AIChE Education and Accreditation Committee
Guidelines for PEVs and Programs
19 July 2023

Introduction and Purpose

As provided in the charge of the AIChE Education and Accreditation (E&A) Committee, one function of the committee is that it "advises schools on methods and standards of chemical engineering education." In addition, the E&A Committee's Manual of Procedures (2005) indicates the committee should:

- Provide consistent interpretations of ABET Criteria and Policy across the diverse population of chemical engineering programs that seek accreditation ensuring minimum standards are met while avoiding strict, narrow interpretations.
- Help chemical engineering programs prepare for accreditation visits in ways that improve their programs without undue effort.

Based on the experience and feedback from program evaluators, this document summarizes the guidance and recommendations made by the E&A Committee to meet the above objectives and goals. The intention of this document is to summarize the guidance and recommendations that would be appropriate for use as a reference or in structuring training for the benefit of chemical engineering programs and program evaluators alike. It is recognized that ABET Criteria (as documented in the Engineering Accreditation Commission Criteria for Accrediting Engineering Programs) and Policy (as documented in the Accreditation Policy and Procedure Manual or APPM) will change over time, and this document is updated regularly to provide the best information available. This document will be made available to AIChE PEVs before the fall accreditation visits begin and be made available on the Education & Accreditation Committee page of the AIChE web site.

The objective of "advising programs on methods and standards of chemical engineering education" is not addressed in this document to avoid any position which may promote a strict, narrow interpretation. Consequently, the committee objective is provided through presentations and training programs.

The guidance and recommendations provided by the E&A Committee are not intended to be in conflict with ABET Criteria or Policy and should be interpreted in the context of the evaluation team in a manner consistent with the ABET evaluation process. In cases where this document does not provide additional guidance, programs and PEVs are advised to refer directly to the appropriate ABET Criteria or Policy. This document was prepared for the current accreditation cycle. The current wording of the AIChE Program Criteria is also discussed.

Criteria for Accrediting Engineering Programs

All general reviews for the upcoming accreditation cycle will be evaluated based on the current Criteria for Accrediting Engineering Programs[a]. Changes to Criterion 3 and 5 were in effect for the first time for visits in 2019-2020. For 2023-2024 visits, programs should use the current Criterion 3 and 5.

There are helpful documents that present a mapping of the previously used a-k student outcomes to the new 1-7 student outcomes in Criterion 3[b] along with Frequently Asked Questions[c] (posted in April 2019) regarding changes to Criteria 3 and 5. As indicated previously, comments provided here are not intended to be in conflict with ABET Criteria or Policy and should be interpreted in the context of the evaluation team in a manner consistent with the ABET evaluation process.

[a] https://www.abet.org/accreditation/accreditation-criteria/
[b] https://www.abet.org/wp-content/uploads/2018/03/C3_C5_mapping_SEC_1-13-2018.pdf
[c] https://www.abet.org/wp-content/uploads/2019/04/FAQs-for-EAC-C3-C5-4-8-2019.pdf

Criterion 3. Student Outcomes

The following comments regarding Student Outcomes are taken directly from the FAQ document referenced above. Some elements to consider in the definitions:

> Basic Science: The EAC considers computer science to be engineering science and NOT basic science. It is therefore an engineering topic.
>
> College-Level Mathematics: Pre-calculus and remedial math do not count as college-level mathematics.
>
> Complex Engineering Problems: It is important to pay attention to the complexity of problems used to develop and assess students' ability to solve problems.
>
> Engineering Design: Consideration of risk has been added to the definition. It is expected that the listed characteristics and phases of the design process will be incorporated somewhere in the curriculum. It is not necessary that all phases be contained in the major design experience. The phrase "for illustrative purposes only" introduces a list of example constraints, which are neither mandatory nor comprehensive.
>
> Team: Indicates the importance of considering the team members' backgrounds, skills, and perspectives. It does NOT prescribe a mandatory make-up of a team, such as requiring students on a team come from two or more engineering programs.

Student Outcomes (SOs) describe what students are expected to know and be able to do as they progress through the program and attain by the time of graduation. Successful attainment by students of SOs is accomplished through a process of assessment (one or more processes that identify, collect, and prepare data) and evaluation (interpretation of assessment data). The FAQ also includes discussion of elements to consider in SOs which are quoted directly below. Note that programs will have been assessing SOs in the form of (a)-(k) at the beginning of the period covered by the self-study report (except possibly for programs that are seeking initial accreditation).

Student Outcome 1 (SO1) "requires that students have the ability to solve complex problems. Programs will want to ensure that their problems are complex." The definition of Complex Engineering Problems is included in the general criteria as having "one or more of the following characteristics: involving wide-ranging or conflicting technical issues, having no obvious solution, addressing problems not encompassed by current standards and codes, involving diverse groups of stakeholders, including many component parts or sub-problems, involving multiple disciplines, or having significant consequences in a range of contexts." In any particular element of the program, only one of these characteristics is required to satisfy the definition. Of course, programs have the freedom to choose where this SO is assessed.

Student Outcome 2 (SO2) "requires that students have the ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. This does not mean that each of these elements must have a significant effect on the design — it just means that the program must show that students consider [all of] these elements as they engage in design." Because all elements must be considered, programs should assess whether students have considered all elements. This may be most easily documented by requiring students to state reasons for including or excluding these elements in the current design. Consideration of risk has been added as an element of engineering design in the term's definition. There are several potential directions by which risk can be considered in process design such as but not limited to: risks addressed by using principles of inherently safer design; risks associated with business considerations or profitability; or risks to co-workers, the public, or the environment. The definition of engineering design lists examples of possible constraints as illustrative examples, and this list should be recognized as (1) not being comprehensive and (2) not mandatory (no example in the list is mandatory).

Student Outcome 3 (SO3) "requires that students have the ability to communicate with a range of audiences. It is the program's responsibility to determine the range of audiences. For example, if a program stresses preparing students for graduate school, it might have students prepare a journal paper. There are many other possible audiences: faculty, students, non-technical, the public sector, etc. For example, students in biomedical engineering programs might communicate with physicians, nurses, or other medical personnel. In the major design experience, students might communicate with external clients. It is the program's responsibility to determine the most meaningful audiences for its students." While ABET is not prescriptive of the audiences chosen by the program, it is clear that more than a single audience is required to be identified along with evaluation of attainment by students for each audience.

Student Outcome 4 (SO4) "requires in part that students have the ability to make informed judgments that consider the impact of engineering solutions in global, economic, environmental, and societal contexts. It is not necessary for every engineering situation to require that each of these contexts be a major consideration. Consideration of the impact as the judgment is made is key." This SO does not require that every engineering situation include all (or any) of these contexts as a major consideration, but it does require that each of these contexts are considered (including documentation) by students while considering their ethical and professional responsibilities in engineering situations in the evaluation of attainment of this SO. Because all contexts must be considered, programs should assess whether students have considered each of these contexts. This may be most easily documented by requiring students to state reasons for including or excluding each of these contexts in the current engineering solution. SO4 also requires that students have the "ability to recognize ethical and professional responsibilities in engineering situations."

Student Outcome 5 (SO5) "requires that students be able to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives." Programs have a variety of methods for developing and assessing attainment of this SO. There are many texts on project management available for use. Gantt charts, schedules, scrum, goal setting, and decision matrices might be useful as project management tools and techniques. Inclusiveness and collaboration can be characterized using existing instruments in the literature." SO5 requires the ability of students to function effectively on teams be evaluated based on: (1) providing leadership; (2) creating a collaborative and inclusive environment; (3) establishing goals; planning tasks; meeting objectives. Note that creating a collaborative (team members working together) and inclusive (insuring that all team members are equally involved) environment within teams does not include a requirement that teams be diverse in every aspect. Examples of methods for assessing collaborative and inclusive behavior in teams include: videotaping a team meeting with subsequent evaluation; self-reporting by team members; evaluation by an external client after meeting with a team; feedback from teaching assistants or course instructors. Such assessment exercises typically benefit from using a rubric for evaluation. Past ABET guidance has mentioned the use of web-based peer evaluations such as CATME.org and TeamMates.

Student Outcome 6 (SO6) "requires in part that students have the ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. There is no requirement that students be able to design an experiment." The development of appropriate experimentation could involve modification of experimental parameters to consider different materials or conditions, for example.

Student Outcome 7 (SO7) "requires that students be able to acquire and apply new knowledge as needed, using appropriate learning strategies. The ABET Industrial Advisory Council indicated that it is important for students to take responsibility for their own learning. There are many ways a student can demonstrate this ability. For example, students could engage in such activities as identifying needed information for a project, examining sources for the information, determining an appropriate source and applying the information." Past ABET guidance mentioned such learning strategies as "courses, research, interviewing experts – whatever is appropriate to the task."

Criterion 5. Curriculum

1. Categorizing Coursework: Fulfilling Engineering Topics (ET) or College-Level Math and Basic Sciences (MBS) Requirements. The ABET Criteria for Engineering Programs defines both of these terms and should be consulted to ensure definitions are current. At present, the General Criteria define Basic Sciences as chemistry, physics, and other natural sciences including life, earth, and space sciences. Criterion 5 states that Engineering Topics consists of courses pertaining to engineering and computer sciences and engineering design.

    a. Engineering and Computer Sciences. Engineering and Computer Sciences have their roots in mathematics and basic sciences but carry knowledge further toward creative application. Therefore, to be categorized as fulfilling ET requirement, a course must demonstrate engineering application of mathematics and basic sciences. There is no requirement or restriction on the college or department in which the course is taught or the pedigree or academic home of faculty teaching it. Supporting evidence of engineering application should be evaluated for all courses claiming to have engineering science content. Examples of such engineering application evidence might include course syllabi, textbooks, homework, project reports, examinations, or other course materials, and information from instructor and student interviews. Examples of courses that should not be categorized as Engineering Science include biochemistry, microbiology, and physical chemistry (all of which are clearly defined as Basic Sciences) and courses which could have engineering applications but do not, such as thermodynamics taught in a chemistry department without significant engineering applications, which could be classified as MBS. If a basic science course includes significant engineering applications and such content is reflected in the course catalog description, course credit may be split between ET and MBS categories if justified by the examples of evidence discussed above (e.g., course syllabi, textbooks, etc.).

    b. Engineering Design. To be categorized as Engineering Design, the General Criteria specifically state that the course (1) incorporates appropriate engineering standards and multiple constraints, and (2) is based on the knowledge and skills acquired in earlier course work.

       Criterion 5 also specifies that the curriculum culminates in a major design experience based on the knowledge and skills acquired in earlier course work. The criterion is not specific as to how literal the word "culminate" is to be taken and does not specify that the design experience must be the very last element in the curricular schedule, nor does it prohibit any curricular elements following the major design experience. The criterion does not prescribe the specific content of the design experience, the duration of the design experience, or the possible distribution of the design experience over several parallel or sequential courses.

Criterion 5 also specifies that the major design experience must incorporate appropriate engineering standards and multiple realistic constraints. The definition of Engineering Design does include an illustrative list of possible constraints (see SO2 above), but does not specifically define "appropriate engineering standards". The chemical engineering profession has not codified standards of practice for its discipline or its processes, although some companies and organizations do develop and maintain standards, for example as related to piping practice, process instrumentation and control, process safety, etc. With regard to process safety, AIChE has adopted the use of "Recognized and Generally Accepted Good Engineering Practice (RAGAGEP)" which are "based on established codes, standards, published technical reports or recommended practices or similar documents", and this definition has, in turn, been adopted by OSHA[a]. Consequently, "appropriate engineering standards" may be widely interpreted in the context of the program's major chemical engineering design experience and the Program Educational Objectives. PEV evaluation of this requirement must be limited to determining whether programs use "appropriate engineering standards" in design without prescription of which ones are (or are not) used. Examples of appropriate engineering standards can include any of but are not limited to: Hazard identification and management (e.g., chemical and reactivity hazards, process hazard analysis, independent protection layers); protective systems (e.g., pressure relief, inerting, secondary containment); environment (e.g., emissions evaluation); process design (e.g., process flow diagrams, P&IDs); materials of construction (e.g., material properties and selection); process equipment design (e.g., equipment selection); instrumentation and process control (e.g., safety instrumented systems). Programs are encouraged to note the use of standards in engineering design where appropriate. Finally, reference to codified standards is not required to meet ABET requirements.

The definition of Engineering Design in Criterion 5 requires that designs consider multiple realistic constraints. It is the responsibility of the program to identify and justify the constraints placed on the design experience. As discussed above, ABET has provided a list of constraints which are neither mandatory nor restrictive, and consequently, PEV evaluation of this requirement must be limited to determining whether programs use multiple realistic constraints on engineering design without regard to which constraints are (or are not) used. For courses that specify that they include Engineering Design content, evidence in support of that objective might include course syllabi, textbooks, homework, project reports, examinations, or other course materials, and information from instructor and student interviews.

2. Curriculum Content. Criterion 5 requires that the curriculum include a minimum of 30 semester credit hours (or equivalent) of mathematics and basic sciences (MBS) and a minimum of 45 semester credit hours (or equivalent) of engineering topics (ET). If a program fails to meet these requirements, this can result in a program shortcoming during an evaluation visit. Often, it is helpful for a PEV to consider the sample transcripts of recent graduates in the determination of the type of shortcoming that is appropriate.

Also, programs may implement changes to their curriculum so that the requirements of the Criterion are currently satisfied even though recent graduates may not have met the requirements of Criterion 5. Under these circumstances, a previously accredited program may be in compliance with Criterion 5 even though problems were identified during the transcript evaluation process (but this guidance does not apply to new programs as discussed below).

3. Broad Education Component. Criterion 5 requires that the curriculum include "a broad educational component that complements the technical content of the curriculum and is consistent with the program educational objectives."

[a]https://www.osha.gov/laws-regs/standardinterpretations/2016-05-11

Chemical Engineering Program Criteria

The current Chemical Engineering Program Criteria includes only requirements for the program curriculum as follows:

The curriculum must include:

a) Applications of mathematics, including differential equations and statistics to engineering problems.
b) College-level chemistry and physics courses, with some at an advanced level, as appropriate to the objectives of the program.
c) Engineering application of these sciences to the design, analysis, and control of processes, including the hazards associated with these processes.

Programs with biochemical, biomolecular, or similar modifiers in their titles must also include biologically-based engineering applications in their curriculum as appropriate to the program's name and educational objectives.

Note that PEVs assigned through AIChE may be asked to evaluate a program other than ones with "chemical", "biochemical", "biomolecular", or other similar modifiers in their titles, and such programs need to address the appropriate program criteria if any apply.

To assist in this program decision process, the following points address frequent questions regarding the Chemical Engineering Program Criteria.

1. Mathematics. The ABET General Criteria specify that college level mathematics consists of mathematics that requires a degree of mathematical sophistication at least equivalent to that of introductory calculus. The Program Curriculum Criterion does not specify that particular mathematics courses beyond differential equations are mandated. However, the Program Curriculum Criterion does require the application of mathematics to engineering problems, including differential equations and statistics (such as used in the analysis of data). It is incumbent on the program to justify how their mathematics curriculum is appropriate in this context.

2. Basic Sciences. Chemistry and physics are mandated by the Program Curriculum Criterion. The Program Criterion does specify that programs with biochemical, biomolecular, or similar modifiers include biologically-based engineering applications as appropriate to the program's educational objective. The ABET General Criteria specify that the basic sciences must include an experimental experience. Advanced level science courses (one or more) are considered to be any courses beyond college level general chemistry, general physics, or general biology (as appropriate) including courses which fall into more than one of these categories. The operative phrase for the amount and content of advanced basic science is "as appropriate to the objectives of the program", and it is in that context that compliance with the Program Curriculum Criterion must be evaluated. The Program Curriculum Criterion does not specify whether particular chemistry subjects such as organic or physical or instrumental analysis or particular physics or biology topics are mandated, but only those whose mastery would reasonably be required to achieve the objectives of the program. It is incumbent on the program to justify how their mathematics and basic science curriculum is appropriate in this context.

3. Engineering Application. The Program Curriculum Criterion also specifies that the curriculum include the engineering application of the program's sciences to the design (devising) of processes, to the analysis of the behavior of such processes under realistic constraints, to the control of such processes, and to the analysis and control of the hazards associated with such processes (process safety). As with other parts of the Program Curriculum Criterion, the criterion does not specify precisely what kinds of chemical, physical, or biological processes are to be devised, nor exactly under which or what realistic constraints they must be evaluated or controlled, nor precisely what kinds of associated process hazards must be considered and controlled. However, consideration of process hazards must be a part of the program's process design experience. It is incumbent on the program to justify their choices in all of these matters within the context of the objectives of the program.

4. Process Hazards. As discussed above, programs must state and justify their choices with regard to addressing process hazards (also referred to as process safety education, which is distinct from lab safety training) in the curriculum. Laboratory safety (and lab safety training) is an important aspect of the education of undergraduate students; providing a safe environment for conducting any laboratory work is required by the ABET APPM (discussed below) and is a necessary first step in the preparation of students to address process hazards. <u>However, curriculum addressing process hazards should extend beyond laboratory safety training.</u> While no course in process safety is required by the Program Curriculum Criterion, courses in the curriculum which cover process safety topics must specifically be identified. Examples of the coverage of process hazards in the curriculum and specifically in the design experience will be helpful in the evaluation process.

5. Process Control. As discussed above, programs must state and justify their choices with regard to the address of control of processes in the curriculum. Note that the Program Curriculum Criterion does not require that the curriculum include a separate course in process control.

6. Transcript Analysis. PEVs are required to complete a transcript analysis for sample students who graduated in the past year from the program. One requirement of the transcript analysis is that the PEV determine whether the curriculum requirements of the Program Criteria are met. Based on the Program Curriculum Criterion, the following categories can be easily identified and should be listed by the PEV as Applicable Program Criteria in the Curriculum Analysis Table on Form E331:

    - Mathematics and statistics engineering applications
    - Basic sciences (e.g., chemistry, physics, and biology as appropriate) with some advanced coverage
    - Design, analysis, and control of processes
    - Process hazards, particularly in process design
    - Biological engineering courses when appropriate

    Such a determination for the curriculum can be made from course titles and course catalog descriptions. Neither the General Criteria nor the Program Criteria specify that the curriculum include specific course titles. As part of the Self-Study, Programs may find that listing required courses in each of these categories will facilitate the transcript evaluation process. For programs with titles that do not include in "biochemical," "biomolecular," or similar modifiers, the row labeled "Biological engineering courses when appropriate" can be left off.

Accreditation Policy and Procedure Manual: Facilities

For chemical engineering, the predominant issue which can arise from requirements in the Accreditation Policy and Procedure Manual (APPM 1.E.5.b(1)) relates to whether instructional and learning environments are adequate and safe for the intended purpose. This policy and procedure applies to instructional and learning environments within the program and relevant instructional and learning environments within any supporting unit identified by the team. Safety is of paramount importance to the chemical engineering profession, and our program criteria require that the curriculum include analysis and control of the hazards associated with such processes. In addition, providing a safe laboratory environment for the students is critically important. Consequently, it is appropriate to determine if common practices related to laboratory safety are observed such as:

- Laboratories are clean and free of hazards.
- There are no obvious safety issues related to the purpose of the instructional and learning environments. Some possible areas to explore are noted below.
- There are laboratory safety policies and procedures and they are enforced.
- There are routine safety inspections of labs and the associated equipment by appropriate personnel.
- There is safety training for all people using labs and experimental equipment

It is important to recognize that these practices should be known by all people involved in laboratory work including faculty, staff, and students. It is important to recognize that safety expectations can be impacted because of local laws and regulations especially for international programs.

The PEV will tour program laboratory facilities as part of the site visit, and during this time, the PEV may check several items indicating that safe laboratory practices are being followed such as:

- Ensuring that safety signage is present and clearly visible;
- Ensuring that fume hoods, emergency showers, and eye wash stations are properly maintained and fire extinguisher inspections are up to date;
- Ensuring that materials are not stored inappropriately (such as flammable materials in commercial refrigerators, or reactive chemicals stored together);
- Ensuring that gas cylinders are secured properly;
- Ensuring that personal protection equipment (PPE) is used;
- Ensuring that extension cords and cables are appropriately used, secured, and are not tripping hazards;
- Asking the faculty and technicians that teach/monitor the laboratory courses what safety protocols are in place for classes and what training is required; or
- Asking safety personnel at international institutions about local safety regulations for educational institutions.

If a laboratory safety policy is not being followed by the program or its faculty (e.g., by many students in a lab without appropriate PPE) or if there is a clear program or institution safety violation observed during the visit, it will immediately be brought to the attention of the Program Head or Chair. If feasible, any safety violation should be corrected before the evaluation is presented during the exit meeting. Uncorrected safety violations will result in a program shortcoming cited under APPM I.E.5.b.(1).

It should be noted that the APPM makes clear that neither ABET nor its representatives (including PEVs) certify that the institution's facilities comply with any applicable rules or regulations pertaining to: fire, safety, building, and health codes, or consensus standards and recognized best practices for safety. However, PEVs are required to report any safety issues identified during the evaluation visit, especially related to laboratory facilities.

Accreditation Policy and Procedure Manual: New Programs

As stated in the APPM, a new program with deficiencies will be unaccredited (unless reconsidered as part of the ABET appeal process). New programs receiving shortcomings other than a deficiency can receive accreditation although the accreditation can still lead to an interim report or visit depending upon the nature of the shortcoming. If a new program is found to have a deficiency, the new program must:

- Address the shortcoming so that it is no longer considered a deficiency,
- Require all current and future students to follow the program changes required to address the deficiency, and
- Have at least one student who graduated with the program changes in place that removed the deficiency.

For example, if a new program has a shortage of hours that leads to a deficiency in Criterion 5, the program must correct the required hours. The deficiency may not be removed if any current student remains on the "uncorrected" curriculum. In addition, at least one student must have graduated from the corrected curriculum within the past academic year before the program can be accredited. Similarly, if there is a deficiency in Criterion 5 related to the design experience, the design experience must be corrected and all current and future students must abide by the new design experience, and at least one student who completed the new design experience must have graduated before the program can be accredited. Typically, the earliest accreditation date associated with a corrected deficiency of a new program is the date at which the first student graduated under the corrected action, but the EAC has the authority to set the date of initial accreditation as specified in the APPM. All guidance with regard to new programs is made with the intention of being consistent with guidance provided in the APPM.

Relating to the Evaluation Visit

1. Roles of Participants (following ABET guidance with the exception of AIChE Liaisons which have a role unique to AIChE):
   a. PEV/Evaluation Team. The PEV works with the visiting team and the team chair in all deliberations about the program under review. The PEV is expected to follow the ABET guidance.

b. Observers. Observers have the opportunity to learn good practices by experience during the review process with an experienced PEV. One possible task for an observer might be to separately visit some of the supporting departments such as Biology (if biological processes are emphasized by the program). As much as is possible, observers should participate in all aspects of the visit, including review of the self-study, visiting the laboratories, visits with faculty and students. Observers should also work with the PEV in the evaluation of the course materials displayed, particularly the capstone design reports. However, it is important to recognize that input from observers should not interfere with the Evaluation Team process, and that observers are not voting members of the Evaluation Team. Observers should recognize that they are present at the discretion of the Team Chair.
c. Liaisons. Liaisons are members of the AIChE E&A Committee and are available to provide support to the PEV before and during the accreditation visit on a limited basis. Consequently, liaisons and PEVs should be in contact before the visit. Under ABET's present practices, PEVs may contact liaisons when seeking advice and clarification, particularly on chemical engineering-related issues (e.g., curriculum, design reports, program criteria, etc.).

2. PEV responsibilities prior to the visit
   a. Liaison contact. PEVs should contact their liaison prior to the visit. However, PEVs should not provide the Self-Study to liaisons because they are confidential. If questions regarding chemical engineering-related issues arise before or during the visit, the PEV can share relevant excerpts from the Self-Study to facilitate input from the liaison. It is important to recognize that input from the liaison should not interfere with the Evaluation Team process, and that all decisions during the Evaluation Visit are team decisions.
   b. Self-Study preliminary evaluation. PEVs should read the Self-Study so that initial questions can be addressed before the site visit by the program's Point of Contact (POC). PEVs should always include their Team Chair/Co-Chair on correspondence with the POC in addition to others as appropriate (e.g., observer).
   c. Supplemental Information. To the extent possible, PEVs and Program POCs should coordinate what supplemental information will be provided prior to the visit as well as during the visit. Based on APPM I.E.5.b.(2), "Evaluators will review materials that are sufficient to demonstrate that the program is in compliance with the applicable criteria and policies. Much of this information should be incorporated into the Self –Study Report (see I.D.1.f); additional evidence of program compliance may be made available to evaluators prior to and during the visit, using an on-line storage location." The program should make the following materials available to the team, without duplicating materials provided in the Self-Study Report.
      i. Materials addressing issues arising from the team's review of the Self-Study Report or on-line instructional materials
      ii. Documentation of actions taken by the program after submission of Self-Study Report as being available for review during the visit
      iii. Materials necessary for the program to demonstrate compliance with the criteria and policies

   iv. Representative examples of graded student work including, when applicable, major design or capstone projects. Note that from ABET's perspective, names need not be redacted from student work, but programs may choose to do so to meet institution policies.
  d. Plan to visit supporting departments. In coordination with the Evaluation Team, PEVs are strongly encouraged to visit supporting departments, particularly chemistry.

3. PEV responsibilities to complete **with two weeks** after the visit
   a. Complete a survey that will be sent to you. The survey will request (1) one to three examples of best practices that you did or observed that you would like to share with others, (2) challenges that occurred in which you think future training would be helpful, and (3) how the program curriculum included the control of hazards associated with processes (e.g. courses, lab training, etc.). If lab training is cited as an example, the survey also asks how lab safety training is related to the control of process hazards. This survey will provide guidance to the E&A committee as they develop future AIChE-specific training materials for PEVs. *Please do not include any comments in the file that can be used to identify you or the program that was reviewed to help the E&A Committee in the process of avoiding conflicts in the review process.*
   b. Send your completed PEV Worksheet (Form E331) to your liaison. The PEV Worksheet has a sheet for tracking shortcomings, and it is simple and effective to include the Exit statement in the comments section of this sheet when submitted at the end of the visit.
   c. Call or email your liaison and brief them on the report you sent. You should only discuss the documented shortcomings with your liaison so that your liaison can clearly represent any shortcomings at the July meeting to maintain consistency among the programs. Do not discuss other information unrelated to the shortcomings, team discussions, personal opinions, etc. You will have an opportunity to interact with your liaison again prior to the July Commission meeting to provide an update on any due process information.
   d. Do NOT delete your files until after the July E&A Committee Meeting and ABET Commissioner's Meeting. ABET statements are not finalized until after this time and you may need past documents to aid the team chair during the editing process.
   e. Communication with the ABET Team. After the visit, the POC should only contact the Team Chair/Co-Chair with regard to matters related to the evaluation visit. The PEV should refer any communication from the POC to the Team Chair/Co-Chair.

Frequently Encountered Issues for Programs

The guidance and recommendations provided here are not intended to be in conflict with ABET Criteria or Policy and should be interpreted in the context of the evaluation team in a manner consistent with the ABET evaluation process. There are common problems that can be encountered by programs based on observations by the E&A Committee. The following comments are intended to be consistent with ABET Criteria and Policy and reflect current ABET training.

1. ABET web site information. In addition to guidance regarding the accreditation process, the ABET web site (www.abet.org) provides additional information which may be helpful for programs to consider including the EAC Program Evaluator Workbook which includes ABET form (E341 PEV Worksheet). The Program Evaluator Workbook link can be found on https://www.abet.org/accreditation/accreditation-criteria/.

2. Criterion 2. Program Educational Objectives. This ABET criterion states:

   > The program must have published program educational objectives that are consistent with the mission of the institution, the needs of the program's various constituencies, and these criteria. There must be a documented, systematically utilized, and effective process, involving program constituencies, for the periodic review of these program educational objectives that ensures they remain consistent with the institutional mission, the program's constituents' needs, and these criteria

   Based on current ABET PEV training and practice, programs can be found to have a shortcoming in Criterion 2 if the periodic review of the Program Educational Objectives does not involve all constituencies identified in the program's Self-Study.

3. Consistency of Accreditation Actions. The ABET Team evaluation is a team process that revolves around the program Self-Study and team visit. The team visit culminates in the exit statement at the end of the visit which reflects deliberation by the team intended to bring consistency to the current evaluation as well as actions taken by the program during the visit. In successive team visits (typically 3 to 6 years apart), the conclusion of the team deliberations can differ. <u>One example of differences between successive team visits is the evaluation of a particular course regarding categorization as Engineering Topics (ET) or Math and Basic Sciences in Table 5-1 of the Self-Study. It is important for the PEV to communicate any concerns regarding how a course is categorized in Table 5-1 early in the process (before the visit) so that the program can provide supporting evidence. Under these circumstances, PEVs are encouraged to contact their Liaison to provide feedback on such questions.</u> The ABET process allows for response by the institution after the team visit to address any shortcomings identified in the exit statement. In addition, ABET has internal reviews of all exit statements which provides consistency across teams in the same review cycle. As part of the process, the E&A Committee reviews all findings based on the available documentation for the purpose of consistency between chemical engineering programs before final consideration by ABET in July in the calendar year following the team visit.

4. Backup of Files. Although not a frequent problem, keep a backup of files related to the review. One of our evaluators had a hard drive crash on the Tuesday morning of a visit. This can be done securely by emailing files to yourself and avoiding the potential of misplacing a flash drive.

Program Communication. Many PEVs find it helpful to begin and end each day of an evaluation visit with a meeting with the program POC to ensure questions and requests for additional material are communicated in a timely fashion. It is also helpful to address questions to the program POC before the visit as questions arise.

5. Student Outcome Factors and Contexts. SO2 includes a list of factors to consider in the process of engineering design including “consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.” SO4 includes a list of contexts to consider the impact of engineering solutions including “global, economic, environmental, and societal contexts.” As discussed above, all factors should be considered in SO2 and all contexts are to be considered in SO4. To ensure that all factors and contexts are considered, programs should assess whether students consider each factor or context. However, not all factors and contexts will be important for any particular design or engineering situation. Consequently, assessment of attainment by students may simply involve documented recognition that the particular factor or context is not relevant in the current design or engineering situation.

6. Student Outcome Audiences. SO3 requires that students demonstrate the “ability to communicate effectively with a range of audiences.” It is the program's responsibility to determine the appropriate range of audiences. There are many other possible audiences including but not limited to: faculty, students, non-technical audiences, the public sector, etc. For example, students in biomedical engineering programs might communicate with physicians, nurses, or other medical personnel. In the major design experience, students might communicate with external clients or the public. It is the program's responsibility to determine the most meaningful audiences for its students.

7. Criterion 4. Criterion 4 deals specifically with using regular, appropriate, documented process for assessing (gather data) and evaluating that data regarding the extent to which Student Outcomes (SOs) are attained. The evaluation process must be systematically used as one input to the continuous improvement process of the program. Note that the continuous improvement process of the program will probably include other information beside the processes required by Criterion 4. Note that the term “regular“ is not defined in the EAC criteria but should be interpreted in the context of the typical six year cycle for accreditation visits.

Statements of Equity, Diversity, and Inclusion

The importance of actively practicing equity, diversity, and inclusion in professional practice of engineering in general and chemical engineering in particular is vitally important. ABET[a] and AIChE[b] have made defining statements to address the role of these organizations in the active practice of these principles. As a PEV, it is important to recognize the importance of actively practicing these principles during your interactions with students, faculty, administration, and ABET representatives.

[a]https://www.abet.org/abets-commitment-to-support-anti-racism-and-justice/

[b]https://www.aiche.org/equity-diversity-inclusion/statement

Summary

This document summarizes the guidance and recommendations that would be appropriate for use as a reference or in structuring training for the benefit of chemical engineering programs and program evaluators alike. It is recognized that ABET Criteria and Policy will change over time and this document should be updated regularly to provide the best information available. The guidance and recommendations provided by the E&A Committee are not intended to be in conflict with ABET Criteria or Policy and should be interpreted in the context of the evaluation team in a manner consistent with the ABET evaluation process. Any training program developed from the contents of this document should avoid duplication of ABET training. In addition to the material summarized here, training should include example exercises illustrating the issues that can arise as a consequence of the evaluation process for chemical engineering programs.

Documentation and Outreach Subcommittee
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