

### Assessment Plan Example: Green Chemistry (Graduate Certificate)

The mission of the graduate green chemistry certificate program is to prepare students to face chemical research and manufacturing problems through the lens of sustainability and systems thinking.

#### 1. Discipline Specific Knowledge and Skills

- a. Program Goal 1: Graduates will be able to integrate the 12 guiding principles of green chemistry with economic and productivity perspectives to propose environmentally beneficial research methods and manufacturing processes.
  - i. Program Learning Outcome (PLO) 1 for Goal 1: Students will be able to analyze applications of the 12 green chemistry principles in established manufacturing processes and/or research methods.
    1. Assessment Method 1 for PLO 1 for Goal 1: All students completing the certificate complete course CHEM XXXX, Applied Green Chemistry, which is also taken by students interested in green chemistry but not necessarily seeking the certificate. In this course, students are assigned to read three recently published articles from chemistry journals, one of which is focused on green chemistry and the others focused on the students' research sub-disciplinary area(s). Students write a summary of each article, including a list of the 12 principles of green chemistry as they are applied in the research or manufacturing process described in the article. While the full summaries are graded as a part of the course grade, this grade is not a sufficient assessment of this specific outcome. So, the list component of the summary is independently scored by the instructor of record in the course based on percent correctly identified out of the 12 principles. If the course is achieving the goal of facilitating this learning outcome, 95% of students enrolled in the course (certificate-seeking or not) should be able to correctly identify the application of 75% (9) of the 12 Green Chemistry principles in each article.
  - ii. PLO 2 for Goal 1: Students will be able to generate a research proposal that is informed by systems thinking and green perspectives.
    1. Assessment Method 1 for PLO 2 for Goal 1: Students complete the certificate as a component of completing the full Ph.D. program. In order to move forward toward the Ph.D., students must present an original research proposal. Those pursuing the certificate must include in that proposal a detailed analysis of the extent to which green chemical principles are applied, including life-cycle/fate analyses as appropriate. The proposals are defended orally for the student's graduate committee, which is a group of 2 faculty members from the chemistry department, 1 faculty member from outside the department, and the student's major professor. The committee scores the proposal on a three-point scale: "Pass," "Conditional Pass," and "Fail," coming to consensus via discussion. A summary written by the major professor details the specific components of the proposal that were acceptable and those that need improvement. For certificate pursuers, the major professor will additionally provide insight into the application of green chemical principles in this summary to elucidate areas for improvement in this outcome. Those pursuing the certificate should be nearly complete with the certificate courses at this point, and therefore 95% should meet the "Pass" criteria and demonstrate effective application of green chemistry to the proposal.

A sample curriculum map based on the examples above is available at: <https://confluence.usf.edu/x/-Q2CHO>