Special Consideration Item:

Graduate Council approved the College of Engineering request for a Master of Science in Safety Engineering via distance learning.
MEMORANDUM

Date: July 10, 2010

TO: David Reed
Chair of the COE Graduate Committee
Texas A&M University

THROUGH: Jan Wright Richards
Acting Director
Office of Distance Education

THROUGH: Dr. Robin Autenrieth
Associate Dean for Graduate Programs
Look College of Engineering

THROUGH: Dr. Michael V. Pishko
Charles D. Holland '53 Professor and Head
Artie McFerrin Department of Chemical Engineering

FROM: Dr. M. Sam Mannan
Regents Professor, Holder of T. Michael O'Connor Chair, Professor and
Director Mary Kay O'Connor Process Safety Center
Artie McFerrin Department of Chemical Engineering

SUBJECT: Master of Science – Safety Engineering via Distance Learning

We propose to offer, in addition to the current Master of Science – Safety Engineering program, this degree with a distance learning option. This degree encompasses multiple engineering disciplines and by adding the distance learning option it will open the door significantly and increase the number of graduate students by attracting professionals in the safety industry as well as recruiting students from the other engineering disciplines. The program via distance learning that will train and educate current engineers and those individuals entering the workforce and fill the demand for safety professionals over the next ten years, thereby ensuring an environment for national/public health, safety and security. The department is dedicated to linking all engineering disciplines and promoting a safety culture that is jointly supported by all engineering fields.

Objective

To start a distance education program in Safety Engineering, this first initiative is committed to offering the Master of Science – Safety Engineering degree via
distance learning. This will meet an identified industry need for continuing education for its professionals. This distance learning option will meet the challenges the industry is facing in growth, technological advancements, and continuous changes.

Goals
To provide a distance education opportunity that will lead to a master’s degree. To seek approval to offer a Master of Science – Safety Engineering distance learning program.

Justification
This distance learning degree is an effort to meet an identified industry need for continuing education for its professionals. This distance learning option will meet the challenges the industry is facing in growth, technological advancements, and continuous changes.

I have prepared the attached proposal for a distance education option for the Master of Science – Safety Engineering program. Dr. Robin Autenrieth, Associate Dean of Graduate Programs in the Look College of Engineering, has reviewed the proposal and concurs that the proposal as written meets all requirements for final approval by the Board of Regents (BOR). The degree being proposed already exists; this proposal seeks BOR approval to offer the degree via distance learning.
Texas A&M University
New Certificates, Bachelors, Masters, or Doctoral Programs
• Proposal Checklist •

Requested by the Department of Unit of: Chemical Engineering

Program Type, Level, Designation, Title, Description, Hours
Program Type Certificate Program □ Degree Program X
Program Level Undergrad Certificate □ Grad Certificate □ Bachelor □ Master X □ Doctoral □
Degree Designation (i.e., BS, BA, MA, MS, MAg, Med, PhD, EdD, etc.) None
Title of proposed program: Master of Science – Safety Engineering
Proposed CIP Code (if known):

Brief program description (provide a catalog description for undergraduate and graduate certificates):
The degree program’s primary focus, with thesis, is to teach the principles and practices of safety engineering for leadership careers in industry. Those engineers working on this degree via distance learning will have the opportunity to integrate course work with real-time industry experience to enhance job performance, leadership skills and classroom involvement. The objective of this particular effort is to meet an identified industry need for continuing education for its professionals. The industry is in a state of unprecedented growth, wherein technology advancement are ever changing and even the most recent graduates need continued education training and knowledge is order to succeed.

Minimum program semester credit hours (SCH) Certificates – 12 hours* Bachelors – 120 hours Masters – 30 hours
Proposed program hours:

Off-Campus or Distance Delivery
% of Program a student can take off-campus or through Distance Education

<table>
<thead>
<tr>
<th>Program Start Date</th>
<th>SACS Approval**</th>
<th>When Provost needs to inform SACS</th>
</tr>
</thead>
<tbody>
<tr>
<td>X 100%</td>
<td>January 2011</td>
<td>Approval Required 6 months before first day of program</td>
</tr>
</tbody>
</table>

**Notification letter arranged through the Assistant Provost and sent by TAMU President

Program Delivery Mode

□ On-campus

□ Broadcast/TTVN

□ Specific off-campus location***

X Distance Education/Internet In-State X Out-of-State X Start Date January 2011

□ Out-of-Country

Will this program be offered with another institution? Yes □ No □
If yes, contact Assistant Provost for additional reporting requirements.

***Is this an approved SACS location Yes □ No □
If no, a program prospectus must be sent to SACS.
Approved locations as of September 2009: TAMU-Galveston, TAMU-Qatar, University Center-The Woodlands, Dubai (EMBA)
Program Funding
Has program funding been finalized at the department or college level? Yes X No □
If no, explain or attach budget: ____________
Will new costs for the first five years of the program be under $2 million? Yes X No □
If new costs exceed $2 million, coordinating board approval is required.

Submitted by (Contact Person):
M. Sam Mannan ______________________ mannan@tamu.edu ______________________
Name __________________________ Email __________________________
Regents Professor and T. Michael O’Connor Chair Jr. ______________________ 979-845-3489 ______________________
Title __________________________ Phone __________________________

Certification Statement
By signing below, the Dean of the College certifies the proposed program complies with coordinating board standards. If the program is delivered through Distance Education, the Dean of the College certifies that they are following the Principles of Good Practice for Academic Degree and Certificate Programs and Credit Courses Offered Electronically.

Use additional signature lines if program is between three or more departments or colleges.

Signature, Department Head or Interdisciplinary Program Chair _______________ Date _______________

Typed or Printed Name

Signature, Department Head or Interdisciplinary Program Chair (if joint program) _______________ Date _______________

Typed or Printed Name

Chair, College Review Committee _______________ Date _______________

Chair, College Review Committee _______________ Date _______________

Dean of College _______________ Date _______________

Dean of College _______________ Date _______________

Chair, University Curriculum Committee or Graduate Council _______________ Date _______________

Chair, University Curriculum Committee or Graduate Council _______________ Date _______________

Additional Approvals Required: Faculty Senate and President.

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Approval to Propose an Existing Degree Program for Delivery Via Distance Education At Texas A&M University

Master of Science- Safety Engineering

Name of Program

Chemical Engineering
Department Hosting Program

College of Engineering
College

We have examined the attached proposal to convert the degree MS- Safety Engineering For distance delivery and endorse its submission to the Board of Regents and the Texas Higher Education Coordinating Board.

__________________________
Department Head

__________________________
Graduate Advisor

__________________________
Program Director

__________________________
Dean of the College

__________________________
Date

9/14/09

__________________________
Date

9/14/09

__________________________
Date

9/14/09

6 of 33 F
July 12, 2010

Dr. Michael Pishko
Department Head

Dr. Sam Mannan
Director of the Mary Kay O’Connor Process Safety Center

Department of Chemical Engineering
3122 TAMU

RE: Process Safety Engineering degree to be offered at a distance

Dear Drs. Pishko and Mannan:

I am very excited about the possibility of a distance learning (DL) Process Safety Engineering degree because it will open more opportunities for our online students to take external graduate level courses as part of their graduate degree in petroleum engineering. Because Process Safety Engineering is becoming increasingly important worldwide and has emerged as a discipline on its own, we have cross listed Process Safety Engineering courses with Petroleum Engineering catalog number in the past as a means to deliver officially these courses to Petroleum Engineering DL students. The fact that these courses have been well received by our students indicates clearly that industry demands the kind of degree Process Safety Engineering proposes to offer. Offering this new Process Safety Engineering degree to DL students will allow our Petroleum Engineering DL Students registration to these courses and could eventually lead to a minor outside our department.

Because we have been involved with the development of the DL program in Process Safety engineering from the beginning, we are especially pleased to see the department building on that foundation. Our own experience shows that these courses will be in great demand not only for their content but also for the DL delivery that will make them accessible to engineers across the State and around the globe.

We look forward to having the new program available to our students and to the benefits it will bring the university as we establish our reputation as a leader in online engineering education. Please do not hesitate to contact our team for any future help we are able to provide.

Sincerely,

Maria A. Barrufet
Assistant Department Head and Director of Distance Learning Program
Proposal

Master of Science, Safety Engineering
via Distance Education
(Electronic Transmission and Off-Campus Locations)

Submitted to
Texas A&M University Board of Regents
April 2010
Request submitted to the Texas A&M University Board of Regents
Approval to Offer MS Degree in Safety Engineering
via Distance Education

The Artie McFerrin Department of Chemical Engineering requests approval to offer the Master of Science, Safety Engineering degree program via instructional communication technologies to training facilities in the chemical industry, and as requested by companies training their engineers.

Mary Kay O’Connor Process Safety Center (MKOPSC), a center within the Artie McFerrin Department of Chemical Engineering, has a history of outreach and an established record of safety education through its continuing education program. As the Center manages the Safety Engineering program for the Dwight Look College of Engineering, the Center receives numerous inquiries from students, companies and other academic institutions in the U.S. and abroad regarding the availability of web-based safety courses as well as a complete Master’s degree. In addition to the students attending on-campus classes in the traditional university setting, the Master of Science degree in Safety Engineering will be offered via distance learning to professionals employed in industry who cannot enroll and complete their degree by attending on-campus classes. Thus, by offering this degree more widely we are not only developing and training the workforce needed to fill the demand for safety professionals over the next ten years, we are ensuring an environment for national/public health security. This program will be made available through a variety of delivery methods such as compressed digital video, TTVM, and internet communications. Most courses will be delivered simultaneously through interactive video to all sites.

All Safety Engineering courses offered via instructional telecommunications will follow all Texas Higher Education Coordinating Board guidelines for off-campus and instructional telecommunications courses. These courses will be determined and scheduled by the appropriate academic departments; will be taught by university faculty members; will require identical work and evaluation of students; and will be structured and evaluated as the on-campus sections. These courses will differ only in that they will be delivered simultaneously via distance learning technology and that they will be overseen by the Distance Education Program (http://distance.tamu.edu/).

The majority of funding for this program will be provided by interested and cooperating industry and consortia groups who have identified a need for additional continuing educational opportunities for practicing engineers within their organizations. Delivering courses directly to corporate sites and to public sites easily accessible to engineers will provide them the opportunity to continue their studies, advance their degree and continue working on the job as valuable engineers (See Appendix D for sample of programs/companies).
History

Authority for compressed video transmission of instructional courses was approved by the Texas Higher Education Coordinating Board (THECB) for the Texas A&M University System in July 1991. Texas A&M University is authorized to use distance learning technology for instructional telecommunications courses in conformance with THECB Rules and Regulations.

The Department of Chemical Engineering conferred its first Master of Science degree in 1913. We have offered regularly approved graduate-level courses via compressed telecommunications since the fall semester 2007. The first course that is in the degree plan for the Master of Science, Safety Engineering degree was first offered via distance learning in the fall semester 2007. At this time, we have two graduate level courses we are offering via compressed telecommunications and have constructed three additional technology carts with the appropriate equipment to provide additional required courses.

Degree Program

Oversight for the Master of Science in Safety Engineering degree has been in place for over 7 years in the Mary Kay O'Connor Process Safety Center within the Artie McFerrin Department of Chemical Engineering. However, this program has been in existence in the College of Engineering for more than 20 years prior to being transferred. The degree program’s primary focus, with thesis, is to teach the principles and practices of safety engineering for leadership careers in industry. Engineers with their Bachelor of Science degree working on the MS in Safety Engineering degree via distance learning will have the opportunity to integrate course work with real-time industry experience to enhance job performance, leadership skills and classroom involvement.

The Department’s graduate program as a whole is widely respected and was ranked 18th in the nation by US News & World Report in its most recent ranking of schools of chemical engineering (2009). In addition to the Master of Science in Safety Engineering, the Department of Chemical Engineering also offers Master of Engineering, Master of Science and Doctors of Philosophy in Chemical Engineering.

Program Goals

The objective of this particular effort is to meet an identified industry need for continuing education for its professionals. The industry is in a state of unprecedented growth, wherein technology advancements are ever changing and even the most recent graduates need continued educational training and knowledge in order to succeed.
TEXAS A&M ENGINEERING

Entrance Requirements

Applicants must meet minimum entrance requirements as set by Texas A&M University in the current graduate catalog.

Coursework Requirements

As with all Master of Science degrees requiring a thesis, a minimum of 32 semester credit hours of approved courses and research is required. This program consists of 24 hours of courses, 8 hours of 691 research hours (including a thesis). This program includes extensive engineering applications with integration of safety principles, safety practices, and case studies. Of those 24 hours of coursework, 12 hours of Safety Engineering (SENG) core courses are required in the degree plan as listed in Table 1. The remaining 12 hours of coursework will be electives as determined by the Director of the Safety Engineering program in discussion with the student based on the student’s area of specialization. These courses can come from any graduate level course and 400 level undergraduate courses as outlined in the graduate course catalog for the Master of Science degree. If lab research work is needed, the student will be required to physically come to Texas A&M University to perform experiments under the supervision of the student’s advisor. This will be determined on a case-by-case basis. The use of courses from outside the Texas A&M University System to transfer to the degree will be used only on a case-by-case basis and must comply with university requirements.

Sufficient Safety Engineering courses will be offered directly through this program to meet these requirements, and additional non-CHEN courses will be added to the program as they become available for transmission. Some such courses are already being offered by other distance education programs at Texas A&M University and others are being proposed with interested faculty from non-CHEN departments. As noted, the faculty members of record for these courses are teaching within departments in the College of Engineering. These faculty members are selected and evaluated by the same standards, review, and approval procedures used to select and evaluate faculty responsible for on-campus instruction. In order to teach these courses the faculty members must also be eligible to teach graduate level instruction in residence.
Table 1. Recommended Courses for a DL degree in the MS Safety Engineering program

<table>
<thead>
<tr>
<th>Course Section</th>
<th>Course Title</th>
<th>Course Description</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>SENG 611</td>
<td>Occupational and Environmental Epidemiology</td>
<td>The epidemiologic evaluation of human health hazards in the workplace and the environment; issues in the design and critical review of epidemiologic studies in the determination of effects of chemicals, heavy metals and radiation on human health resulting from occupational and environmental exposures. Prerequisites: SENG 680 and VIBS 607 or approval of instructor.</td>
<td>3</td>
</tr>
<tr>
<td>SENG 636</td>
<td>Biological Control System Analysis</td>
<td>Current advances in practical biomechanics and ergonomics in industry in combating musculoskeletal injury and illness, demonstrations of the positive effects of redesign of job requirements, hand tools, chairs, manual material handling tasks, machine controls and workspace arrangements. Prerequisite: ISEN 430 or 630. Cross-listed with ISEN 636.</td>
<td>3</td>
</tr>
<tr>
<td>SENG 644</td>
<td>Worker Response to Physiological and Environmental Stress in Manufacturing</td>
<td>Function of the human body in a work environment in response to physical exertion and environmental stress in manufacturing; anatomy, anthropometry, strength, respiration, neurophysiology, electrophysiology, cardiovascular muscle physiology, and worker capacity evaluation (back and carpal tunnel syndrome). Prerequisite: ISEN 430 or 630. Cross-listed with ISEN 644.</td>
<td>3</td>
</tr>
<tr>
<td>SENG 645</td>
<td>Occupational Biomechanics</td>
<td>Fundamental topics upon which models are constructed; variety of models appropriate in occupational settings; bioinstrumentation theory and practice for model evaluation; experience in applying the models and associated tools in the</td>
<td>3</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Description</td>
<td>Credits</td>
</tr>
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<td>---------</td>
</tr>
<tr>
<td>SENG 655</td>
<td>Process Safety Engineering</td>
<td>Fundamental topics upon which models are constructed; variety of models appropriate in occupational settings; bioinstrumentation theory and practice for model evaluation; experience in applying the models and associated tools in the occupational setting. Prerequisite: SENG 644 or ISEN 644 or equivalent. Cross listed with CHEN 655.</td>
<td>3</td>
</tr>
<tr>
<td>SENG 660</td>
<td>Quantitative Risk Analysis</td>
<td>Fundamental concepts, techniques and applications of quantitative risk analysis and risk-informed decision making for students in all engineering fields. Practical uses of probabilistic methods are demonstrated in exercises and case studies from diverse engineering areas. Cross listed with CHEN 660</td>
<td>3</td>
</tr>
<tr>
<td>SENG 670</td>
<td>Industrial Safety Engineering</td>
<td>General concepts and techniques of safety engineering upon which more detailed and advanced applications may be based; applications of safety engineering principles to industrial and commercial systems; the concept of designing optimally safe systems.</td>
<td>3</td>
</tr>
<tr>
<td>SENG 671</td>
<td>Product Safety Engineering</td>
<td>Provides specialized emphasis required to develop within a student the ability to function in the product design as a specialist in product safety engineering; safety engineering and human factors principles are focused on specific problems in product safety and liability considerations; application of system safety principles.</td>
<td>3</td>
</tr>
<tr>
<td>SENG 674</td>
<td>System Safety Engineering</td>
<td>Current system safety engineering analysis techniques; failure mode and effect and fault tree analysis. Engineering economic analysis is reviewed to develop skills for the safety engineer in presenting alternate solutions to management.</td>
<td>3</td>
</tr>
<tr>
<td>SENG 677</td>
<td>Fire Protection Engineering</td>
<td>Theory of combustion, characteristics of flammables, fire resistance, fire spread, fire protection principles, public and private fire service organization and equipment; automatic extinguishing systems. Fire protection analysis and design projects.</td>
<td>3</td>
</tr>
<tr>
<td>SENG 680</td>
<td>Industrial Hygiene</td>
<td>Recognition of environmental stresses present in man-machine-environment systems and the effect of these stresses on human performance, safety and health; chemical, physical, ergonomic</td>
<td>3</td>
</tr>
</tbody>
</table>
and biological exposures, manufacturing systems, materials and operations.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>SENG 681</td>
<td>Seminar</td>
<td>Formal presentations in industrial hygiene and safety engineering by students and professional industrial representatives.</td>
<td>1</td>
</tr>
<tr>
<td>SENG 682</td>
<td>Instrumentation for Industrial Hygiene</td>
<td>Evaluation of environmental stress factors present in man-machine-environment systems. Introduction to quantitative and qualitative instrumentation used in industrial hygiene. Development of in-depth evaluation techniques as a precursor to the design of engineering controls. Prerequisite: SENG 680 or approval of instructor.</td>
<td>4</td>
</tr>
<tr>
<td>SENG 683</td>
<td>Evaluation and Control of the Occupational Environment</td>
<td>Detection, evaluation and control of chemical, physical and biological agents prevalent in manufacturing, construction and mercantile operations. Evaluation procedures and control technology emphasized. Guest speakers and field trips to local industry. Prerequisites: SENG 680 and 682 or approval of instructor.</td>
<td>4</td>
</tr>
<tr>
<td>SENG 684</td>
<td>Professional Internship</td>
<td>Training under the supervision of practicing engineers in settings appropriate to the student's professional objectives. Prerequisites: Approval of chair of student's advisory committee and department head.</td>
<td>1-6</td>
</tr>
<tr>
<td>SENG 685</td>
<td>Directed Studies</td>
<td>Investigation of topics not within the scope of thesis or dissertation research and not covered by other formal courses.</td>
<td>1-12</td>
</tr>
<tr>
<td>686</td>
<td>Acoustic and Noise Control</td>
<td>Physical, physiological and psychological aspects of noise; evaluation and control of the noise problem in the work environment and community. Source, path and level of noise; acoustical properties of materials; damage-risk criteria for hearing; and criteria for noise and vibration in communities, buildings and vehicles.</td>
<td>3</td>
</tr>
<tr>
<td>687</td>
<td>Industrial Ventilation</td>
<td>Development of design principles and application of natural, dilution and local exhaust ventilation to control occupational exposures to conditions conducive to the development of occupational disease.</td>
<td>3</td>
</tr>
<tr>
<td>689</td>
<td>Special Topics in...</td>
<td>Selected topics in an identified area of safety engineering and industrial hygiene. May be repeated for credit. Prerequisite: Approval of instructor.</td>
<td>1-4</td>
</tr>
<tr>
<td>691</td>
<td>Research</td>
<td>Research in industrial hygiene, safety engineering or related topics for thesis or dissertation.</td>
<td>1 or more</td>
</tr>
</tbody>
</table>

**Examination Procedures**

*Course Examinations*

Off-campus students in the program will complete the same examinations as local on-campus students. Because most professors want to see the students’ actual written work in the form of math problems worked, graphs, charts, etc., we offer the following examination options: deliver the exam as an attachment or deliver the exam electronically inside of VNET (computer networking system for electronic course delivery) using their testing tool. Since students may potentially be located around the globe, in different time zones, and have access to varied levels of technology, it will be necessary to offer exams within a window of time. The primary method of test delivery, will be to open a testing time and have students return the test by a specified time and date. If the exam needs to be timed, there is a means of establishing a time stamp on the test using the VNET.
program. The VNET software offers the following for examinations including the ability to limit access to testing centers or IP addresses for proctoring purposes:

- Timer- for setting time limit on tests
- Attach document, video or sound to question of any type
- Multiple Attempt Testing- takes choice of best score/first attempt/last attempt of multiple attempts by student (limited or unlimited)
- Restrict Access to specific IP - for testing in testing center or allowing only specific IP addresses

The options for proctoring will be made available online for faculty in departments outside of Engineering and the Chemical Engineering department. There are several software programs available that incorporate proctors in remote locations, such as libraries or campus testing facilities. In addition, there are options within industry settings for supervisors to act as the proctor for their employees.

**Final Degree Program Examination**

After completing all Distance Masters of Safety Engineering program requirements, all students will be required to complete a final examination in accordance with University policy.

**Delivery System**

With technologies developing rapidly in both the academic and industrial settings of this industry, the Safety Engineering program will maximize transfer of course content through a combination of communications and educational technology systems. To do this, compressed video will be used as the primary delivery methodology with the support of Internet, Centra software for webconferences and videoconference. Because our students may be located in unusual places with various types of technology available to them, we will adhere to the goal of delivering the course content as effectively and efficiently as possible. The primary goal will be to deliver a comparable quality of instruction as is expected of graduate level courses at Texas A&M and in such a way as to meet the unique needs of remote students and to access their experiential knowledge to the benefit of other students, both on campus and in remote locations.

**Internet and Other Media**

The Distance Masters of Safety Engineering program will encourage direct student communication with professors by whatever media means is available and appropriate. Primary among these will be electronic mail and course discussion boards, which allows fast, inexpensive communications. Some professors have already used this successfully, for example, for submittal and return of weekly “homework” assignments; it also allows opportunities for some discussion among students and with the professor.
TEXAS A&M ENGINEERING

Web pages will announce dates and locations of proposed future course offerings and provide necessary class notes before meetings; provide a chat room for intercommunications between students and professors, especially for opportunities for team-development projects; and broadcast other information useful to the students and the general public regarding our classes.

Students who for some reason cannot communicate with professors via the Internet will be able to reach them by fax, telephone, or other media. Class materials will be distributed to them via these same media or overnight delivery.

Off-Campus Instruction

As opportunities arise, the program may need to provide classroom instruction at one of the distant sites separate from the other televideo sites. Any such class will be coordinated with the university, the department, and the Coordinating Board exactly as if it were being taught on campus at College Station, but will provide an instructor onsite at the off-campus location. We project that this will occur in the event, for example, that a video-transmissions room or class time might not be available at the same time for both the College Station and off-campus locations.

Geographical Areas Served

The Department of Chemical Engineering proposes to deliver the Distance Masters of Safety Engineering program to identified industry that has indicated a need for continuing education of its professional workforce. Location is not predetermined.

Course Inventory

All courses offered in the Distance Masters of Safety Engineering program will be applicable to the existing Master of Safety Engineering degree. Several courses exist in other Engineering programs via distance learning (See Table 2 below). Students will be able to choose these courses as part of their degree program as well. Because of the rapid development of important new technologies in the field, we expect to offer at least a portion of the courses for this degree as 689 Special Topics courses. In addition, students may take a portion of their work from other universities and as long as TAMU guidelines are followed transfer credit may be applied to this degree.

All courses offered in the Distance Masters of Safety Engineering program will be listed in the university’s current course inventory approved by the Texas Higher Education Coordinating Board.
Table 2. Distance Learning Classes for Engineering Degrees Offered at Texas A&M
(Engineering Systems Management, Petroleum, Industrial and Industrial
Distribution, Statistics)

<table>
<thead>
<tr>
<th>Course Section</th>
<th>Course Title</th>
<th>Course Description</th>
<th>Credit Hours</th>
</tr>
</thead>
</table>
| ISEN 608       | Industrial Case Analysis            | Practice in applications of principles to the solution of actual case problems involving broad management decisions.  
Prerequisites: ISEN 303, 315, 404 or approval of instructor. | 3            |
| ISEN 609       | Probability for Engineering Decisions | Introduction to probability as an analytical methodology for characterizing uncertainty. Development of dynamic probability models for use in engineering decision making. Applications will include strategic and operational planning, large-scale resource allocation, risk analysis, and production and inventory control. Prerequisite: Graduate standing in industrial and systems engineering. | 3            |
| ISEN 620       | Survey of Optimization              | Theoretical and numerical methods for deterministic linear and nonlinear optimization. Topics to be discussed include linear programming, unconstrained-nonlinear optimization, constrained- nonlinear optimization: Lagrange and K-K-T conditions, and numerical algorithms. Prerequisite: MATH 304 and MATH311 | 3            |
| ISEN 625       | Simulation Methods and Applications | Fundamental methodologies of simulation modeling; random number and variate generation, statistical analysis of model output, and discrete event modeling using a commercial simulation language. Prerequisite: STAT 212 or 601. | 3            |
| ISEN 627       | Engineering Analysis for Decision Making | Principles and application of techniques in analysis of decision processes involving engineering systems under uncertainty. Areas of utility and information theory as related to quantification of information for decision-making.  
Prerequisites: ISEN 420 and 667; STAT 601 or approval of instructor. | 3            |
<p>| ISEN 630 | Human Operator in Complex Systems | Formulation techniques are studied along with general approaches for solving integer and combinatorial optimization problems: basic polyhedral theory, cutting planes, branch and bound, matroids and theoretical background behind network optimization problems including the traveling salesman problem. <strong>Prerequisite:</strong> ISEN 622. | 3 |
| ISEN 640 | Systems Thinking and Analysis | Introduction to the systems thinking process, systems of systems, and the fundamental considerations associated with the engineering of large-scale systems, or systems engineering. These include systems modeling and design, system development process, needs analysis, concept exploration, concept definition, engineering design, integration and evaluation, and systems engineering management. <strong>Prerequisite:</strong> STAT 212 or 414 or STAT 601 or equivalent, senior level or graduate standing. | 3 |
| ISEN 663 | Engineering Management Control Systems | Integration of human relations, planning and control concepts, systems analysis and design, and principles of management oriented toward engineering functions within an organization; organizational design and administration as they impact along the product life cycle, i.e., research, design, development, production and use. | 3 |
| ISEN 667 | Engineering Economy | Fundamental concepts and advanced techniques of engineering economic analysis; evaluation of alternative capital investments considering income taxes, depreciation and inflation; discounted cash flow analysis of competing projects, break-even analysis and determination of rate of return on investment. Risk and uncertainty in engineering analysis. <strong>Prerequisite:</strong> ISEN 303 or equivalent. | 3 |</p>
<table>
<thead>
<tr>
<th>Course</th>
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</tr>
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<tbody>
<tr>
<td>ISEN 669</td>
<td>Software Tools for Stochastic Decision Support Analysis</td>
<td>The study and understanding of modeling complex decision situations in a logical and structural manner. Complex decision problems are considered and modeled using decision trees, sensitivity analysis, simulation and statistical analysis techniques. Decision situations are considered within the context of risk and uncertainty and modeled and evaluated accordingly.</td>
<td>3</td>
</tr>
<tr>
<td>ISEN 685</td>
<td>Directed Studies</td>
<td>Special topics not within scope of thesis research and not covered by other formal courses.</td>
<td>1 to 12 each semester</td>
</tr>
<tr>
<td>ISEN 691</td>
<td>Internship</td>
<td>Research in industrial engineering field; content and credit dependent upon needs of individual student.</td>
<td>1 or more each semester</td>
</tr>
<tr>
<td>PETE 602</td>
<td>Well Stimulation</td>
<td>Design and analysis of well stimulation methods, including acidizing and hydraulic fracturing; causes and solutions to low well productivity.</td>
<td>3</td>
</tr>
<tr>
<td>PETE 603</td>
<td>Advanced Reservoir Engineering I</td>
<td>Petroleum reservoir simulation basics including solution techniques for explicit problems.</td>
<td>3</td>
</tr>
<tr>
<td>PETE 605</td>
<td>Phase Behavior of Petroleum Fluids</td>
<td>Pressure, volume, temperature, composition relationships of petroleum reservoir fluids.</td>
<td>3</td>
</tr>
<tr>
<td>PETE 608</td>
<td>Well Logging Methods</td>
<td>Well logging methods for determining nature and fluid content of formations penetrated by drilling. Development of computer models for log analysis.</td>
<td>3</td>
</tr>
<tr>
<td>PETE 609</td>
<td>Enhanced Oil Recovery Processes</td>
<td>Fundamentals and theory of enhanced oil recovery; polymer flooding, surfactant flooding, miscible gas flooding and steam flooding; application of fractional flow theory; strategies and displacement performance calculations.</td>
<td>3</td>
</tr>
</tbody>
</table>

**Artie McFerrin Department of Chemical Engineering**

Master of Science, Safety Engineering

Page 13 of 26
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PETE 611</td>
<td>Applications of Petroleum Reservoir Simulation</td>
<td>Use of simulators to solve reservoir engineering problems too complex for classical analytical techniques. <strong>Prerequisites:</strong> PETE 400 and 401.</td>
<td>3</td>
</tr>
<tr>
<td>PETE 616</td>
<td>Engineering Near-Critical Reservoirs</td>
<td>Identification of reservoir fluid type; calculation of original gas in place, original oil in place, reserves and future performance of retrograde gas and volatile oil reservoirs. <strong>Prerequisites:</strong> PETE 323, 400, 401.</td>
<td>3</td>
</tr>
<tr>
<td>PETE 617</td>
<td>Petroleum Reservoir Management</td>
<td>The principles of reservoir management and application to specific reservoirs based on case studies presented in the petroleum literature.</td>
<td>3</td>
</tr>
<tr>
<td>PETE 618</td>
<td>Modern Petroleum Production</td>
<td>An advanced treatment of modern petroleum production engineering encompassing well deliverability from vertical, horizontal and multilateral/multibranch wells; diagnosis of well performance includes elements of well testing and production logging; in this course the function of the production engineer is envisioned in the context of well design, stimulation and artificial lift.</td>
<td>3</td>
</tr>
<tr>
<td>PETE 620</td>
<td>Fluid Flow in Petroleum Reservoirs</td>
<td>Analysis of fluid flow in bounded and unbounded reservoirs, wellbore storage, phase redistribution, finite and infinite conductivity fractures; dual-porosity systems. <strong>Prerequisite:</strong> PETE 323.</td>
<td>3</td>
</tr>
<tr>
<td>PETE 630</td>
<td>Geostatistics</td>
<td>Introductory and advanced concepts in geostatistics for petroleum reservoir characterization by integrating static (cores/logs/seismic traces) and dynamic (flow/transport) data; variograms and spatial correlations; regionalized variables; intrinsic random functions; kriging/cokriging; conditional simulation; non-Gaussian approaches. <strong>Prerequisites:</strong> Introductory course in statistics or PETE 322.</td>
<td>3</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Description</td>
<td>Credits</td>
</tr>
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<tr>
<td>PETE 648</td>
<td>Pressure-Transient Testing</td>
<td>Diffusivity equation and solutions for slightly compressible liquids; dimensionless variables; type curves; applications of solutions to buildup, drawdown, multi-rate, interference, pulse and deliverability tests; extensions to multiphase flow; analysis of hydraulically fractured wells. Prerequisites: PETE 324 and 620.</td>
<td>3</td>
</tr>
<tr>
<td>PETE 661</td>
<td>Drilling Engineering</td>
<td>Introduction to drilling systems: wellbore hydraulics; identification and solution of drilling problems; well cementing; drilling of directional and horizontal wells; wellbore surveying abnormal pore pressure, fracture gradients, well control; offshore drilling, underbalanced drilling.</td>
<td>3</td>
</tr>
<tr>
<td>PETE 662</td>
<td>Petroleum Production Systems</td>
<td>Development of fundamental skills for the design and evaluation of well completions, monitoring and management of the producing well, selection and design of article lift methods, modeling and design of surface facilities.</td>
<td>3</td>
</tr>
<tr>
<td>PETE 663</td>
<td>Formation Evaluation and Analysis of Reservoir Performance</td>
<td>Current methodologies used in geological description/analysis, formation evaluation (the analysis/interpretation of well log data), and the analysis of well performance data (the design/analysis/interpretation of well test and production data); specifically, the assessment of field performance data and the optimization of hydrocarbon recovery by analysis/interpretation/integration of geologic, well log, and well performance data. Prerequisite: Approval of instructor or graduate classification.</td>
<td>3</td>
</tr>
<tr>
<td>PETE 664</td>
<td>Petroleum Economics and Reservoir Management</td>
<td>Introduction to oil industry economics, including reserves estimation and classification-, building and using reservoir models, developing and using reservoir management processes, managing new and mature fields, and investment ranking and selections.</td>
<td>3</td>
</tr>
<tr>
<td>Course</td>
<td>Title</td>
<td>Description</td>
<td>Prerequisite</td>
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<tr>
<td>PETE 665</td>
<td>Petroleum Reservoir Engineering</td>
<td>Reservoir description techniques using Petrophysical and fluid properties; engineering methods to determine fluids in place, identify production-drive mechanisms, and forecast reservoir performance; implementation of pressure-maintenance schemes and secondary recovery.</td>
<td>Approval of instructor or graduate classification.</td>
</tr>
<tr>
<td>PETE 667</td>
<td>Probability evaluation techniques for oil &amp; gas properties, including reservoir descriptions, economic analyses, reserves classifications and decision making.</td>
<td>Prefer PETE 664</td>
<td>3</td>
</tr>
<tr>
<td>PETE 689</td>
<td>Production Logging</td>
<td>Covers fluid flow in pipes, the theoretical basis of production logging techniques, production log interpretation techniques, and operational considerations. Production Logging has been described as &quot;that area of well logging concerned with two general goals: (1) problem well diagnosis, and (2) reservoir surveillance.&quot; Production logging refers to a suite of logs that are run normally on completed injection or production wells to evaluate the performance of the well itself or of the reservoir as a whole. Many of these logs measure properties of the fluid in the wellbore, rather than formation properties as in openhole logging. An understanding of the fluid dynamics in a wellbore is an important part of understanding production logs.</td>
<td>Graduate classification.</td>
</tr>
<tr>
<td>Course</td>
<td>Title</td>
<td>Description</td>
<td>Credits</td>
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<tr>
<td>PETE 689</td>
<td>Special Topics in Horizontal Well Completion and Stimulation</td>
<td>Discusses the integrated drilling, completion and stimulation issues in horizontal well development. The topics of the course include well orientation for drilling, completion and stimulation consideration, well completion design, completion performance, horizontal well hydraulic fracturing and acid stimulation. Intelligent completion will also be discussed. Field examples will be used to illustrate the applications of the theories and models presented in the course. <strong>Prerequisite:</strong> Graduate classification.</td>
<td>3</td>
</tr>
<tr>
<td>PETE 689</td>
<td>Special Topics in Advanced Drilling Engineering</td>
<td>Unconventional drilling systems; Horizontal, Extended Reach, Multi-Lateral Drilling; and Fishing Operations; Geothermal drilling, Well control; Underbalanced drilling. <strong>Prerequisites:</strong> PETE 661.</td>
<td>3</td>
</tr>
<tr>
<td>PETE 689</td>
<td>Special Topics in Energy and Sustainability</td>
<td>Overview of energy resources and use with special attention to their long term sustainability; considers fossil, nuclear, and alternative energy sources, electricity and transportation, energy conversions, energy efficiency, energy security, energy policy, and environmental impact. <strong>Prerequisite:</strong> Graduate classification.</td>
<td>3</td>
</tr>
<tr>
<td>Course</td>
<td>Title</td>
<td>Description</td>
<td>Credits</td>
</tr>
<tr>
<td>----------</td>
<td>--------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>PETE 689</td>
<td>Special Topics in Formation Damage: Mechanisms &amp; Remediation</td>
<td>Formation damage can occur in oil and gas wells during drilling, completion, or even following chemical treatments. It adversely impacts well performance and significantly affects the economics of damaged wells. It is essential to understand the various mechanisms that cause formation damage before applying any chemical treatments. This course is designed to explain: (1) how to identify field problems, then (2) how to solve them. It is important to understand how cleaning fluids will interact with the formation brines, rock and oil. Improper design of chemical treatments can result in a new and more difficult type of damage to remove. This course will cover and explain in detail mechanisms of formation damage that can occur during drilling, completion, and following chemical treatments. Finally, the course will address chemical treatments to remove various types of damage. Field examples will be given to highlight the mechanism of damage, and the best method to remove it.</td>
<td>3</td>
</tr>
<tr>
<td>PETE 689</td>
<td>Special Topics in Upscaling of Geologic Models for Flow Simulation</td>
<td>Covers the upscaling of 3D geologic models for reservoir flow simulation. It is based on published papers and supplemented by research topics. The students will be expected to develop upscaling solvers as part of this course. Graduate classification.</td>
<td>3</td>
</tr>
<tr>
<td>PETE 692</td>
<td>Professional Study</td>
<td>Approved professional study or project. May be taken more than once but not to exceed 6 hours of credit towards a degree.</td>
<td>1 to 12</td>
</tr>
<tr>
<td>STAT 601</td>
<td>Statistical Analysis</td>
<td>For students in engineering, physical and mathematical sciences. Introduction to probability, probability distributions and statistical inference; hypotheses testing; introduction to methods of analysis such as tests of independence, regression, analysis of variance with some consideration of planned experimentation.</td>
<td></td>
</tr>
</tbody>
</table>
Evaluation Plan

Evaluation of the Distance Masters of Safety Engineering program will encompass performance of students and professors and quality of program from the perspective of both students and the professors. Students at distant locations will be evaluated in comparison to students in the classroom on campus through grade distributions and test evaluations. Professors will be evaluated through the same evaluation tools used by the department for other courses. The Distance Masters of Safety Engineering program will be evaluated through a survey instrument provided to students at all delivery sites. This instrument will ask students to evaluate the quality of instruction they received through interactive video transmissions, to comment on their use of other media for communications, and to suggest ways to improve various facets of the course. Departmental faculty will monitor courses to evaluate teaching methods and effectiveness and suggest improvements in delivery techniques.

Arrangement to Meet Unique Need of Distance Learners

Distance learners have equal access to resources related to the program. Of particular concern are library and computer resources. All students involved in the program will be subject to the library use fee, which is standard for all Texas A&M University students. They can access library resources either by Internet, electronic document search/review, or in person. Program staff will assist these students as needed in acquiring necessary materials.

Departmental experience in maintaining communications with former students and others in this industry suggests that communications between distant students and faculty or program staff should be convenient and appropriate through use of existing technologies.

Student Financial Aid

Graduate students in this program will qualify for the same financial aid opportunities as students attending classes on campus.

Budget

All budget information below is based on current annual operations. Faculty payment has come from subvention for courses taught on campus, as no distance courses have been offered solely to off-campus sites, but always concurrently to on-campus students. Since all students on- and off-campus are enrolled exactly the same as local students, the only additional expenses of this program are the administrative, communications, and supplies costs. (The THECB Instructional Telecommunications Costs Estimates Form detailing this budget appears as Appendix A to this proposal).
### Appendix A

<table>
<thead>
<tr>
<th>Expenses</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personnel</td>
<td></td>
</tr>
<tr>
<td>Faculty</td>
<td>$ 0.00</td>
</tr>
<tr>
<td>Administrative</td>
<td>35,000.00</td>
</tr>
<tr>
<td>Distribution</td>
<td>27,000.00</td>
</tr>
<tr>
<td>Equipment</td>
<td>15,000.00</td>
</tr>
<tr>
<td>Supplies, materials, travel, etc.</td>
<td>5,000.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$72,000.00</strong></td>
</tr>
</tbody>
</table>

**Income**

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<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>State appropriations</td>
<td>$ 0.00</td>
</tr>
<tr>
<td>Local funds</td>
<td>0.00</td>
</tr>
<tr>
<td>Federal funds</td>
<td>0.00</td>
</tr>
<tr>
<td>Other funds (from industry)</td>
<td>72,000.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$72,000.00</strong></td>
</tr>
</tbody>
</table>
Appendix B

Safety Engineering (SENG)

611. Occupational and Environmental Epidemiology. (3-0). Credit 3.

The epidemiologic evaluation of human health hazards in the workplace and the environment; issues in the design and critical review of epidemiologic studies in the determination of effects of chemicals, heavy metals and radiation on human health resulting from occupational and environmental exposures. Prerequisites: SENG 680 and VIBS 607 or approval of instructor.

636. Biological Control System Analysis. (3-0). Credit 3.

Current advances in practical biomechanics and ergonomics in industry in combating musculoskeletal injury and illness, demonstrations of the positive effects of redesign of job requirements, hand tools, chairs, manual material handling tasks, machine controls and workspace arrangements. Prerequisite: ISEN 430 or 630. Cross-listed with ISEN 636.

644. Worker Response to Physiological and Environmental Stress in Manufacturing. (3-0). Credit 3.

Function of the human body in a work environment in response to physical exertion and environmental stress in manufacturing; anatomy, anthropometry, strength, respiration, neurophysiology, electrophysiology, cardiovascular muscle physiology, and worker capacity evaluation (back and carpal tunnel syndrome). Prerequisite: ISEN 430 or 630. Cross-listed with ISEN 644.

645. Occupational Biomechanics. (3-0). Credit 3.

Fundamental topics upon which models are constructed; variety of models appropriate in occupational settings; bioinstrumentation theory and practice for model evaluation; experience in applying the models and associated tools in the occupational setting. Prerequisite: SENG 644 or ISEN 644 or equivalent.


Applications of engineering principles to process hazards analysis including source and dispersion modeling, emergency relief systems, fire and explosion prevention and mitigation, hazard identification, risk assessment, process safety management, etc. Prerequisite: Approval of instructor. Cross-listed with CHEN 655.
660. Quantitative Risk Analysis (3-0). Credit 3

Fundamental concepts, techniques and applications of quantitative risk analysis and risk-informed decision making for students in all engineering fields. Practical uses of probabilistic methods are demonstrated in exercises and case studies from diverse engineering areas.

670. Industrial Safety Engineering. (3-0). Credit 3.

General concepts and techniques of safety engineering upon which more detailed and advanced applications may be based; applications of safety engineering principles to industrial and commercial systems; the concept of designing optimally safe systems.

671. Product Safety Engineering. (3-0). Credit 3.

Provides specialized emphasis required to develop within a student the ability to function in the product design as a specialist in product safety engineering; safety engineering and human factors principles are focused on specific problems in product safety and liability considerations; application of system safety principles.

674. System Safety Engineering. (3-0). Credit 3.

Current system safety engineering analysis techniques; failure mode and effect and fault tree analysis. Engineering economic analysis is reviewed to develop skills for the safety engineer in presenting alternate solutions to management.


Theory of combustion, characteristics of flammables, fire resistance, fire spread, fire protection principles, public and private fire service organization and equipment; automatic extinguishing systems. Fire protection analysis and design projects.

680. Industrial Hygiene. (3-0). Credit 3.

Recognition of environmental stresses present in man-machine-environment systems and the effect of these stresses on human performance, safety and health; chemical, physical, ergonomic and biological exposures, manufacturing systems, materials and operations.


Formal presentations in industrial hygiene and safety engineering by students and professional industrial representatives.
TEXAS A&M ENGINEERING

682. Instrumentation for Industrial Hygiene. (3-3). Credit 4.
Evaluation of environmental stress factors present in man-machine-environment systems. Introduction to quantitative and qualitative instrumentation used in industrial hygiene. Development of in-depth evaluation techniques as a precursor to the design of engineering controls. Prerequisite: SENG 680 or approval of instructor.

Detection, evaluation and control of chemical, physical and biological agents prevalent in manufacturing, construction and mercantile operations. Evaluation procedures and control technology emphasized. Guest speakers and field trips to local industry. Prerequisites: SENG 680 and 682 or approval of instructor.

684. Professional Internship. Credit 1 to 6.
Training under the supervision of practicing engineers in settings appropriate to the student’s professional objectives. Prerequisites: Approval of chair of student’s advisory committee and department head.

685. Directed Studies. Credit 1 to 12 each semester.
Investigation of topics not within the scope of thesis or dissertation research and not covered by other formal courses.

Physical, physiological and psychological aspects of noise; evaluation and control of the noise problem in the work environment and community. Source, path and level of noise; acoustical properties of materials; damage-risk criteria for hearing; and criteria for noise and vibration in communities, buildings and vehicles.

Development of design principles and application of natural, dilution and local exhaust ventilation to control occupational exposures to conditions conducive to the development of occupational disease.

689. Special Topics in... Credit 1 to 4.
Selected topics in an identified area of safety engineering and industrial hygiene. May be repeated for credit. Prerequisite: Approval of instructor.

691. Research. Credit 1 or more each semester.
Research in industrial hygiene, safety engineering or related topics for thesis or dissertation.
Appendix C  RECOMMENDED COMPUTER TECHNOLOGY

1. Computer: (these are the lowest computer requirements)
   - Pentium 4 or better machine with Windows XP/SP2 or newer operating system
   - operating speed 1 GHz
   - 512MB RAM
   - 40G hard drive
   - video card with at least 6MB RAM
   - sound card
   - speakers
   - CD-ROM

   OR

   Any intel based Macintosh with a minimum of 1 GB RAM
   Any G4 based Macintosh with 1.0 GHz or faster CPU & 1 GB RAM

2. Internet connection:
   - Ethernet (company LAN) or
   - DSL connection or
   - Cable modem connection

3. Additional/Optional Hardware:
   - at least 100MB of extra storage medium (zip drive, thumb drive, flash drive, cd burner, dvd burner...highly recommended)
   - printer or printer access

4. Software Requirements:
   - E-mail software (or web-based email account)
   - Anti-virus – UP TO DATE
   - It is highly recommended that MS Internet Explorer v. 7.0 or above be installed (preferably v.8.0)
   - MS 2003 or newer
     - Excel
     - PowerPoint
     - Word
5. Software Requirements, Free:

- Windows Media Player

- Adobe Shockwave Player
  http://www.macromedia.com/shockwave/download/

- QuickTime

- RealPlayer
  http://www.realplayer.com/

- PowerZip lets you zip and unzip files directly from My Computer or Windows Explorer.
  http://www.download.com/PowerZip/3000-2250_4-10574019.html?tag=lst-0-10

- Adobe Acrobat Reader
  http://www.adobe.com/products/acrobat/readstep2.html

- Web Browser - Microsoft Internet Explorer
  http://www.microsoft.com/windows/i/e/default.mspx

- Java Scripting
  https://hdc.tamu.edu/reference/documentation/?section_id=425
Appendix D  Sample Companies/Programs Expressing Interest/Need for MS in Safety Engineering

Amgen
Bureau Veritas technical center - Abu Dhabi
BP
Chevron
COMIMSA
ConocoPhillips
DNV
Dow
Emmerson Process Management
ExxonMobil
Fluor
Green Plain Renewable Energy, Inc.
Huntsman

Kaltim Pasifik Amoniak
KBR
Kuwait Oil Company
Lloyds
Oklahoma State University-School of Fire Protection and Safety
Royal Commission for Jubail & Yanbu
SASOL
Saudi Polyolefins Company
Schlumberger
Shell
Siemens
Spectra Energy
Sunoco, Inc