THE CATHOLIC UNIVERSITY OF AMERICA

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Introduction to Engineering Standards in Capstone Design

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Robert Pool in *Beyond Engineering: How Society Shapes Technology*

"Of all the mistakes the U.S. nuclear industry made in the 1960's and 1970's, the single most damaging was the failure to settle on one or a few standard designs for nuclear plants. Standardization maximizes learning. It allows people to learn from others' experience as well as from their own. But the utilities never saw the need for it."

Outline

- ABET Criteria – minor changes for 2005-2006
- Engineering standards
- Including “constraints” in design
- Assessment opportunities
- Opportunities to enhance general education
- Summary

ABET Criterion 4 (2005-2006)

- Students must be prepared for engineering practice through the curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple realistic constraints.

What are Engineering Standards?

- Codes
- Standards
  - Specifications
  - Test methods
- Technical regulations
- Conformity assessment
- Management systems standards

Criterion 3 (c)

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as

- economic
- environmental
- social
- political
- ethical
- health and safety
- manufacturability
- sustainability

Health and Safety

- Technical regulations (mandatory standards) that apply
- Building code considerations
- Environmental management systems ISO
- Occupational Safety and Health Administration (OSHA)
- Food and Drug Administration (FDA)
- Consumer Product Safety Commission (CPSC)
- Nuclear Regulatory Commission (NRC)

Environmental

- ASTM International's testing procedures
- State regulations
- Federal regulations
- International conventions or guidance
- Reporting schemes
- ISO 14000

Conformity Assessment

- Conformity assessment issues may also have to be addressed
  - Will the product have to be listed or certified? (For example, UL)
  - Is the product a systems component and will it have to meet specifications?
  - How is compliance determined?

Capstone Courses and Outcomes Assessment

- Capstone courses can be a good place to focus assessment activities
  - Some of the constraints provide good summative assessment opportunities
  - They can also provide good opportunities to relate the technical and general education components of the curriculum
  - Standards could provide one unifying theme in technical education.

More from ABET Criterion 3

- Engineering programs must demonstrate that their graduates have:
  - (f) an understanding of professional and ethical responsibility
  - (g) an ability to communicate effectively
  - (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context
  - (i) a recognition of the need for, and an ability to engage in life-long learning
  - (j) a knowledge of contemporary issues

Underlined new for 2005-2006

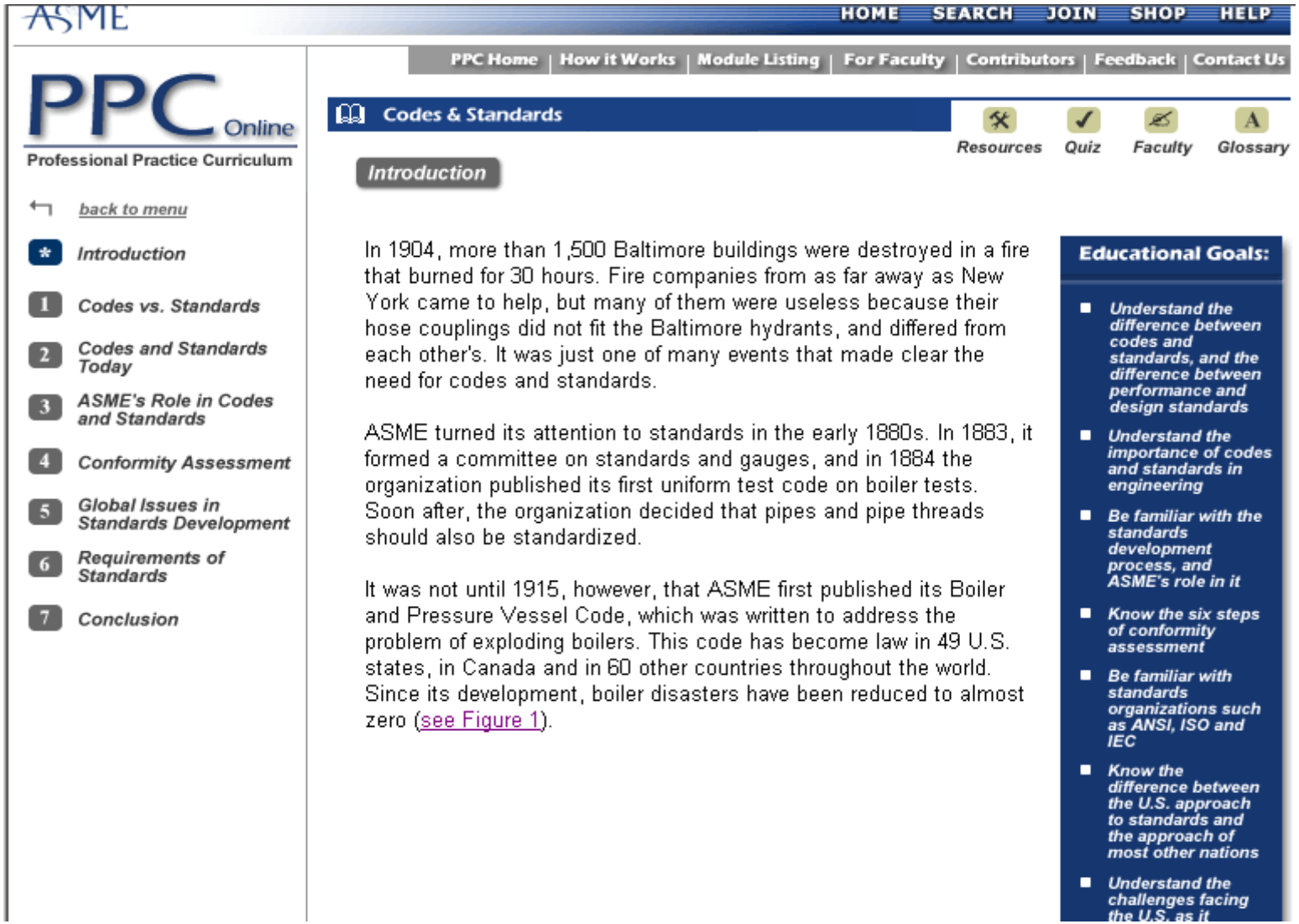
Standards Assessment Opportunities

- Complete ANSI's online courses at www.StandardsLearn.org
  - Introduction to standards
  - National standards systems
  - International standards system *(coming soon)*
  - An online certificate is awarded - (i) life-long learning

Standards Assessment Opportunities

- Present short report on standards and codes applying to project – (g) communications
- Research potential international barriers to a product e.g. EU regulations on waste reduction and recycling related to electronic products (h) understand the impact of engineering solutions in a global, economic, environmental, and societal context
- Review proposed standards on social responsibility and there potential effects on industry practices - ethics (f), contemporary issues (j)

ASME Online Standards Course



Opportunities to Enhance General Education

- For some of the constraints students need to address in design, the requisite knowledge and background to discuss them could (must?) come from non-engineering courses or special engineering courses designed to supplement general education.
- There is a an opportunity to assess students general education and how it complements the technical education.
- This feedback can be used to modify/improve the general education component

Project Examples

- ANSI is considering developing some examples to demonstrate the use of standards in a simple setting.
  - One that is being considered is design of a playground

Playground Design

ASTM standard F-1487-95, *Safety Performance Specifications for Playground Equipment for Public Use*

U.S. Consumer Product Safety Commission (CPSC) Publication No. 325 Handbook for Public Playground Safety

EPA's Recommended Recovered Materials *Content Levels for Playground Equipment*

Building Permit?

Accessibility?

Summary

- Criterion 4 requires incorporation of engineering standards — workshop will attempt to show you “how to”.

- Criterion 3 & 4 “constraints” have standards aspects discussion of which from an engineering perspective can contribute to and complement students’ general education.