of annual M&O funding comes from State appropriations; the majority of expenditures must be raised by the unit.

SRI funds are derived from indirect costs. The Vice President for Research Administration establishes the indirect cost funds that are available for return to the colleges. Typically, about twenty percent of the available funds are returned to the colleges, prorated based on the level of indirect costs generated. The CoE Dean's office keeps 2% SRI funds and returns the remainder to the generating School. CEES SRI funds are divided between the PI (65%) and CEES (35%). CEES uses captured SRI funds for TAs and additional M&O expenditures.

Teaching Incentive (TIPS) funds are awarded to CEES by the Provost in proportion to the Course Credit Hours generated. These funds can go towards classroom supplies, materials and assistance. The Provost also provides funds each year to support Assessment Activities. CEES uses the assessment funds to pay the fees for students taking the FE exam.

Externally funded contract research typically contains some funds to pay faculty time during the academic year. All faculty positions are funded at 100% by the State (for each FTE). Therefore, a faculty member having external funding may appoint him/herself to a project or grant for pay. The funds from the project release an equal amount of funds from the State appropriation for that particular faculty position. These are called salary release funds (SRF). All of the released State funds are retained by the School generating the external research funds. CEES currently returns all SRF funds to the PI.

In FY04, CEES had an annual State budget allotment of approximately 14 TAs (i.e., 1 TA = a work commitment of 20 hours per week for 1 semester). Typically, an equal number of State-supported TAs are assigned in the fall and spring semesters. Preference for excess TAs is given to: courses with laboratory components; new faculty, and those between contracts; faculty with extraordinary and compelling requirements; and/or lower division classes with enrollments over 30, upper division classes with over 20 students, and graduate classes with more than 10 students. For classes, other than those described above, faculty are expected to fund their own TA requirements using returned SRF/SRI funds.

Recent support expenditures for CEES are shown in Table 5 of Appendix IA.

Adequacy of Institutional Support

As noted above, the State-funded M&O and graduate TA budgets are grossly underfunded

and have to be augmented by SRI funds. Using research-generated funding to meet day-to-day expenses is not a healthy situation.

Faculty salaries continue to be low when contrasted with comparator institutions (see chart below). The discrepancy in salary levels is particularly evident for mid-level (i.e., Associate Professor) faculty members. This is of particular concern because this group includes five of the six NSF CAREER awardees. Other universities could try to lure away these talented individuals unless the University can provide them with competitive salaries.

2003-04 AVERAGE FACULTY SALARIES

	No.	O.U.	Big 10/12	Research I and II
Professor	7	$106,659	$105,533	$101,917
Associate Professor	7	$64,211	$78,200	$75,993
Assistant Professor	3	$62,417	$67,129	$65,441

Equipment Operation and Maintenance

Teaching and research laboratories, and the accompanying equipment, are vital components of an effective program for attracting and retaining students. Research and teaching laboratories are not funded through State budgets, and equipment must be acquired, replaced and maintained using either SRF or SRI funds.

The chemical technician for CEES is Ron Conlon. Mr. Conlon maintains and services equipment for environmental and geotechnical laboratories in the CEC.

The other departmental technician (Mike Schmitz) is assigned to the Fears Structural Engineering Laboratory. Mr. Schmitz maintains all testing equipment at the laboratory and assists in construction of various teaching and/or research devices. Mr. Schmitz also provides mechanical maintenance and repair services for CEES on an as-needed basis.

The costs of maintenance and servicing are covered by a number of sources. Routine course fees are used to purchase equipment and supplies required to teach courses. Research grant funds are used to cover routine maintenance and servicing requirements and to purchase maintenance agreements for equipment that is vulnerable to large maintenance and servicing costs. As needed, faculty use SRF and SRI funds to maintain and service equipment required for research activities.

Support Services

The CoE has its own library. Library services are described in more detail in Appendix II. Computing resources and services are also detailed in Appendix II. Student advising records are maintained by the WSSC. See Appendix II for a complete description of the services provided by WSSC.

8. Program Criteria

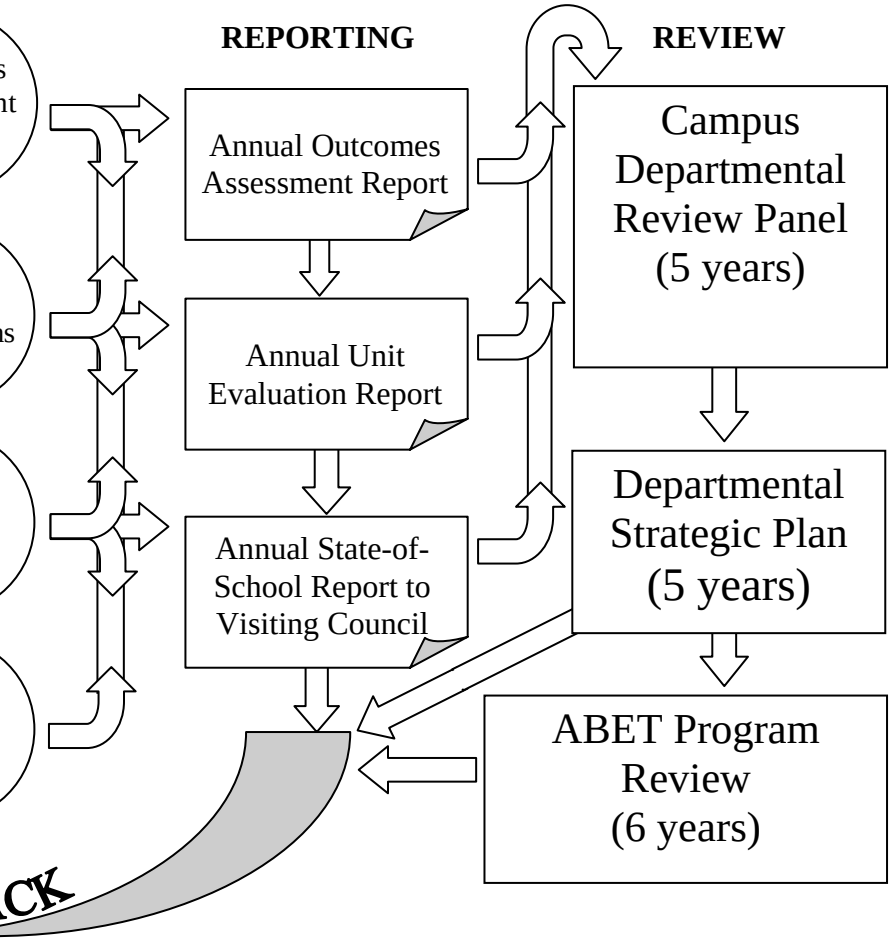
As noted in Table 1 of Appendix IA, the undergraduate curriculum meets the Program Criteria for mathematics, physics, and chemistry. The undergraduate Environmental Engineering curriculum requires coursework in the areas of general chemistry, earth science, biological science, introduction to environmental issues (e.g., air land, water and environmental health), and environmental engineering design, plus 6 credits of professional electives (all in environmental engineering,

environmental science or approved substitutes (Attachment 20) except in unusual circumstances). Other professional practice issues, although covered in many electives, are also woven with ES 4813 Environmental Professional Practice and CE 4903 Capstone.

Laboratory sections are required for select courses from each of the four broad areas: Geotechnical (CE 3364 - Soil Mechanics); Measurements (CE 3334- Measurements); Environmental Processes (CE 3243- Water and Wastewater Treatment); and Environmental Sciences (CE 4114- Aquatic Chemistry and CE 4234- Applied Environmental Microbiology). A number of the Professional Electives in each area also include laboratory components.

Design concepts, methodology and teamwork are incorporated throughout the CEES curriculum via the Sooner City concept, in which components of a fictitious city are designed in designated courses. Sooner City courses in the curriculum function using a format of teamwork, written and oral presentations, and practitioner involvement; the final product is a student portfolio at the end of their studies. Currently, the curriculum culminates in a major capstone experience (CE 4903). The capstone course addresses a practitioner-guided, real world design problem using multidisciplinary teams.

Professional issues and other non-traditional topics are addressed in junior and senior level design courses. In addition, the Professional Practice course focuses on professional practice issues such as registration, ethics, etc (in ES 4813) as well as real-world design (in CE 4903). Attachment 21 lists the professional issues addressed by courses within the Environmental Engineering curriculum. The content of each course is summarized on the course syllabi in Appendix IB.



essment process. The main components of this process are the
d (Reporting), and how the information is used to demonstrate
l Feedback).

Table 2. Approved Professional Electives and Areas of Emphasis for Bachelor of Science in Environmental Engineering Degree

ly s	Environmental Systems Modeling	Environmental Chemistry	Wastewater Management	Solid & Hazardous Waste Management	Environmental & Occupational Health
	CE 5883	ES 4473	CE 4123	CE 4263	ES 4863
	ES 4863	ES 5020 (IEC)	CE 5244	CE 5343	ES 4493
	MATH 4753	ES 5020 (EES)	CE 5624	CE 5423	ES 5913
		ES 5943	ES 4324	CE 5803	
				ES 4863	

e
nt areas of emphasis.
nce electives.

.	Title
	Water Quality Management
	Environmental Modeling
	Environmental Biology and Ecology
	Soil Science
	Environmental Evaluation and Management
	Assessment Method
	Ecological Engineering Science (EES)
	Instrumentation for Environmental Chemistry (IEC)
	Risk Assessment and Management
3	Applied Math Statistics

Table 3. Environmental engineering professional issues addressed in the core curriculum for Bachelor of Science in Environmental Engineering Degree

ng Professional Issues		
s Envirn. Health	Engineering Design	Other Professional Practice Issues
		✓
	✓	
	✓	
	✓	
	✓	
	✓	
	✓	
✓	✓	✓
	✓	
✓		✓
✓	✓	✓
		✓
	✓	✓