ENTC 4490 – SPECIAL TOPICS HUMAN PERFORMANCE FOR NUCLEAR POWER PLANT ENGINEERS

Instructor(s): John W. Poston, Sr., Professor, Department of Nuclear Engineering
TAMUCC Administrator: Ruby Mehrubeoglu, Associate Professor, School of Engineering and Computing Sciences

Instructor Availability: On demand via E-mail, WebCT Course Page chat rooms and/or phone
http://elearning.tamu.edu/ Centra/Saba conference system, http://webconference.tamus.edu/

COURSE DESCRIPTION
This course is divided into six modules: Human performance fundamentals, the organization and the processes, the individual worker, the engineer, corrective action programs and root cause analysis, and case studies including TMI-2, Chernobyl, Davis-Besse, and Fukushima Daiichi.

This course is offered to students pursuing non-nuclear majors as a part of the Nuclear Power Engineering Technology Certificate program. The course is divided into six modules: Human Performance Fundamentals, the Organization & the Processes, the Individual Worker, the Engineer, Corrective Action Programs and Root Cause Analysis, and numerous Case Studies including TMI-2, Chernobyl and Davis-Besse.

Human Performance Fundamentals. Using principles recognized by the HP industry, the fundamentals of human performance theory will allow students to understand the interrelationship between worker, culture, and organizations.

The Organization & the Processes. This topic details the various pieces and parts that provide the direction, expectations, design and much more to the individual for performing tasks. An individual’s performance cannot be any better than the support organization & processes equip it to be.

The Individual. This describes the various error drivers, tools, motivations & mindsets that combine to make or break an individual’s performance.

The Engineer. Here we discuss the role of the engineer, primarily at a nuclear power plant. It is important to understand how he/she is viewed by the Operations & Maintenance staffs. Their professionalism will play a key
role in the overall performance of the plant. Tools and traps that are specific to most engineers will be detailed as well as how latent errors can eventually reveal themselves in event investigations.

**Corrective Action Programs & Root Cause Analysis.** The nuclear industry, as well as other industries, looks to CAP for ways to continuously improve. The student will learn basic root cause analysis techniques.

**Final Case Study.** Numerous case studies are dispersed throughout the entirety of this course. The student will analyze an event by asking the instructor questions suited for different personnel on that particular job.

**Nuclear Power – a higher standard.** We will discuss the nuclear power industry & the standards that are maintained. We will compare those to other industries.

**COURSE OBJECTIVES**

This course allows the student to understand the interrelationships associated with human performance and the role he/she plays in determining the workplace’s human performance culture. In the words of the Institute of Nuclear Power Operations “Goals to improve human performance should be developed to 1) anticipate and prevent active errors at the job site and 2) discover and eliminate process and cultural weaknesses in the organization. Managers and supervisors can improve job site performance by focusing on procedures, tools, equipment access, equipment condition, work environment, incentives, individual knowledge and skill, individual readiness, and motives to reduce the chances of error.”

**Learning Outcomes:**

1. Understand the importance of human performance and its effect on the a well-functioning organization
2. Understand the nuclear safety culture and its implementation in nuclear facilities
3. Ability to function effectively and safely on multidisciplinary and multicultural teams
4. Ability to communicate effectively with peers, subordinates, and superiors
5. Understand professional and ethical responsibilities in nuclear organizations

**Specific objectives include:**

1. **Explain Human Performance fundamentals including:**
   a. The 5 principles of Human Performance
   b. The difference/link between an error and an event
   c. The 6 variables that affect job performance
   d. The 3 performance modes
   e. The 20 common accident components
   f. The value of operating experience

2. **Explain the role the organization & the processes play in Human Performance including:**
   a. Procedure use & quality
   b. Minimizing “shots on goal”
   c. Culture
   d. Design
   e. Latent weaknesses
   f. Training
   g. Equipment reliability
   h. Management’s expectations
   i. Job site issues

3. **Explain the individual worker’s role in Human Performance including:**
   a. Tools that minimize errors when used consistently
   b. Error Drivers to be aware of
   c. Motivation
   d. Understanding the performer is the last defense e. Mindsets/behaviors
4. Explain the role the engineer plays in Human Performance including:
   f. Understanding the relationship between engineer and client
g. Tools specific to the engineer
h. Error Drivers specific to the engineer
i. The importance of getting into the field
j. Professionalism – what it looks like
   k. The role of the Shift Technical Advisor

5. Using learned methods of analysis, participate in a basic classroom investigation of an event to find the causes.

6. Explain the high standards associated with nuclear power plants.

Textbook:

Lecture Notes/References:

ONLINE RESOURCES:

1. Chemical Safety Board website, CSB.gov
   a. Anatomy of a Disaster – the BP Texas City refinery explosion on 3/23/2005 (55 min)
   b. Blast Waves in Danvers – Massachusetts paint company explosion on 11/22/2006 (19 min)
   c. Fire from Ice – Texas Panhandle Valero plant fire on 2/16/2007 (13 min)
   d. Explosion at Formosa Plastics in Illinois on 4/23/2004 (10 min)
   e. Fire at Formosa Plastics in Texas on 10/06/2005 (8 min)
   f. Emergency Preparedness: Findings from CSB Accident Investigations (20 min)

2. YouTube website case studies
   b. BHOPAL UNION CARBIDE GAS RELEASE (4 parts) http://www.youtube.com/watch?v=v4QPPELiDjY
   c. Meltdown at TMI, 1999. Cable TV documentary. (6 parts) http://www.youtube.com/watch?v=eLPAigeMUBk0
   d. Phil Day – Challenger (6 parts) http://www.youtube.com/watch?v=hrNPCMvCDps
   e. Birgenair Flight 301 (5 parts) http://www.youtube.com/watch?v=CzsF-7i7ui4
f. Northwest Flight 255 crash (5 parts) http://www.youtube.com/watch?v=1QF7g6n2FA

g. Flight Air Florida 90 (Plane Crash In The Potomac) (4 parts)
http://www.youtube.com/watch?v=m2ww2rC694

h. Technicians racking in breaker results in explosion
http://www.youtube.com/watch?v=BNdRhS6FWjE

3. Darker Shades of Blue: A Case Study of Failed Leadership By Major Tony Kern United States Air Force
http://www.crm-devel.org/resources/paper/darkblue/darkblue.htm

4. How Nuclear Power Works @http://science.howstuffworks.com/nuclear-power.htm


6. FAA.GOV – FEDERAL AVIATION ADMINISTRATION WEBSITE

7. NRC.GOV – NUCLEAR REGULATORY COMMISSION WEBSITE

8. NTSB.GOV – NATIONAL TRAFFIC SAFETY BOARD WEBSITE

9. IAEA.ORG – INTERNATIONAL ATOMIC ENERGY AGENCY WEBSITE

10. AHRQ.GOV – AGENCY FOR HEALTHCARE RESEARCH & QUALITY

- New course materials may be uploaded to the course WebCT page. Each new upload will be followed up with E-mail notifications sent to the class.
- Students are expected to check the WebCT course page regularly and be up-to-date with course material, progress and assignments.

Prerequisite(s): NUEN 432, junior or senior classification in the College of Engineering

Lectures: The lectures will consist primarily of presentations. Students are responsible for the material covered in the course lectures and other assignments. Their knowledge will be evaluated as described below.

Major Course Requirements:

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<th>Homework Assignments</th>
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<td>Mid-Term Exam</td>
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<tr>
<td>Final Exam</td>
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Homework Assignments: Homework is an important part of this course. HW assignments will be assigned almost every class. HW assignments will include reading material and other exercises like viewing YouTube videos. Homework will be graded according to answers given by students when asked questions during class.

Example: You were told to view a video on Three Mile Island. The next class the instructor may begin the class by asking a student, “Peggy, did President Carter take his wife with him when he toured TMI just following the accident?” or “Joe, how would you characterize the role Harold Denton of the NRC played in the endeavors following the accident?” If the student did the homework the answers will not be difficult. Each homework assignment will be graded as Pass/Fail. At the end of the semester, those students who consistently did all homework will receive a 100% for 40% of the total grade. For those that did half of their assignments, they will receive a 50%. In the event that a student does not attend the class with the instructor & other students, the instructor will test the student’s homework completion another way, possibly via email.

Examinations: Two major exams will be given during the semester. A mid-term examination will be conducted according to the course schedule. A final exam for the class will be scheduled according to the approved University Final Examination Schedule. This exam will be comprehensive. Questions about exam
scores must be submitted in writing within one week after the exams have been returned or the scores will be considered correct.

**OTHER COURSE POLICIES**

**Academic Dishonesty:**
As commonly defined, plagiarism consists of passing off as one’s own the ideas, work, writings, etc., that belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you have the permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated.

**Professional behavior:** an important attribute of your professional development is that you act and speak in a manner that does not offend others, giving particular care to diversity issues.

**Religious holidays:** Observance of a religious holiday, to be excused the student must notify his or her instructor in writing (acknowledged e-mail message is acceptable) prior to the date of absence if such notification is feasible. In cases where advance notification is not feasible (e.g. accident, or emergency) the student must provide notification by the end of the second working day after the absence. This notification should include an explanation of why notice could not be sent prior to the class. Accommodations sought for absences due to the observance of a religious holiday can be sought either prior or after the absence, but not later than two working days after the absence.

**CASA Writing Center:** TAMUCC CASA Writing Center, Glascock Building, offers help to writers at any stage of the writing process with 30-minute appointments. Meeting with CASA Writing Center staff is highly recommended but are not required and will not directly affect your final grade.

**Courtesy notice:** Students are encouraged to behave in a professional, respectful and courteous manner. The use of cell phones is forbidden and your phones should be turned off during the class time. Please no food and/or snack during the class. You may have your snack before class begins or after the class.

**Attendance**

Class attendance is required and students are expected to complete all assignments. Please submit a completed absence form with supporting material when requesting an excused absence.

Unexcused absences: Students who miss class without prior approval of their instructor will receive a grade of zero on the missed in quiz. University excused absences: Authorized absences must be approved by your instructor in advance of the absence, unless you have an emergency or illness. Make-up work must be completed outside of normal class hours within ONE WEEK following an excused absence.

**Copyright Notice**

The handouts used in this course are copyrighted. By “handouts,” this means all materials generated for this class, which includes but is not limited to syllabi, quizzes, exams, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless expressly granted permission (for more information, contact the instructor).

**COLLEGE AND UNIVERSITIY POLICIES**

**Academic Integrity (University)**

It is expected that university students will demonstrate a high level of maturity, self-direction, and ability to
manage their own affairs. Students are viewed as individuals who possess the qualities of worth, dignity, and the capacity for self-direction in personal behavior.

See Full University Policy at
http://catalog.tamucc.edu/content.php?catoid=10&navoid=313#Academic_Integrity

**Deadline for Dropping a Course with a Grade of W (University)**

The grade of W will be assigned to any student officially dropping a course by Friday, April 10, 2015. No student is eligible to receive a W without completing the official drop process by this deadline. Visit the Office of the University Registrar for the Course Drop Form that must submitted. After April 10, 2015 a student will not be allowed to drop a course.

**Grade Appeals (College of Science and Engineering)**

As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at [http://www.tamucc.edu/provost/university_rules/index.html](http://www.tamucc.edu/provost/university_rules/index.html), and the College of Science and Engineering Grade Appeals webpage at [http://sci.tamucc.edu/students/GradeAppeal.html](http://sci.tamucc.edu/students/GradeAppeal.html). For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

**Disability Services**

Disability Services (DS) is the hub for coordinating services and accommodations to ensure accessibility and utilization of all programs for all Texas A&M University-Corpus Christi students with disabilities. Our services are designed to meet the unique educational needs of enrolled students with documented permanent or temporary disabilities. DS provides intake and consultation services to students seeking to register with our office. DS reviews an individual’s documentation of disability and assesses eligibility for services and the determination of reasonable accommodations. For more information visit the Disability Services Office at 116 Corpus Christi Hall or go to [http://disabilityservices.tamucc.edu/](http://disabilityservices.tamucc.edu/)
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<td>HP Industry, Company triangle, Common Accident Components, Case studies</td>
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<td>Personalities, understanding the client, remembering the end user, professionalism, field observations, tools &amp; traps specific to engineers, role of the STA, Can do versus can’t do mentality, owning a system. Case studies.</td>
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**Final exam**

**FINAL EXAM**