Summary of 2014-2015 Nuclear Engineering Program Outcome Assessment

During the 2014-2015 academic year, the Nuclear Engineering undergraduate program has been executing the assessment plan that was developed to satisfy ABET accreditation requirements. Assessment data were collected from a number of different courses (ChNE 311, NE 312, NE 413L, NE 464, NE 497L, and NE 498L) and applied toward assessment of the Program Objectives as shown in the plan below.

	Fall 2010 - ABET Review	Spring 2011	Fall 2011	Spring 2012	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Srping 2016 - prepare for ABET Self Study	Fall 2016 - ABET Review
ChNE 101 : Intro to ChNE													
ChNE 213: Electronics													
ChNE 230: Rad Protection			A:PC2						A:PC2				
ChNE 231: Intro to NE													
ChNE 310: Diffusion Theory													
ChNE 311: Transport Phen			A:PC1				A:PC1				A:PC1		
ChNE 312: Unit Ops				E:PC1-5		C:PC1		E:PC1-5		C:PC1		E:PC1-5	
ChNE 313L: Intro NE Lab						G:PC1				G:PC1			
ChNE 314: Thermo and Nucl Syst													
NE 315: NE Anal and Calculations													**K:PC2**
ChNE 317: Numerical Analysis					K:PC2				K:PC2				
ChNE 323L: Rad Meas Lab					B:PC1,2				B:PC1,2				B:PC1,2
ChNE 330: Nucl Engr Science													
ChNE 372: Materials for NE													
ChNE 410: Reactor Theory													
ChNE 413L: Reactor Ops Lab				B:PC3-5		**K:PC1**		B:PC3-5		B:PC3-5 **K:PC1**		B:PC3-5	
ChNE 452: Senior Seminar						F:PC1-3; G:PC2: H:PC2-3; I:PC1: J:PC1,2				F:PC1-3; G:PC2: H:PC2-3; I:PC1: J:PC1,2			
ChNE 462: Monte Carlo													
ChNE 464: ThermalHydraulics					A:PC3				A:PC3				A:PC3
ChNE 470: Fuel Cycle and Rx Matls													
ChNE 497L: Computation Methods			K:PC1,3		I:PC2		K:PC3		I:PC2		K:PC3		
ChNE 498L: Senior Design		D:PC1-3		C:PC2,3 H:PC1				D:PC1-3		C:PC2,3 D:PC1-3 H:PC1			
Revised October 2015													

For the 2014 – 2015 academic year, the following Skills and associated Performance Criteria (PC) were assessed. Outcome A, PC 2 and 3, Outcome B PC 1, 2, 3, 4, and 5, Outcome C PC 1, 2, and 3, Outcome D PC 1, 2, and 3, Outcome F PC 1, 2, and 3, Outcome G PC 1 and 2, Outcome H PC 1, 2, and 3, Outcome I PC 1 and 2, Outcome J PC 1 and 2, and Outcome K PC 1 and 2. The only outcomes not assessed in this cycle were Outcome A PC 1 and Outcome E PC 1, 2, 3, 4, and 5. The results for Outcomes B, C, and D were again very disappointing. Although the scores for the first 3 criteria in B (laboratory experiments) were up slightly, the last two performance criteria were down from the previous year. In fact the last one, Explains physical meaning and/or significance of data and observations, had over 70% of the students failing to meet expectations. Unfortunately, similar downward trends were seen in PC 2 and 3 of Outcome C and PC 2 of Outcome D. These were the same performance criteria that were of concern in previous assessments, so the faculty decided there were issues in the class material that needed to be addressed. The results for the other Outcomes indicated most students were meeting or exceeding expectations.

Evaluation of the outcomes using the performance criteria has provided good indicators for areas where changes in the curriculum are needed.

The results of the assessments were discussed at faculty meetings in September and October 2015. The areas of concern as indicated by low scores in the performance criteria were:

- Estimates and accounts for error and error propagation, and reports measurements and uncertainties appropriately.
- Explains physical meaning and/or significance of data and observations on nuclear processes
- Utilizes Neutron Transport codes (such as DANT, MCNP, KENO, or SCALE) and burnup codes (such as Leopard, Triton, or Cinder) to perform design optimization and calculate the neutron energy spectrum, spatial distribution and fuel depletion analyses
- Shares in the work of the team, and completes assigned tasks in a timely fashion
- Identifies important technical and social constraints related to nuclear system and reactor design, construction and operation. Also attempts to resolve conflict among various design constraints while satisfying the design requirements.

The first two related to lab classes, so it was decided to put more stress on uncertainty analysis and its impact on reporting of experimental results and also to stress the relationship of results to physical behavior (i.e., better relate theory to practice). This will be done in the three lab classes (NE 323L, NE 313L, and NE 413L) over the next two years to address these weaknesses.

For the neutron transport codes, we are changing our emphasis in the NE497L class to focus on one Monte Carlo code (Serpent) so the students will feel comfortable using it in analyses needed for the senior design class.

The last two are related to the design process, sharing information, and providing significant input in team projects. We are adding some team participation rubrics to help assess contributions and to explicitly indicate to the students what is expected while working on team projects.

Providing a focus on these issues in addition to the curriculum changes implemented from the previous year's assessment should help more of our students meet or exceed expectations in their nuclear engineering classes. With our accreditation visit in the Fall of 2016, the effects of these changes will be evaluated in the 2016-2017 academic year.

In parallel to the program outcome assessment described above, all mandatory courses in the undergraduate program have an independent assessment of course-specific outcomes each time the course is taught. In addition, the Undergraduate Program Committee reviews program outcome assessment data from the overall perspective of the curriculum. This analysis involves factors that go beyond the performance criteria measurements. Past reviews indicated there was a need for more active learning time in the NE 312 Unit Operations class, so the class periods have a summary lecture followed by in class problem solving sessions where individuals or teams of students work on the applications of the material. This is an example of a continuous improvement process that relies on the quantitative outcome assessment as well as other feedback mechanisms.