Analysis Questions and Analysis Answers

For Academic Programs
Informed by your assessment activities related to student learning, what changes have you made in your degree program in the last three to five years? Describe the changes (e.g., curriculum revision, new courses, faculty development), the general results that prompted the changes (e.g., student performance on an assessment measure), and any impact on student learning that you might attribute to these changes.

No changes have been made to our assessment process for our Thesis MS (Plan I) degree program over the past several years. We have had only two students earn Thesis MS degrees during the past three years, so insufficient data is available to prompt changes to the curriculum or assessment process for this degree program.

Mission / Purpose
The Department of Chemistry is committed to the intellectual, technological, cultural, and economic advancement of the state, region, and nation through the discovery and development of new scientific knowledge. Research programs in the Department are both fundamental (create new knowledge) and applied (solve technical problems). Many of these research endeavors are anchored in interdisciplinary efforts drawing on and adding to the research base within The University. A strong and active research effort allows faculty to enable and keep abreast of the latest scientific advances and to impart new ideas and concepts into the curricula. Research activities play a vital role in the education of the next generation of academic, industrial, and government laboratory scientists who will be called upon to solve new problems. By maintaining these research programs, the Department helps to increase the recognition and reputation for quality of The University of Alabama locally, regionally, nationally, and internationally. Critical research areas include the synthesis and characterization of chemicals and materials and biochemistry. There is a strong emphasis in materials for advanced energy technologies including applications of 'green chemistry' and for information storage.

The University of Alabama conducts a Program Review of departments and their degree programs every eight years. The last program review for the Department of Chemistry was in 2006-2007. Internal program committee members were selected jointly by Dr. David Francko, Dean of the Graduate School, and Dr. Robert Olin, Dean of the College of Arts and Sciences. The committee acquired information about the department’s mission, goals (i.e., 5-year plans), curriculum, teaching/research/service mix, quality of department and its programs, distinguishing characteristics of the department and its programs, and institutional effectiveness (i.e., department outcomes and assessment). The committee also analyzed the strengths of the department and its degree programs, areas of opportunity for the department and its degree programs, and recommendations to improve the department and its degree programs (in ranked order, low or no-cost, mid cost, and high cost improvements). The information below (measures and results) comes directly from the report of the Internal Program Review Committee.

Finding(s) describing the extent to which the outcome is achieved
The report generated by the Internal Program Review Committee is extensive. Only those elements that are directly related to the current program outcome are presented: quality of program, strengths of degree program, areas of opportunities for the program, including recommendations to improve the degree program.

Quality of M.S. Degree Program:
The average GRE scores and GPA for entering graduate students has increased from 1067/3.0 in Fall 2003 to 1103/4.0
in Fall 2006, and the number of conditional admissions has decreased (2005-06 Annual Report). The annual admission success rate has been highly variable, ranging from 21.84% from 2003-07. The percent of incoming graduate students who are U.S. citizens and women is variable for the 2003-07 period. The department has an active recruiting strategy to increase the diversity of the graduate student population. Within the past 2 years, international students have entered the program from seven countries. Ethnic and gender diversity among graduate students, especially with domestic students, remains a challenge and a priority.

The number of graduate students enrolled is currently reduced compared to enrollment during the 2003-05 period. The faculty members attribute this reduction to the availability of GTAs. In Fall 2005, 31 (27%) students were supported by GTAs and 40 (48%) were supported by GRAs.

In 2005, the department offered 21 graduate-level courses—14 at the 500 level and 7 at the 600 level. This is down slightly from the two preceding years where the total was 24 in each year. In our interviews, the graduate students expressed the need for more upper-level graduate courses. This complaint continues from the previous, 1998, internal review.

Graduate chemistry majors have won college, university, national and international awards: attendance at the 2005 Nobel Laureate Meeting, attendance at the 2005 ACS-DRF Summer Graduate School in Green Chemistry at McGill University (2), NASA Space Grant Fellowship, College of Arts and Sciences Outstanding Dissertation Award, Dean’s Merit Assistantship, Alabama Power Fellowship (2), National Alumni Association Graduate Fellowship, Future Faculty Fellowship, Graduate Council Fellowships (3), and Graduate School Student Travel Awards (8). Most graduating students obtain postdoctoral positions, college/university faculty positions, and employment in industry. Interviews with graduate students were mixed. Concerns voiced included the need for more class offerings and improved teaching methods in certain courses, more access to faculty to discuss department matters, consistency in the duties of teaching assistants, and evaluation of the effectiveness of cumulative examinations. Overall the graduate program is strong but must be further strengthened to attain the status of a nationally renowned program.

The Program Outcome improvement actions and measures indicated in this plan are derived from the findings and recommendations in the 8-year program review.

The Department is dedicated to the instruction, training, and intellectual growth of undergraduate students. This mission is accomplished through the use of several mechanisms including 1) classic and innovative classroom and laboratory instruction, 2) student advising, and 3) undergraduate research. The Department reaches out not only to chemistry, science, and engineering majors but also to other non-science majors in its mission. Undergraduate research is strongly encouraged and supported in the Department. There are two basic degree tracks in the Department: a bachelor of science in Chemistry including a Biochemistry track and a Pre-health Professional track leading to a Bachelor’s of Science degree in Chemistry.

The Department offers opportunities for graduate study in a variety of exciting interdisciplinary programs as well as the traditional fields of analytical, inorganic, organic, physical, and biochemistry leading to the Master of Science and the Doctor of Philosophy degrees in chemistry. The Chemistry faculty offer the highest quality graduate education.

Service is an important function of the Department. Faculty and staff are bound by mutual respect and dedication to the field of chemistry and provide their expertise in science to serve the people of Alabama, the region, and the nation. The Department has strong outreach activities and has strong efforts in technology transfer.

Overall, the Department is truly the capstone of chemistry within the state of Alabama and beyond.

Student Learning Outcomes, with Any Associations and Related Measures, Targets, Findings, and Action Plans

**SLO 1: Students will apply fundamental and intermediate-level chemistry knowledge**

Students will apply fundamental and intermediate-level chemistry knowledge in solving problems related to kinetic and thermodynamic principles, chemical reactivity and synthesis, reaction stoichiometry, molecular structure and bonding, and chemical analysis

**Connected Documents**
- Curriculum Maps Chemistry MS Thesis Option 2013-2014
- Methods for MS Chemistry Program
- MS Chemistry Curriculum Maps

**Relevant Associations:**
- SACS 3.3.1
  - 3.3.1.1 Educational programs, to include student learning outcomes

**General Education/Core Curriculum Associations**

Mathematics - SLO is related to the essential characteristics and basic processes of inquiry and analysis in the discipline, encourages the development of critical thinking and requires students to analyze, synthesize and evaluate knowledge

**Strategic Plan Associations**

University of Alabama
- 1.1 Promote and enhance areas of academic, scholarship, and research excellence.

**Related Measures**

M 1: American Chemical Society (ACS) Chemical Education Subject Examinations
Upon entry into the program, students will take American Chemical Society (ACS) Chemical Education Subject Examinations in analytical, inorganic, organic, and physical chemistry to assess baseline fundamental knowledge of chemistry. Upon completion of the degree requirements, students will retake the (ACS) Chemical Education Subject Examination in their designated area of specialization to assess the learning of associated fundamental chemistry concepts since commencing their graduate education.

Source of Evidence: Academic direct measure of learning - other

Connected Document
Methods for MS Chemistry Program

Target:
Higher average % correct answers on ACS Subject Test Score in area of specialization upon degree completion than upon program entry.

Related Action Plans (by Established cycle, then alpha):
For full information, see the Details of Action Plans section of this report.

Obtain Data from Additional Degree Recipients
Established in Cycle: 2011-2012
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

Obtain Data from Additional Degree Recipients
Established in Cycle: 2012-2013
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

M 2: Oral Thesis Defense
Upon completing the degree, students will be asked questions in an oral examination format before a faculty committee. Questions will probe fundamental and intermediate-level knowledge of kinetic and thermodynamic principles, chemical reactivity and synthesis, reaction stoichiometry, molecular structure and bonding, and chemical analysis, as appropriate. The faculty committee will assign a grade using a scoring rubric based upon the student's command of the concepts.

Source of Evidence: Academic direct measure of learning - other

Connected Document
Methods for MS Chemistry Program

Target:
Average score of >2.0 on related dimensions in Thesis MS Examination Assessment Form

Related Action Plans (by Established cycle, then alpha):
For full information, see the Details of Action Plans section of this report.

Obtain Data from Additional Degree Recipients
Established in Cycle: 2011-2012
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

Obtain Data from Additional Degree Recipients
Established in Cycle: 2012-2013
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SLO 2: Students will select and express chemical terminology appropriately
Students will select and express chemical terminology appropriately and convey (oral and written) chemistry results in accepted technical formats with adequate and appropriate referencing (e.g., American Chemical Society standards)

Connected Documents
Curriculum Maps Chemistry MS Thesis Option 2013-2014
Methods for MS Chemistry Program
MS Chemistry Curriculum Maps

Relevant Associations:
Standard Associations
SACS 3.3.1
3.3.1.1 Educational programs, to include student learning outcomes

General Education/Core Curriculum Associations
8 Mathematics - SLO is related to the essential characteristics and basic processes of inquiry and analysis in the discipline, encourages the development of critical thinking and requires students to analyze, synthesize and evaluate knowledge

Strategic Plan Associations
University of Alabama
1.1 Promote and enhance areas of academic, scholarship, and research excellence.

Related Measures
M 3: Research Seminar
Students convey experimental details and demonstrate their research productivity during their Departmental Research Seminar oral presentation. Faculty attendees evaluate the student’s knowledge of the research project, including experimental details, using a detailed scoring rubric. Students will also prepare a written 10 page technical research summary. Faculty attendees will use a scoring rubric to grade the student in terms of appropriate use of terminology and quality and formatting of the written report.

Source of Evidence: Academic direct measure of learning - other
Connected Document
Methods for MS Chemistry Program

Target:
Average score of >3.2/4.0 or >1.6/2.0 on all related dimensions of the Research Seminar Assessment Form

Related Action Plans (by Established cycle, then alpha):
For full information, see the Details of Action Plans section of this report.

Obtain Data from Additional Degree Recipients
Established in Cycle: 2011-2012
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Obtain Data from Additional Degree Recipients
Established in Cycle: 2012-2013
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M 4: Written Thesis
A faculty thesis committee evaluates the student's written thesis with respect to grammar, organization and completeness, formatting, quality of illustrations, experimental detail/compound characterization, and appropriate citations.

Source of Evidence: Academic direct measure of learning - other

Connected Document
Methods for MS Chemistry Program

Target:
Average score of >2.0 on related dimension in Thesis MS Examination Assessment Form

Related Action Plans (by Established cycle, then alpha):
For full information, see the Details of Action Plans section of this report.

Obtain Data from Additional Degree Recipients
Established in Cycle: 2011-2012
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Obtain Data from Additional Degree Recipients
Established in Cycle: 2012-2013
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

SLO 3: Knowledge of Research Methods and Demonstration of Productivity
Students will demonstrate general knowledge of research tools and methodologies and demonstrate research productivity related to chemical synthesis techniques, precise and accurate measurement, chemical analysis and characterization, and proper use of instrumentation.

Connected Documents
Curriculum Maps Chemistry MS Thesis Option 2013-2014
Methods for MS Chemistry Program
MS Chemistry Curriculum Maps

Relevant Associations:

Standard Associations
SACS 3.3.1
3.3.1.4 Research within its educational mission

General Education/Core Curriculum Associations
8 Mathematics - SLO is related to the essential characteristics and basic processes of inquiry and analysis in the discipline, encourages the development of critical thinking and requires students to analyze, synthesize and evaluate knowledge
9 Natural Science - SLO is related to a hands-on laboratory or field experience that emphasizes the scientific method and analysis of data

Strategic Plan Associations
University of Alabama
1.1 Promote and enhance areas of academic, scholarship, and research excellence.

Related Measures

M 5: Oral Thesis Defense
Students will have an oral thesis defense before a faculty committee. Students will be evaluated using a scoring rubric with respect to knowledge of chemistry concepts including common research tools and experimental methodologies. Students must demonstrate sufficient research productivity to be recommended for the M.S degree.

Source of Evidence: Senior thesis or culminating major project

Connected Document
Methods for MS Chemistry Program

Target:
Average score of >2.0 on related dimensions in Thesis MS Examination Assessment Form

Related Action Plans (by Established cycle, then alpha):
For full information, see the Details of Action Plans section of this report.
Obtain Data from Additional Degree Recipients
Established in Cycle: 2011-2012
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

Obtain Data from Additional Degree Recipients
Established in Cycle: 2012-2013
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

M 6: Research Seminar
Students will convey experimental details and demonstrate their research productivity during their Departmental Research Seminar oral presentation. Faculty attendees will evaluate the student's knowledge of the research project, including experimental details, using a detailed scoring rubric.
Source of Evidence: Presentation, either individual or group

Connected Document
Methods for MS Chemistry Program

Target:
Average score of >3.2/4.0 or >1.6/2.0 on all related dimensions of the Research Seminar Assessment Form

Related Action Plans (by Established cycle, then alpha):
For full information, see the Details of Action Plans section of this report.

Obtain Data from Additional Degree Recipients
Established in Cycle: 2011-2012
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

Obtain Data from Additional Degree Recipients
Established in Cycle: 2012-2013
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

Other Outcomes, with Any Associations and Related Measures, Targets, Findings, and Action Plans

OthOtcm 4: Program Outcome: High Level of Recognized Quality
The program will improve and sustain a high level of recognized quality.

Connected Documents
Methods for MS Chemistry Program
MS Chemistry Curriculum Maps

Related Measures

M 7: Graduate Applications Received
Annual departmental graduate application data will be compared with the annual CCR Survey application data to determine where we rank nationally among Chemistry departments with regard to number of applicants. This data can serve as a measure of both national and international departmental recognizability and reputation.

Source of Evidence: Administrative measure - other
Target:
No target established.

M 8: Annual Research Expenditures
Annual departmental research expenditures will be compared with the annual CCR Survey research expenditure data to determine where we rank nationally among Chemistry departments.

Source of Evidence: Activity volume
Target:
No target established.

M 9: Number of Faculty Publications
The number of peer-reviewed manuscripts, review articles, books or book chapters, and patent applications will be reported, because this data has a direct impact on the national/international perception of the productivity and quality of Chemistry research programs.

Source of Evidence: Activity volume
Target:
Add

OthOtcm 5: Program Outcome: Sustain Optimal Level of Enrollment
The program will build and sustain an optimal level of annual program enrollments and degree completion.

Connected Documents
Methods for MS Chemistry Program
MS Chemistry Curriculum Maps

Related Measures

M 10: Number of MS degrees
Number of MS degrees for last August+December+May commencments [Target: 4 degrees]

Source of Evidence: Academic indirect indicator of learning - other

Connected Document
Methods for MS Chemistry Program
Target: No target established.

**M 11: Relation of number of MS degrees awarded to ACHE viability standards**
Relation of number of MS degrees awarded to ACHE viability standards
Source of Evidence: Academic indirect indicator of learning - other

**Connected Document**
Methods for MS Chemistry Program

Target: Average of 3.75 degrees per year over five years required to meet ACHE viability standards

**Finding (2013-2014) - Target: Met**

TBD

**M 12: Student: Faculty Ratio**
Total number of graduate students and postdoctoral researchers compared to total number of research active faculty.
Source of Evidence: Activity volume

**Connected Document**
Methods for MS Chemistry Program

Target: 4 per research active faculty member=100

**Finding (2013-2014) - Target: Met**

TBD

**OthOtcm 6: Program Outcome: Highly Valued by Graduates and Constituencies**
The program will be highly valued by its program graduates and other key constituencies it serves.

**Connected Documents**
Methods for MS Chemistry Program
MS Chemistry Curriculum Maps

**Related Measures**

**M 13: Graduate student survey conducted by the Department of Chemistry**
Graduate student survey conducted by the Department of Chemistry. A Likert scale will be used to obtain numerical averages for each question asked.
Source of Evidence: Academic indirect indicator of learning - other

**Connected Document**
Methods for MS Chemistry Program

Target: No target established.

**M 14: Graduate Placement**
Students who graduated with a Thesis MS degree in Chemistry within the past year will be asked to complete an anonymous survey. Results will indicate the percentage of respondents who are employed in a science-related field (industry or academics) or who are continuing studies in a science or chemical engineering graduate program.
Source of Evidence: Job placement data, esp. for career/tech areas

**Target:** Minimum of 80% of our Thesis MS graduates are gainfully employed or involved in other academic programs.

**OthOtcm 7: Department Outcome: Student Recruitment**
Recruitment of a sufficient number of high quality students into our graduate program with competitive representation by racial and gender minorities.

**Connected Documents**
Methods for MS Chemistry Program
MS Chemistry Curriculum Maps

**Related Measures**

**M 15: Minority Enrollment**
% Racial minority graduate students (target: national avg. % minority enrollment in chemistry graduate programs = 4.6% for programs with 41-105 graduate students as reported by 2008 ACS Committee on Professional Training Special Report)
Source of Evidence: Activity volume

**Connected Document**
Methods for MS Chemistry Program

**M 16: Female Enrollment**
% Female graduate students (target: national avg. %female enrollment in chemistry graduate programs = 26.1% for programs with 41-105 graduate students as reported by 2008 ACS Committee on Professional Training Special Report)
Source of Evidence: Activity volume

**Connected Document**
Methods for MS Chemistry Program

**M 17: Average GRE Scores**
New graduate student quality based upon avg. total GRE score (target: avg. GRE >1150)
Source of Evidence: Activity volume

Connected Document
Methods for MS Chemistry Program

M 18: Subject Test Score
New graduate student quality based upon ACS Subject Test score in Chemistry division of interest upon arrival in the program (target: avg. ACS placement exam score >50th percentile)
Source of Evidence: Academic indirect indicator of learning - other

Connected Document
Methods for MS Chemistry Program

OthOtcm 8: Department Outcome: Scholarly Publications
Publication of scholarly research results and application for intellectual property rights

Connected Documents
Methods for MS Chemistry Program
MS Chemistry Curriculum Maps

Relevant Associations:
Change the minimum standard in Measure 2.1 to 1.5/non-first year graduate student and postdoctoral researcher to more accurately reflect recent publishing activity.

Related Measures

M 19: Peer-reviewed Publications
Total number of peer-reviewed publications [target: 1.5 per non-first graduate student and postdoctoral researcher (66 non-first year graduate students and 16 postdocs as of Sept. 1, 2011 = 123 targeted publications)]
Source of Evidence: Activity volume

Connected Document
Methods for MS Chemistry Program

M 20: Patent Applications
Total number of patent applications submitted or awarded [target: no target]
Source of Evidence: Activity volume

Connected Document
Methods for MS Chemistry Program

M 21: Target Revisions
Assess whether the revised target for measure 2.1 is a more accurate reflection of recent Departmental publishing activity than the previous target of 1.0/non-first year graduate student and postdoctoral researcher
Source of Evidence: Document Analysis

Connected Document
Methods for MS Chemistry Program

OthOtcm 9: Department Outcome: Outreach Programs
Organization of, and participation in, outreach programs to enhance local and regional science education and training

Connected Documents
Methods for MS Chemistry Program
MS Chemistry Curriculum Maps

Relevant Associations:
Faculty will be strongly encouraged to conduct satisfaction surveys during outreach events in which surveys are tractable. Events including the NSF sponsored Research Experiences for Undergraduates program, the Alabama Instrumentation and Technology Colloquium, and area K-12 events are expected to implement surveys in 2011-2012.

Related Measures

M 22: Event Number
Total outreach events organized or participated in by faculty or graduate students [target: 10 activities]
Source of Evidence: Activity volume

Connected Document
Methods for MS Chemistry Program

M 23: Informal Evaluation by Faculty, Graduate Students and Participants
Informal evaluation by faculty, graduate students, and participants
Source of Evidence: Evaluations

Connected Document
Methods for MS Chemistry Program

M 24: Surveys
Percentage of outreach activities in which surveys or evaluations were administered [target: >33%]
Source of Evidence: Service Quality

Connected Document
Methods for MS Chemistry Program

OthOtcm 10: Department Outcome: Professional Networking
Establish networks with chemists to enhance Departmental recognition and reputation and to disseminate research results at national and international venues

Connected Documents
Related Measures

**M 25: Faculty Presentations**
Total number of faculty research presentations at regional, national, and international conferences, universities, or with industry [target: 3 per research active faculty member = 75]
Source of Evidence: Activity volume

**Connected Document**
Methods for MS Chemistry Program

**M 26: Extramural Research Presentations**
Total number of student or postdoctoral associate extramural research presentations [target: two student/postdoctoral presentations per research active faculty member = 50]
Source of Evidence: Presentation, either individual or group

**Connected Document**
Methods for MS Chemistry Program

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### Details of Action Plans for This Cycle (by Established cycle, then alpha)

#### Obtain Data from Additional Degree Recipients
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data derived from the performance of one Plan I (Thesis) MS graduate. Data from additional Chemistry Thesis MS degree earners must be acquired and analyzed before any program-level changes should be considered.

**Established in Cycle:** 2011-2012  
**Implementation Status:** In-Progress  
**Priority:** High

**Relationships (Measure | Outcome/Objective):**
- **Measure:** American Chemical Society (ACS) Chemical Education Subject Examinations  
  **Outcome/Objective:** Students will apply fundamental and intermediate-level chemistry knowledge
- **Measure:** Oral Thesis Defense  
  **Outcome/Objective:** Knowledge of Research Methods and Demonstration of Productivity  
  | Students will apply fundamental and intermediate-level chemistry knowledge
- **Measure:** Research Seminar  
  **Outcome/Objective:** Knowledge of Research Methods and Demonstration of Productivity  
  | Students will select and express chemical terminology appropriately
- **Measure:** Written Thesis  
  **Outcome/Objective:** Students will select and express chemical terminology appropriately

**Projected Completion Date:** 07/2013  
**Responsible Person/Group:** Department Assessment Coordinator/Chemistry Faculty

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**Established in Cycle:** 2012-2013  
**Implementation Status:** In-Progress  
**Priority:** High

**Relationships (Measure | Outcome/Objective):**
- **Measure:** American Chemical Society (ACS) Chemical Education Subject Examinations  
  **Outcome/Objective:** Students will apply fundamental and intermediate-level chemistry knowledge
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- **Measure:** Written Thesis  
  **Outcome/Objective:** Students will select and express chemical terminology appropriately

**Projected Completion Date:** 08/2014  
**Responsible Person/Group:** Department Assessment Coordinator/Chemistry Faculty
Mission / Purpose

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The review committee consisted of Dr. J.W. Harrell (Physics and Astronomy), committee chair, Dr. Ernie Mancini (Geological Sciences), and Dr. Robert Taylor (Mechanical Engineering). The external reviewer was Dr. Gary Schuster (Provost and Dept. of Chemistry and Biochemistry, Georgia Institute of Technology). The committee began the review process by meeting with Assoc. Dean John Schmitt (Graduate School), Assoc. Dean Joe Benson (A&S), and Prof. Joseph Thrasher (Chemistry dept. chair), where Dean Schmitt provided an overview of the review. Documents provided to the committee included program review forms completed by the department chair, student satisfaction survey results, the previous departmental review report, the departmental academic profile, the departmental annual report for 2005-06, a list of individual grant awards for 2002-03 through 2005-06, and the department’s successful White Paper Graduate Enhancement Proposal from the late 1990s. Prof. Thrasher also provided the committee with a “State of the Department” PowerPoint type document and results of a 2006 Southeast Departmental Chairs Survey and a 2006 Council for Chemical Research (CCR) survey.

The committee met with Dr. Schuster, Dean David Francko (Graduate School), Dean Robert Olin (A&S), and Prof. Thrasher. It had numerous meetings with various clusters of chemistry faculty members. The meetings with interdisciplinary groups included faculty from other programs such as MINT, Biological Sciences, and Engineering. The committee also met with the chemistry staff and had separate meetings with graduate students and undergraduate students. All members of the committee contributed to writing the report and the report represents a consensus of the committee.

Finding(s) describing the extent to which the outcome is achieved
The report generated by the Internal Program Review Committee is extensive. Only those elements that are directly related to the current program outcome are presented: quality of program, strengths of degree program, areas of opportunities for the program, including recommendations to improve the degree program.

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The Department offers opportunities for graduate study in a variety of exciting interdisciplinary programs as well as the traditional fields of analytical, inorganic, organic, physical, and biochemistry leading to the Master of Science and the Doctor of Philosophy degrees in chemistry. The Chemistry faculty offer the highest quality graduate education.

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**SLO 1: Students will apply fundamental and intermediate-level chemistry knowledge**

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**Connected Documents**
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- MS Chemistry Curriculum Maps

**Relevant Associations:**

**Standard Associations**
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**Strategic Plan Associations**
- University of Alabama
  - 1.1 Promote and enhance areas of academic, scholarship, and research excellence.

**Related Measures**
- **M 1: American Chemical Society (ACS) Chemical Education Subject Examinations**
  
  Upon entry into the program, students will take American Chemical Society (ACS) Chemical Education Subject Examinations in analytical, biochemistry, inorganic, organic, and physical chemistry to assess baseline fundamental knowledge of chemistry. Upon completion of the degree requirements, students will retake the (ACS) Chemical Education Subject Examination in their designated area of specialization to assess the learning of associated fundamental chemistry concepts since commencing their graduate education.

  Source of Evidence: Academic direct measure of learning - other

**Connected Document**
- Methods for MS Chemistry Program

**Target:**

Higher average % correct answers on ACS Subject Test Score in area of specialization upon degree completion than upon program entry.

**Finding (2012-2013) - Target: Not Reported This Cycle**
Only one student earned a Plan I (Thesis) MS Degree in Chemistry in 2012-2013. To ensure confidentiality of the student’s academic performance record, no assessment data will be reported for 2012-2013.

**Related Action Plans (by Established cycle, then alpha):**
For full information, see the Details of Action Plans section of this report.

**Obtain Data from Additional Degree Recipients**
*Established in Cycle: 2011-2012*
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

**Obtain Data from Additional Degree Recipients**
*Established in Cycle: 2012-2013*
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

### M 2: Oral Thesis Defense
Upon completing the degree, students will be asked questions in an oral examination format before a faculty committee. Questions will probe fundamental and intermediate-level knowledge of kinetic and thermodynamic principles, chemical reactivity and synthesis, reaction stoichiometry, molecular structure and bonding, and chemical analysis, as appropriate. The faculty committee will assign a grade using a scoring rubric based upon the student’s command of the concepts.

Source of Evidence: Academic direct measure of learning - other

**Connected Document**
*Methods for MS Chemistry Program*

**Target:**
Average score of >2.0 on related dimensions in Thesis MS Examination Assessment Form

**Finding (2012-2013) - Target: Not Reported This Cycle**
Only one student earned a Plan I (Thesis) MS Degree in Chemistry in 2012-2013. To ensure confidentiality of the student’s academic performance record, no assessment data will be reported for 2012-2013.

**Related Action Plans (by Established cycle, then alpha):**
For full information, see the Details of Action Plans section of this report.

**Obtain Data from Additional Degree Recipients**
*Established in Cycle: 2011-2012*
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

**Obtain Data from Additional Degree Recipients**
*Established in Cycle: 2012-2013*
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

### SLO 2: Students will select and express chemical terminology appropriately
Students will select and express chemical terminology appropriately and convey (oral and written) chemistry results in accepted technical formats with adequate and appropriate referencing (e.g., American Chemical Society standards)

**Connected Documents**
*Methods for MS Chemistry Program*
*MS Chemistry Curriculum Maps*

**Relevant Associations:**

**Standard Associations**
*SACS 3.3.1*
3.3.1.1 Educational programs, to include student learning outcomes

**General Education/Core Curriculum Associations**
8 Mathematics - SLO is related to the essential characteristics and basic processes of inquiry and analysis in the discipline, encourages the development of critical thinking and requires students to analyze, synthesize and evaluate knowledge

**Strategic Plan Associations**
University of Alabama
1.1 Promote and enhance areas of academic, scholarship, and research excellence.

**Related Measures**

### M 3: Research Seminar
Students convey experimental details and demonstrate their research productivity during their Departmental Research Seminar oral presentation. Faculty attendees evaluate the student’s knowledge of the research project, including experimental details, using a detailed scoring rubric. Students will also prepare a written 10 page technical research summary. Faculty attendees will use a scoring rubric to grade the student in terms of appropriate use of terminology and quality and formatting of the written report.

Source of Evidence: Academic direct measure of learning - other

**Connected Document**
*Methods for MS Chemistry Program*

**Target:**
Average score of >3.2/4.0 or >1.6/2.0 on all related dimensions of the Research Seminar Assessment Form

**Finding (2012-2013) - Target: Not Reported This Cycle**
Only one student earned a Plan I (Thesis) MS Degree in Chemistry in 2012-2013. To ensure confidentiality of the student's academic performance record, no assessment data will be reported for 2012-2013.
Related Action Plans (by Established cycle, then alpha):
For full information, see the Details of Action Plans section of this report.

Obtain Data from Additional Degree Recipients
Established in Cycle: 2011-2012
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

Obtain Data from Additional Degree Recipients
Established in Cycle: 2012-2013
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

M 4: Written Thesis
A faculty thesis committee evaluates the student's written thesis with respect to grammar, organization and completeness, formatting, quality of illustrations, experimental detail/compound characterization, and appropriate citations.

Source of Evidence: Academic direct measure of learning - other

Connected Document
Methods for MS Chemistry Program

Target:
Average score of >2.0 on related dimension in Thesis MS Examination Assessment Form

Finding (2012-2013) - Target: Not Reported This Cycle
Only one student earned a Plan I (Thesis) MS Degree in Chemistry in 2012-2013. To ensure confidentiality of the student's academic performance record, no assessment data will be reported for 2012-2013.

Related Action Plans (by Established cycle, then alpha):
For full information, see the Details of Action Plans section of this report.

Obtain Data from Additional Degree Recipients
Established in Cycle: 2011-2012
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

Obtain Data from Additional Degree Recipients
Established in Cycle: 2012-2013
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

SLO 3: Knowledge of Research Methods and Demonstration of Productivity
Students will demonstrate general knowledge of research tools and methodologies and demonstrate research productivity related to chemical synthesis techniques, precise and accurate measurement, chemical analysis and characterization, and proper use of instrumentation.

Connected Documents
Methods for MS Chemistry Program
MS Chemistry Curriculum Maps

Relevant Associations:
Standard Associations
SACS 3.3.1
3.3.1.4 Research within its educational mission

General Education/Core Curriculum Associations
8 Mathematics - SLO is related to the essential characteristics and basic processes of inquiry and analysis in the discipline, encourages the development of critical thinking and requires students to analyze, synthesize and evaluate knowledge
9 Natural Science - SLO is related to a hands-on laboratory or field experience that emphasizes the scientific method and analysis of data

Strategic Plan Associations
University of Alabama
1.1 Promote and enhance areas of academic, scholarship, and research excellence.

Related Measures

M 5: Oral Thesis Defense
Students will have an oral thesis defense before a faculty committee. Students will be evaluated using a scoring rubric with respect to knowledge of chemistry concepts including common research tools and experimental methodologies. Students must demonstrate sufficient research productivity to be recommended for the MS degree.

Source of Evidence: Senior thesis or culminating major project

Connected Document
Methods for MS Chemistry Program

Target:
Average score of >2.0 on related dimensions in Thesis MS Examination Assessment Form

Finding (2012-2013) - Target: Not Reported This Cycle
Only one student earned a Plan I (Thesis) MS Degree in Chemistry in 2012-2013. To ensure confidentiality of the student's academic performance record, no assessment data will be reported for 2012-2013.

Related Action Plans (by Established cycle, then alpha):
For full information, see the Details of Action Plans section of this report.

Obtain Data from Additional Degree Recipients
Established in Cycle: 2011-2012
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

Obtain Data from Additional Degree Recipients
Established in Cycle: 2012-2013
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

M 6: Research Seminar
Students will convey experimental details and demonstrate their research productivity during their Departmental Research Seminar oral presentation. Faculty attendees will evaluate the student's knowledge of the research project, including experimental details, using a detailed scoring rubric.
Source of Evidence: Presentation, either individual or group

Connected Document
Methods for MS Chemistry Program

Target:
Average score of >3.2/4.0 or >1.6/2.0 on all related dimensions of the Research Seminar Assessment Form

Finding (2012-2013) - Target: Not Reported This Cycle
Only one student earned a Plan I (Thesis) MS Degree in Chemistry in 2012-2013. To ensure confidentiality of the student's academic performance record, no assessment data will be reported for 2012-2013.

Related Action Plans (by Established cycle, then alpha):
For full information, see the Details of Action Plans section of this report.

Obtain Data from Additional Degree Recipients
Established in Cycle: 2011-2012
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

Obtain Data from Additional Degree Recipients
Established in Cycle: 2012-2013
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

Other Outcomes, with Any Associations and Related Measures, Targets, Findings, and Action Plans

OthOtcm 4: Program Outcome: High Level of Recognized Quality
The program will improve and sustain a high level of recognized quality.

Connected Documents
Methods for MS Chemistry Program
MS Chemistry Curriculum Maps

Related Measures

M 7: Graduate Applications Received
Annual departmental graduate application data will be compared with the annual CCR Survey application data to determine where we rank nationally among Chemistry departments with regard to number of applicants. This data can serve as a measure of both national and international departmental recognizability and reputation.
Source of Evidence: Administrative measure - other

Target:
No target established.

Finding (2012-2013) - Target: Met
146 applications were received, including 52 from domestic applicants and 94 from international applicants. This places our department between the 2nd quartile (avg. 252 applications) and 3rd quartile (average 114 applications) nationally, based on data from the national 2013 Chemistry Chair's Report.

M 8: Annual Research Expenditures
Annual departmental research expenditures will be compared with the annual CCR Survey research expenditure data to determine where we rank nationally among Chemistry departments.
Source of Evidence: Activity volume

Target:
No target established.

Finding (2012-2013) - Target: Met
2011-2012 total research expenditures (federal, industrial, general + other) = $3.74 million. This places our department firmly between the 2nd quartile (avg. $6.9 million) and 3rd quartile (average $2.2 million) nationally, based on data from the national 2013 Chemistry Chair's Report.

M 9: Number of Faculty Publications
The number of peer-reviewed manuscripts, review articles, books or book chapters, and patent applications will be reported, because this data has a direct impact on the national/international perception of the productivity and quality of Chemistry research programs.
Source of Evidence: Activity volume

Target:
1.5 per non-first year graduate student and postdoctoral researcher (81 non-first year graduate students and 12 postdocs as of Sept. 1, 2012 = 139.5 targeted publications)
**Finding (2012-2013) - Target: Met**

Chemistry faculty, students, and postdocs had 129 peer-reviewed manuscripts, 6 books, 14 book chapters, and 6 other (non-refereed) articles (149 total peer-reviewed publications and books/book chapters) published in 2012-2013. The Department continues to publish research results and reviews at a reasonable rate. The number of peer-reviewed manuscripts is up from 2011-2012 (130) despite having the same graduate enrollment and one less postdoctoral associate. This can be explained partly by the relative number of non-first year graduate students in the Department (81 in September 2012 vs. 66 in September 2011) and the increased productivity associated with more experienced graduate researchers.

**OthOtm 5: Program Outcome: Sustain Optimal Level of Enrollment**
The program will build and sustain an optimal level of annual program enrollments and degree completion.

**Connected Documents**
- Methods for MS Chemistry Program
- MS Chemistry Curriculum Maps

**Related Measures**

**M 10: Number of MS degrees**
Number of MS degrees for last August+December+May commencements [Target: 4 degrees]
Source of Evidence: Academic indirect indicator of learning - other

**Connected Document**
- Methods for MS Chemistry Program

**Target:**
No target established.

**Finding (2012-2013) - Target: Met**
Nine (9) students earned MS degrees in 2012-2013, although only one (1) student earned a Thesis MS (Plan I). The Thesis MS degree is typically a terminal degree in our department and is not required for continuation to earn a PhD degree. As such, most graduate students bypass this option en route to earning PhD degrees.

**M 11: Relation of number of MS degrees awarded to ACHE viability standards**
Relation of number of MS degrees awarded to ACHE viability standards
Source of Evidence: Academic indirect indicator of learning - other

**Connected Document**
- Methods for MS Chemistry Program

**Target:**
Average of 3.75 degrees per year over five years required to meet ACHE viability standards

**Finding (2012-2013) - Target: Met**
The average number of MS degrees awarded over the past five years = 7.6 degrees. This value far exceeds the ACHE viability standards.

**M 12: Student: Faculty Ratio**
Total number of graduate students and postdoctoral researchers compared to total number of research active faculty.
Source of Evidence: Activity volume

**Connected Document**
- Methods for MS Chemistry Program

**Target:**
4 per research active faculty member = 100

**Finding (2012-2013) - Target: Met**
As of fall 2012, the Department supported 94 graduate students and 12 postdoctoral researchers (106 total researchers). This total is comparable to that from fall 2011 (94 and 13 = 107) and shows the Department continues to meet its goals for researchers (MS and PhD) in the Graduate Program.

**OthOtm 6: Program Outcome: Highly Valued by Graduates and Constituencies**
The program will be highly valued by its program graduates and other key constituencies it serves.

**Connected Documents**
- Methods for MS Chemistry Program
- MS Chemistry Curriculum Maps

**Related Measures**

**M 13: Graduate student survey conducted by the Department of Chemistry**
Graduate student survey conducted by the Department of Chemistry. A Lickert scale will be used to obtain numerical averages for each question asked.
Source of Evidence: Academic indirect indicator of learning - other

**Connected Document**
- Methods for MS Chemistry Program

**Target:**
No target established.

**Finding (2012-2013) - Target: Met**
Thirty two (32) 2012-2013 non-first year graduate students responded to the survey. Two different Lickert scales were used depending upon the question asked. One scale had five possible responses ranging in value from 0 to 4 points (the values correspond to worded responses ranging from 'not effective or satisfied' (worth 0 points) to 'extremely effective or satisfied' (worth 4 points) along with scored responses in between) while the other scale had seven possible responses ranging in value from 0 to 6 points (the values correspond to
worded responses ranging from ‘extremely dissatisfied’ (worth 0 points) to ‘extremely satisfied’ (worth 6 points) along with scored responses in between). The average score for “How effective was instruction in your graduate courses?” = 2.56 out of 6.00, with a value of 2.00 equating ‘moderately effective’ and 3.00 equating ‘very effective’. The average score for “How satisfied were you with course content?” = 4.56 out of 6.00, with a value of 4.00 equating ‘slightly satisfied’ and 5.00 equating ‘satisfied’. The average score for “How satisfied were you with course offerings in the graduate curriculum?” = 4.56 out of 6.00, with a value of 4.00 equating ‘slightly satisfied’ and 5.00 equating ‘satisfied’. The average score for “How satisfied were you with classroom and research facilities?” = 3.31 out of 4.00, with a value of 3.00 equating ‘very satisfied’ and 4.00 equating ‘extremely satisfied’. The average score for “How satisfied are/were you with your graduate research experiences?” = 5.13 out of 6.00, with a value of 5.00 equating ‘satisfied’ and 6.00 equating ‘extremely satisfied’. The average score for “How satisfied are/were you with your graduate program overall?” = 5.03 out of 6.00, with a value of 5.00 equating ‘satisfied’ and 6.00 equating ‘extremely satisfied’. Results from other questions asked, but not scored, included: 25 of 32 respondents claimed there are adequate opportunities available to interact with graduate students outside of their research group, 17 of 24 respondents claimed they have/are receiving adequate preparation to meet their career objectives, 29 of 30 respondents felt they are receiving a competitive stipend and benefits, and 21 of 26 respondents claimed the compensation for a teaching assistant is commensurate with the TA workload. Overall, the responses were quite positive and reflect the strengths of the graduate program in terms of its courses, facilities, research experiences, and overall environment. Less than 10% of responses to any one question were negative and a much greater percentage, in all cases, was strongly positive.

M 14: Graduate Placement
Students who graduated with a Thesis MS degree in Chemistry within the past year will be asked to complete an anonymous survey. Results will indicate the percentage of respondents who are employed in a science-related field (industry or academics) or who are continuing studies in a science or chemical engineering graduate program.

Source of Evidence: Job placement data, esp. for career/tech areas
Target:
Minimum of 80% of our Thesis MS graduates are gainfully employed or involved in other academic programs.

Finding (2012-2013) - Target: Not Reported This Cycle
Only one student earned a Plan I (Thesis) MS Degree in Chemistry in 2012-2013. To ensure confidentiality of the student’s academic performance and placement record, no assessment data will be reported for 2012-2013.

OthOtcn 7: Department Outcome: Student Recruitment
Recruitment of a sufficient number of high quality students into our graduate program with competitive representation by racial and gender minorities.

Connected Documents
Methods for MS Chemistry Program
MS Chemistry Curriculum Maps

Related Measures

M 15: Minority Enrollment
% Racial minority graduate students (target: national avg. % minority enrollment in chemistry graduate programs=4.6% for programs with 41-105 graduate students as reported by 2008 ACS Committee on Professional Training Special Report)

Source of Evidence: Activity volume
Connected Document
Methods for MS Chemistry Program

M 16: Female Enrollment
% Female graduate students (target: national avg. %female enrollment in chemistry graduate programs = 26.1% for programs with 41-105 graduate students as reported by 2008 ACS Committee on Professional Training Special Report)

Source of Evidence: Activity volume
Connected Document
Methods for MS Chemistry Program

M 17: Average GRE Scores
New graduate student quality based upon avg. total GRE score (target: avg. GRE>1150)

Source of Evidence: Activity volume
Connected Document
Methods for MS Chemistry Program

M 18: Subject Test Score
New graduate student quality based upon ACS Subject Test score in Chemistry division of interest upon arrival in the program (target: avg. ACS placement exam score >50th percentile)

Source of Evidence: Academic indirect indicator of learning - other
Connected Document
Methods for MS Chemistry Program

OthOtcn 8: Department Outcome: Scholarly Publications
Publication of scholarly research results and application for intellectual property rights

Connected Documents
Methods for MS Chemistry Program
MS Chemistry Curriculum Maps

Relevant Associations:
Change the minimum standard in Measure 2.1 to 1.5/non-first year graduate student and postdoctoral researcher to more accurately reflect recent publishing activity.

**Related Measures**

**M 19: Peer-reviewed Publications**
Total number of peer-reviewed publications [target: 1.5 per non-first year graduate student and postdoctoral researcher (66 non-first year graduate students and 16 postdocs as of Sept. 1, 2011 = 123 targeted publications)]
Source of Evidence: Activity volume

**Connected Document**
Methods for MS Chemistry Program

**M 20: Patent Applications**
Total number of patent applications submitted or awarded [target: no target]
Source of Evidence: Activity volume

**Connected Document**
Methods for MS Chemistry Program

**M 21: Target Revisions**
Assess whether the revised target for measure 2.1 is a more accurate reflection of recent Departmental publishing activity than the previous target of 1.0/non-first year graduate student and postdoctoral researcher
Source of Evidence: Document Analysis

**Connected Document**
Methods for MS Chemistry Program

**OthOtcm 9: Department Outcome: Outreach Programs**
Organization of, and participation in, outreach programs to enhance local and regional science education and training

**Connected Documents**
- Methods for MS Chemistry Program
- MS Chemistry Curriculum Maps

**Relevant Associations:**
Faculty will be strongly encouraged to conduct satisfaction surveys during outreach events in which surveys are tractable. Events including the NSF sponsored Research Experiences for Undergraduates program, the Alabama Instrumentation and Technology Colloquium, and area K-12 events are expected to implement surveys in 2011-2012.

**Related Measures**

**M 22: Event Number**
Total outreach events organized or participated in by faculty or graduate students [target: 10 activities]
Source of Evidence: Activity volume

**Connected Document**
Methods for MS Chemistry Program

**M 23: Informal Evaluation by Faculty, Graduate Students and Participants**
Informal evaluation by faculty, graduate students, and participants
Source of Evidence: Evaluations

**Connected Document**
Methods for MS Chemistry Program

**M 24: Surveys**
Percentage of outreach activities in which surveys or evaluations were administered [target: >33%]
Source of Evidence: Service Quality

**Connected Document**
Methods for MS Chemistry Program

**OthOtcm 10: Department Outcome: Professional Networking**
Establish networks with chemists to enhance Departmental recognition and reputation and to disseminate research results at national and international venues

**Connected Documents**
- Methods for MS Chemistry Program
- MS Chemistry Curriculum Maps

**Related Measures**

**M 25: Faculty Presentations**
Total number of faculty research presentations at regional, national, and international conferences, universities, or with industry [target: 3 per research active faculty member = 75]
Source of Evidence: Activity volume

**Connected Document**
Methods for MS Chemistry Program

**M 26: Extramural Research Presentations**
Total number of student or postdoctoral associate extramural research presentations [target: two student/postdoctoral presentations per research active faculty member = 50]
Source of Evidence: Presentation, either individual or group

**Connected Document**
Methods for MS Chemistry Program
Details of Action Plans for This Cycle (by Established cycle, then alpha)

**Obtain Data from Additional Degree Recipients**

We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data derived from the performance of one Plan I (Thesis) MS graduate. Data from additional Chemistry Thesis MS degree earners must be acquired and analyzed before any program-level changes should be considered.

**Established in Cycle:** 2011-2012  
**Implementation Status:** In-Progress  
**Priority:** High

**Relationships (Measure | Outcome/Objective):**

- **Measure:** American Chemical Society (ACS) Chemical Education Subject Examinations  
  **Outcome/Objective:** Students will apply fundamental and intermediate-level chemistry knowledge
- **Measure:** Oral Thesis Defense  
  **Outcome/Objective:** Knowledge of Research Methods and Demonstration of Productivity  
  | Students will apply fundamental and intermediate-level chemistry knowledge
- **Measure:** Research Seminar  
  **Outcome/Objective:** Knowledge of Research Methods and Demonstration of Productivity  
  | Students will select and express chemical terminology appropriately
- **Measure:** Written Thesis  
  **Outcome/Objective:** Students will select and express chemical terminology appropriately

**Projected Completion Date:** 07/2013  
**Responsible Person/Group:** Department Assessment Coordinator/Chemistry Faculty

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**Obtain Data from Additional Degree Recipients**

We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data derived from the performance of one Plan I (Thesis) MS graduate. Data from additional Chemistry Thesis MS degree earners must be acquired and analyzed before any program-level changes should be considered.

**Established in Cycle:** 2012-2013  
**Implementation Status:** In-Progress  
**Priority:** High

**Relationships (Measure | Outcome/Objective):**

- **Measure:** American Chemical Society (ACS) Chemical Education Subject Examinations  
- **Outcome/Objective:** Students will apply fundamental and intermediate-level chemistry knowledge
- **Measure:** Oral Thesis Defense  
  **Outcome/Objective:** Knowledge of Research Methods and Demonstration of Productivity  
  | Students will apply fundamental and intermediate-level chemistry knowledge
- **Measure:** Research Seminar  
  **Outcome/Objective:** Knowledge of Research Methods and Demonstration of Productivity  
  | Students will select and express chemical terminology appropriately
- **Measure:** Written Thesis  
  **Outcome/Objective:** Students will select and express chemical terminology appropriately

**Projected Completion Date:** 08/2014  
**Responsible Person/Group:** Department Assessment Coordinator/Chemistry Faculty
Mission / Purpose
The Department of Chemistry is committed to the intellectual, technological, cultural, and economic advancement of the state, region, and nation through the discovery and development of new scientific knowledge. Research programs in the Department are both fundamental (create new knowledge) and applied (solve technical problems). Many of these research endeavors are anchored in interdisciplinary efforts drawing on and adding to the research base within The University. A strong and active research effort allows faculty to enable and keep abreast of the latest scientific advances and to impart new ideas and concepts into the curricula. Research activities play a vital role in the education of the next generation of academic, industrial, and government laboratory scientists who will be called upon to solve new problems. By maintaining these research programs, the Department helps to increase the recognition and reputation for quality of The University of Alabama locally, regionally, nationally, and internationally. Critical research areas include the synthesis and characterization of chemicals and materials and biochemistry. There is a strong emphasis in materials for advanced energy technologies including applications of 'green chemistry' and for information storage.

The University of Alabama conducts a Program Review of departments and their degree programs every eight years. The last program review for the Department of Chemistry was in 2006-2007. Internal committee members were selected jointly by Dr. David Francko, Dean of the Graduate School, and Dr. Robert Olin, Dean of the College of Arts and Sciences. The committee was tasked with reviewing the department's mission, goals (i.e., 5-year plans), curriculum, teaching/research/service mix, quality of department and its programs, distinguishing characteristics of the department and its programs, and institutional effectiveness (i.e., department outcomes and assessment). The committee also analyzed the strengths of the department and its degree programs, areas of opportunity for the department and its degree programs, and recommendations to improve the department and its degree programs (in ranked order, low or no-cost, mid cost, and high cost improvements). The information below (measures and results) comes directly from the report of the Internal Program Review Committee.

The review committee consisted of Dr. J.W. Harrell (Physics and Astronomy), committee chair, Dr. Ernie Mancini (Geological Sciences), and Dr. Robert Taylor (Mechanical Engineering). The external reviewer was Dr. Gary Schuster (Provost and Dept. of Chemistry and Biochemistry, Georgia Institute of Technology). The committee began the review process by meeting with Assoc. Dean John Schmitt (Graduate School), Assoc. Dean Joe Benson (A&S), and Prof. Joseph Thrasher (Chemistry dept. chair), where Dean Schmitt provided an overview of the review. Documents provided to the committee included program review forms completed by the department chair, student satisfaction survey results, the previous departmental review report, the departmental academic profile, the departmental annual report for 2005-06, a list of individual grant awards for 2002-03 through 2005-06, and the department's successful White Paper Graduate Enhancement Proposal from the late 1990s. Prof. Thrasher also provided the committee with a "State of the Department" PowerPoint type document and results of a 2006 Southeast Departmental Chairs Survey and a 2006 Council for Chemical Research (CCR) survey.

The committee met with Dr. Schuster, Dean David Francko (Graduate School), Dean Robert Olin (A&S), and Prof. Thrasher. It had numerous meetings with various clusters of chemistry faculty members. The meetings with interdisciplinary groups included faculty from other programs such as MINT, Biological Sciences, and Engineering. The committee also met with the chemistry staff and had separate meetings with graduate students and undergraduate students. All members of the committee contributed to writing the report and the report represents a consensus of the committee.

Finding(s) describing the extent to which the outcome is achieved
The report generated by the Internal Program Review Committee is extensive. Only those elements that are directly related to the current program outcome are presented: quality of program, strengths of degree program, areas of opportunities for the program, including recommendations to improve the degree program.

Quality of M.S. Degree Program:
The average GRE scores and GPA for entering graduate students has increased from 1067/3.0 in Fall 2003 to 1103/4.0 in Fall 2006, and the number of conditional admissions has decreased (2005-06 Annual Report). The annual admission success rate has been highly variable, ranging from 21-84% from 2003-07. The percent of incoming graduate students who are U.S. citizens and women is variable for the 2003-07 period. The department has an active recruiting strategy to increase the diversity of the graduate student population. Within the past 2 years, international students have entered the program from seven countries. Ethnic and gender diversity among graduate students, especially with domestic students, remains a challenge and a priority.

The number of graduate students enrolled is currently reduced compared to enrollment during the 2003-05 period. The faculty members attribute this reduction to the availability of GTAs. In Fall 2005, 31 (27%) students were supported by GTAs and 40 (48%) were supported by GRAs.

In 2005, the department offered 21 graduate-level courses—14 at the 500 level and 7 at the 600 level. This is down slightly from the two preceding years where the total was 24 in each year. In our interviews, the graduate students expressed the need for more upper-level graduate courses. This complaint continues from the previous, 1998, internal review.

Graduate chemistry majors have won college, university, national and international awards: attendance at the 2005 Nobel
Laureate Meeting, attendance at the 2005 ACS-DRF Summer Graduate School in Green Chemistry at McGill University (2). NASA Space Grant Fellowship, College of Arts and Sciences Outstanding Dissertation Award, Dean's Merit Assistantship, Alabama Power Fellowship (2), National Alumni Association Graduate Fellowship, Future Faculty Fellowship, Graduate Council Fellowships (3), and Graduate School Student Travel Awards (8). Most graduating students obtain postdoctoral positions, college/university faculty positions, and employment in industry. Interviews with graduate students were mixed. Concerns voiced included the need for more class offerings and improved teaching methods in certain courses, more access to faculty to discuss department matters, consistency in the duties of teaching assistants, and evaluation of the effectiveness of cumulative examinations. Overall the graduate program is strong but must be further strengthened to attain the status of a nationally renowned program. The Program Outcome improvement actions and measures indicated in this plan are derived from the findings and recommendations in the 8-year program review.

The Department is dedicated to the instruction, training, and intellectual growth of undergraduate students. This mission is accomplished through the use of several mechanisms including 1) classic and innovative classroom and laboratory instruction, 2) student advising, and 3) undergraduate research. The Department reaches out not only to chemistry, science, and engineering majors but also to other non-science majors in its mission. Undergraduate research is strongly encouraged and supported in the Department. There are two basic degree tracks in the Department: a bachelor of science in Chemistry including a Biochemistry track and a Pre-health Professional track leading to a Bachelor's of Science degree in Chemistry.

The Department offers opportunities for graduate study in a variety of exciting interdisciplinary programs as well as the traditional fields of analytical, inorganic, organic, physical, and biochemistry leading to the Master of Science and the Doctor of Philosophy degrees in chemistry. The Chemistry faculty offer the highest quality graduate education.

Service is an important function of the Department. Faculty and staff are bound by mutual respect and dedication to the field of chemistry and provide their expertise in science to serve the people of Alabama, the region, and the nation. The Department has strong outreach activities and has strong efforts in technology transfer.

Overall, the Department is truly the capstone of chemistry within the state of Alabama and beyond.

### Student Learning Outcomes, with Any Associations and Related Measures, Targets, Findings, and Action Plans

**SLO 1: Students will demonstrate and apply fundamental and intermediate-level chemistry knowledge**

Students will demonstrate and apply fundamental and intermediate-level chemistry knowledge in solving problems related to kinetic and thermodynamic principles, chemical reactivity and synthesis, reaction stoichiometry, molecular structure and bonding, and chemical analysis

**Connected Documents**

Methods for MS Chemistry Program  
MS Chemistry Curriculum Maps

**Relevant Associations:**

**Standard Associations**

SACS 3.3.1  
3.3.1.1 Educational programs, to include student learning outcomes

**General Education/Core Curriculum Associations**

8 Mathematics - SLO is related to the essential characteristics and basic processes of inquiry and analysis in the discipline, encourages the development of critical thinking and requires students to analyze, synthesize and evaluate knowledge

**Strategic Plan Associations**

University of Alabama  
1.1 Promote and enhance areas of academic, scholarship, and research excellence.

**Related Measures**

**M 1: American Chemical Society (ACS) Chemical Education Subject Examinations**

Upon entry into the program, students will take American Chemical Society (ACS) Chemical Education Subject Examinations in analytical, biochemistry, inorganic, organic, and physical chemistry to assess baseline fundamental knowledge of chemistry. Upon completion of the degree requirements, students will retake the (ACS) Chemical Education Subject Examination in their designated area of specialization to assess the learning of associated fundamental chemistry concepts since commencing their graduate education.

Source of Evidence: Academic direct measure of learning - other

**Connected Document**

Methods for MS Chemistry Program

**Target:**

Higher average % correct answers on ACS Subject Test Score in area of specialization upon degree completion than upon program entry.

**Finding (2011-2012) - Target: Not Reported This Cycle**
Only one student earned a Plan I (Thesis) MS Degree in Chemistry in 2011-2012. To ensure confidentiality of the student's academic performance record, no assessment data will be reported for 2011-2012.

Related Action Plans (by Established cycle, then alpha):
For full information, see the Details of Action Plans section of this report.

Obtain Data from Additional Degree Recipients
Established in Cycle: 2011-2012
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

M 2: Oral Thesis Defense
Upon completing the degree, students will be asked questions in an oral examination format before a faculty committee. Questions will probe fundamental and intermediate-level knowledge of kinetic and thermodynamic principles, chemical reactivity and synthesis, reaction stoichiometry, molecular structure and bonding, and chemical analysis, as appropriate. The faculty committee will assign a grade using a scoring rubric based upon the student's command of the concepts.

Source of Evidence: Academic direct measure of learning - other

Connected Document
Methods for MS Chemistry Program

Target:
Average score of >2.0 on related dimensions in Thesis MS Examination Assessment Form

Finding (2011-2012) - Target: Not Reported This Cycle
Only one student earned a Plan I (Thesis) MS Degree in Chemistry in 2011-2012. To ensure confidentiality of the student's academic performance record, no assessment data will be reported for 2011-2012.

Related Action Plans (by Established cycle, then alpha):
For full information, see the Details of Action Plans section of this report.

Obtain Data from Additional Degree Recipients
Established in Cycle: 2011-2012
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

SLO 2: Students will select and express chemical terminology appropriately
Students will select and express chemical terminology appropriately and convey (oral and written) chemistry results in accepted technical formats with adequate and appropriate referencing (e.g., American Chemical Society standards)

Connected Documents
Methods for MS Chemistry Program
MS Chemistry Curriculum Maps

Relevant Associations:
Standard Associations
SACS 3.3.1
3.3.1.1 Educational programs, to include student learning outcomes

General Education/Core Curriculum Associations
8 Mathematics - SLO is related to the essential characteristics and basic processes of inquiry and analysis in the discipline, encourages the development of critical thinking and requires students to analyze, synthesize and evaluate knowledge

Strategic Plan Associations
University of Alabama
1.1 Promote and enhance areas of academic, scholarship, and research excellence.

Related Measures

M 3: Research Seminar
Students convey experimental details and demonstrate their research productivity during their Departmental Research Seminar oral presentation. Faculty attendees evaluate the student's knowledge of the research project, including experimental details, using a detailed scoring rubric. Students will also prepare a written 10 page technical research summary. Faculty attendees will use a scoring rubric to grade the student in terms of appropriate use of terminology and quality and formatting of the written report.

Source of Evidence: Academic direct measure of learning - other

Connected Document
Methods for MS Chemistry Program

Target:
Average score of >3.2/4.0 or >1.6/2.0 on all related dimensions of the Research Seminar Assessment Form

Finding (2011-2012) - Target: Not Reported This Cycle
Only one student earned a Plan I (Thesis) MS Degree in Chemistry in 2011-2012. To ensure confidentiality of the student's academic performance record, no assessment data will be reported for 2011-2012.

Related Action Plans (by Established cycle, then alpha):
For full information, see the Details of Action Plans section of this report.

Obtain Data from Additional Degree Recipients
Established in Cycle: 2011-2012
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

M 4: Written Thesis
A faculty thesis committee evaluates the student’s written thesis with respect to grammar, organization and completeness, formatting, quality of illustrations, experimental detail/compound characterization, and appropriate citations.

Source of Evidence: Academic direct measure of learning - other

**Connected Document**
Methods for MS Chemistry Program

**Target:**
Average score of >2.0 on related dimension in Thesis MS Examination Assessment Form

**Finding (2011-2012) - Target: Not Reported This Cycle**
Only one student earned a Plan I (Thesis) MS Degree in Chemistry in 2011-2012. To ensure confidentiality of the student’s academic performance record, no assessment data will be reported for 2011-2012.

**Related Action Plans (by Established cycle, then alpha):**
For full information, see the Details of Action Plans section of this report.

**Obtain Data from Additional Degree Recipients**
Established in Cycle: 2011-2012
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

**SLO 3: Knowledge of Research Methods and Demonstration of Productivity**
Students will demonstrate general knowledge of research tools and methodologies and demonstrate research productivity related to chemical synthesis techniques, precise and accurate measurement, chemical analysis and characterization, and proper use of instrumentation.

**Connected Documents**
Methods for MS Chemistry Program
MS Chemistry Curriculum Maps

**Relevant Associations:**

**Standard Associations**
SACS 3.3.1
3.3.1.4 Research within its educational mission

**General Education/Core Curriculum Associations**
8 Mathematics - SLO is related to the essential characteristics and basic processes of inquiry and analysis in the discipline, encourages the development of critical thinking and requires students to analyze, synthesize and evaluate knowledge
9 Natural Science - SLO is related to a hands-on laboratory or field experience that emphasizes the scientific method and analysis of data

**Strategic Plan Associations**
University of Alabama
1.1 Promote and enhance areas of academic, scholarship, and research excellence.

**Related Measures**

**M 5: Oral Thesis Defense**
Students will have an oral thesis defense before a faculty committee. Students will be evaluated using a scoring rubric with respect to knowledge of chemistry concepts including common research tools and experimental methodologies. Students must demonstrate sufficient research productivity to be recommended for the M.S degree.

Source of Evidence: Senior thesis or culminating major project

**Connected Document**
Methods for MS Chemistry Program

**Target:**
Average score of >2.0 on related dimensions in Thesis MS Examination Assessment Form

**Finding (2011-2012) - Target: Not Reported This Cycle**
Only one student earned a Plan I (Thesis) MS Degree in Chemistry in 2011-2012. To ensure confidentiality of the student’s academic performance record, no assessment data will be reported for 2011-2012.

**Related Action Plans (by Established cycle, then alpha):**
For full information, see the Details of Action Plans section of this report.

**Obtain Data from Additional Degree Recipients**
Established in Cycle: 2011-2012
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

**M 6: Research Seminar**
Students will convey experimental details and demonstrate their research productivity during their Departmental Research Seminar oral presentation. Faculty attendees will evaluate the student's knowledge of the research project, including experimental details, using a detailed scoring rubric.

Source of Evidence: Presentation, either individual or group

**Connected Document**
Methods for MS Chemistry Program

**Target:**
Average score of >3.2/4.0 or >1.6/2.0 on all related dimensions of the Research Seminar Assessment Form

**Finding (2011-2012) - Target: Not Reported This Cycle**
Only one student earned a Plan I (Thesis) MS Degree in Chemistry in 2011-2012. To ensure confidentiality of
the student's academic performance record, no assessment data will be reported for 2011-2012.  

**Related Action Plans (by Established cycle, then alpha):**  
For full information, see the Details of Action Plans section of this report.

**Obtain Data from Additional Degree Recipients**  
*Established in Cycle: 2011-2012*

We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data de...

### Other Outcomes, with Any Associations and Related Measures, Targets, Findings, and Action Plans

**OthOtmc 4: Program Outcome: High Level of Recognized Quality**  
The program will improve and sustain a high level of recognized quality.

**Connected Documents**  
Methods for MS Chemistry Program  
MS Chemistry Curriculum Maps

**Related Measures**

**M 7: 8-year program review strengths**  
(8-year program review strengths)  
1. Quality graduate students. (As suggested by entering GRE scores, job placements, and research productivity).  
2. Competitive graduate stipends. (Near the average in the CCR survey and comparable to the best in the Southeast chairs survey

Source of Evidence: Academic direct measure of learning - other  

**Connected Document**  
Methods for MS Chemistry Program

**M 8: 8-year program review opportunities for improvement**  
(8-year program review opportunities for improvement)  
1. Increase the number of GTA positions to coincide with laboratory teaching needs.  
2. Improve the rapport between the faculty and graduate students.  
3. Increase graduate student enrollment.

Source of Evidence: Academic indirect indicator of learning - other  

**Connected Document**  
Methods for MS Chemistry Program

**M 9: measure addressing evaluation of improvement action, if any**  
(measure addressing evaluation of improvement action, if any)

In response to Improvement Action 1, the department enacted the following:

Reinvigorate the Graduate Student Organizations: The department currently hosts two student organizations with graduate student members. The Chemistry Graduate Students Organization (CGSO) is open to all graduate students in the department and is supervised by Dr. Stephen Woski. This group has become more active in recent years, particularly as a social organization for the department’s graduate students. The group holds tailgating parties during football season and other social events for the students throughout the year. The UA chapter of the National Organization of Black Chemists and Chemical Engineers (NOBCChE) is advised by Dr. Joseph Thrasher who helped found the UA chapter. This organization is open to all students in chemistry and chemical engineering, but primarily consists of chemistry graduate students. This group has hosted seminar speakers in the department and runs an “Adopt a Classroom” public service project. In this project, the NOBCChE chapter raises funds to purchase supplies for an area elementary school classroom each year. The department has also hosted a Student Chapter of the American Chemical Society chapter, which was historically focused on undergraduate students. Drs. Busenlehner and Frantom have worked with a group of graduate students to reinvigorate this chapter and involve both graduate and undergraduate students. This item is complete, although continued effort is required to keep the student organizations viable and active.

Explore adding graduate student representation to department committees: No action has yet been taken on this item. This item will be addressed as part of the overall discussion of department governance. Input will be sought from the graduate students through CGSO as to whether they wish to participate on departmental committees.

Establish a graduate student lounge: While the faculty is in favor of identifying space for graduate and/or undergraduate student lounges, space and money constraints have not yet allowed such a space to be identified in Shelby. The chair will hold discussions with the VP for Research, who manages Shelby Hall, and the Dean's Office about ways this could be implemented.

Continue to monitor and address graduate student concerns about the cumulative exams. The Department recently changed its cumulative exam policy to allow graduate students to pass exams in all areas of chemistry (analytical, inorganic, organic, physical, and biochemistry). This was done in part to address student concerns that exams in certain areas were often easier than exams in other areas, as well as to be mindful about how the field of chemistry has become increasing inter- and multidisciplinary. Thus, we feel that this concern has already been adequately addressed, but it will continue to be monitored by the Graduate Director. Progress: At the time of the Eight-Year review, the department had changed the cumulative exam requirement so that students could choose to take exams in all areas of chemistry. This was done in part to address concerns about the inequality in exam difficulty in different divisions as well as to meet the needs of students who may bridge multiple research areas. This change addressed
many of the student concerns. This past year, the faculty partially modified this policy so that students would have to pass at least two exams in their major area of study. This modification was enacted so that students would need to demonstrate cumulative knowledge in their major area of study. The Department will continue to monitor this requirement and reconsider as part of the overall graduate program review. This item is substantially complete, but we continue to monitor the most pedagogically effective and fair way to administer this requirement. The cumulative exam requirement will be reviewed with student input as part of the overall graduate curriculum review.

Address student concerns about inequality of domestic/international (no ITAP pass) TA duties. Progress: The Chair, Graduate Director, and Undergraduate Director (TA supervisor) continue to work to ensure equitable TA assignments for all students. It is recognized that non-lab TA assignments do involve less work, particularly since General Chemistry courses have gone exclusively to electronic grading. Efforts continue to address these inequalities. The department has enacted rules that reduce the TA stipend to a 75% stipend for international students who do not pass the ITAP exam within their first two years in the program. This was done to provide motivation for students to pass the exam and become eligible to serve as in lab TAs. This item is complete, but continued effort to ensure equitable workloads is required.

In response to Improvement Action 2, the department enacted the following:

Progress: Currently, the department has 32.4 hard TA lines, which include the "hardening" of the 5 soft TA lines mentioned in the original action plan. Chemistry will have 8 soft-money TAs in 2010-11 for a total of 40.4 TA lines, which is approaching the goal identified in the Eight-Year Review (27.4 + 5 + 12 = 44.4). The significant growth in TA lines has come about as the result of enrollment growth primarily in the 100-level courses. Thus, we have not been able to address issues with our TA workloads or the ability to improve student learning by holding graduate student-led recitations with these additional TAs. The Department appreciates the responsiveness of the Dean and Provost to provide resources to cover the increased enrollment in our service courses. We hope to continue to work with the administration to make these soft-money positions permanent as warranted by continued high enrollment. We also hope to work with the administration on strategies to more effectively teach our undergraduate students through increased use of graduate students in instruction. While this will require additional resources, we also feel that it will have a very beneficial effect on both undergraduate learning and retention, but also on the development of our graduate students. This item is ongoing, but is not complete. The department will continue to work with the administration to ensure that the necessary TA resources to effectively teach our large service courses are available.

As part of our next 5-year plan, we will be looking to develop strategies to significantly grow the graduate program through growth in TA, RA, and fellowship lines. Our goal will be a graduate student population of 120 by 2016 (from 79 currently), which is based on 4 students per faculty with a goal to grow the faculty to 30 by 2016 from our current 25. To achieve this goal, we would anticipate having 55 TA lines. With our current enrollment, the addition of 12 TA lines would allow us to reduce the GTA assignment to 2 labs/week with the addition of 2 recitations per week. Contact hours per week would decrease from 9 to 8. To achieve this goal incrementally, we could implement the GRA-led recitations in CH 101/102 first (8 TAs) and then eventually include CH 104/105 organic chemistry labs (4 additional TA). Of course, continued growth in enrollment will also require additional TAs to cover new lab sections. Assuming 55 TA lines, 65 GRA and fellowship lines would be required to meet our goal of 120. Currently, we have approximately 30 GRA lines, 8 students on fellowship, and 4 self-support. Thus to reach our goal, the number of RA lines would need to increase from 30 to 55, which would increase from our current average of 1.3 GRA/faculty to 1.8 GRA/faculty (assuming 30 faculty in 2016). Assuming that each external grant will support 1 GRA, meeting these goals would require on average that 0.5 additional grant be in force/faculty member annually. Chemistry faculty is committed to aggressively seeking funding to meet these goals. Our more aspirational goal would be to increase the GRA/GTA ratio from the current value of 0.8 to 1.5. Doing so with 50 TA lines would lead to a graduate population of approximately 135 assuming fellowship numbers remain constant. To achieve this goal, the Chemistry Chair will work to ensure all faculty are aggressively seeking external funding. In 09-10, an average 6.8 contract and grant submissions were made by chemistry faculty with a total value of $55 million ($2.3 million/faculty). New awards totaled $5.6 million in 09/10. Our goal will be to increase submissions to 8/faculty with a total value of $75 million and new awards of $7.5 million over the next 5 years.

Source of Evidence: Academic indirect indicator of learning - other

Connected Document
Methods for MS Chemistry Program

OthOtm 5: Program Outcome: Sustain Optimal Level of Enrollment
The program will build and sustain an optimal level of annual program enrollments and degree completion.

Connected Documents
Methods for MS Chemistry Program
MS Chemistry Curriculum Maps

Related Measures

M 10: Number of students in the MS program
Number of students in the MS program for the last three fall semesters [Target: 5-10 students]  
Source of Evidence: Academic indirect indicator of learning - other

Connected Document
Methods for MS Chemistry Program

M 11: Number of MS degrees
Number of MS degrees for last August+December+May commencements [Target: 4 degrees]  
Source of Evidence: Academic indirect indicator of learning - other

Connected Document
Methods for MS Chemistry Program

M 12: Relation of number of MS degrees awarded to ACHE viability standards
Relation of number of MS degrees awarded to ACHE viability standards [Target: average of 3.75 degrees per year over five years required to meet ACHE viability standards]
Source of Evidence: Academic indirect indicator of learning - other

**OthOtm 6: Program Outcome: Highly Valued by Graduates and Constituencies**
The program will be highly valued by its program graduates and other key constituencies it serves.

**Related Measures**

**M 13: Graduate student survey conducted by the Department of Chemistry**
Graduate student survey conducted by the Department of Chemistry
Source of Evidence: Academic indirect indicator of learning - other

**Connected Document**
Methods for MS Chemistry Program

**OthOtm 7: Department Outcome: Student Recruitment**
Recruitment of a sufficient number of high quality students into our graduate program with competitive representation by racial and gender minorities.

**Related Measures**

**M 15: Student: Faculty Ratio**
Total number of graduate students and postdoctoral researchers (target: 4 per research active faculty member=100)
Source of Evidence: Activity volume

**Connected Document**
Methods for MS Chemistry Program

**M 16: Minority Enrollment**
% Racial minority graduate students (target: national avg. % minority enrollment in chemistry graduate programs= 4.6% for programs with 41-105 graduate students as reported by 2008 ACS Committee on Professional Training Special Report)
Source of Evidence: Activity volume

**Connected Document**
Methods for MS Chemistry Program

**M 17: Female Enrollment**
% Female graduate students (target: national avg. %female enrollment in chemistry graduate programs = 26.1% for programs with 41-105 graduate students as reported by 2008 ACS Committee on Professional Training Special Report)
Source of Evidence: Activity volume

**Connected Document**
Methods for MS Chemistry Program

**M 18: Average GRE Scores**
New graduate student quality based upon avg. total GRE score (target: avg. GRE=1150)
Source of Evidence: Activity volume

**Connected Document**
Methods for MS Chemistry Program

**M 19: Subject Test Score**
New graduate student quality based upon ACS Subject Test score in Chemistry division of interest upon arrival in the program (target: avg. ACS placement exam score >50th percentile)
Source of Evidence: Academic indirect indicator of learning - other

**Connected Document**
Methods for MS Chemistry Program

**OthOtm 8: Department Outcome: Scholarly Publications**
Publication of scholarly research results and application for intellectual property rights

**Related Measures**

Change the minimum standard in Measure 2.1 to 1.5/non-first year graduate student and postdoctoral researcher to
more accurately reflect recent publishing activity.

**Related Measures**

**M 20: Peer-reviewed Publications**
Total number of peer-reviewed publications [target: 1.5 per non-first graduate student and postdoctoral researcher (66 non-first year graduate students and 16 postdocs as of Sept. 1, 2011 = 123 targeted publications)]
Source of Evidence: Activity volume

**Connected Document**
Methods for MS Chemistry Program

**M 21: Patent Applications**
Total number of patent applications submitted or awarded [target: no target]
Source of Evidence: Activity volume

**Connected Document**
Methods for MS Chemistry Program

**M 22: Target Revisions**
Assess whether the revised target for measure 2.1 is a more accurate reflection of recent Departmental publishing activity than the previous target of 1.0/non-first year graduate student and postdoctoral researcher
Source of Evidence: Document Analysis

**Connected Document**
Methods for MS Chemistry Program

**OthOtcn 9: Department Outcome: Outreach Programs**
Organization of, and participation in, outreach programs to enhance local and regional science education and training

**Connected Documents**
Methods for MS Chemistry Program
MS Chemistry Curriculum Maps

**Relevant Associations:**
Faculty will be strongly encouraged to conduct satisfaction surveys during outreach events in which surveys are tractable. Events including the NSF sponsored Research Experiences for Undergraduates program, the Alabama Instrumentation and Technology Colloquium, and area K-12 events are expected to implement surveys in 2011-2012.

**Related Measures**

**M 23: Event Number**
Total outreach events organized or participated in by faculty or graduate students [target: 10 activities]
Source of Evidence: Activity volume

**Connected Document**
Methods for MS Chemistry Program

**M 24: Informal Evaluation by Faculty, Graduate Students and Participants**
Informal evaluation by faculty, graduate students, and participants
Source of Evidence: Evaluations

**Connected Document**
Methods for MS Chemistry Program

**M 25: Surveys**
Percentage of outreach activities in which surveys or evaluations were administered [target: >33%]
Source of Evidence: Service Quality

**Connected Document**
Methods for MS Chemistry Program

**OthOtcn 10: Department Outcome: Professional Networking**
Establish network with chemists to enhance Departmental recognition and reputation and to disseminate research results at national and international venues

**Connected Documents**
Methods for MS Chemistry Program
MS Chemistry Curriculum Maps

**Related Measures**

**M 26: Faculty Presentations**
Total number of faculty research presentations at regional, national, and international conferences, universities, or with industry [target: 3 per research active faculty member = 75]
Source of Evidence: Activity volume

**Connected Document**
Methods for MS Chemistry Program

**M 27: Extramural Research Presentations**
Total number of student or postdoctoral associate extramural research presentations [target: two student/postdoctoral presentations per research active faculty member = 50]
Source of Evidence: Presentation, either individual or group

**Connected Document**
Methods for MS Chemistry Program
### Details of Action Plans for This Cycle (by Established cycle, then alpha)

**Obtain Data from Additional Degree Recipients**  
We are unable to draw conclusions regarding the effectiveness of the curriculum and associated program requirements from data derived from the performance of one Plan I (Thesis) MS graduate. Data from additional Chemistry Thesis MS degree earners must be acquired and analyzed before any program-level changes should be considered.

**Established in Cycle:** 2011-2012  
**Implementation Status:** In-Progress  
**Priority:** High

**Relationships (Measure | Outcome/Objective):**  
**Measure:** American Chemical Society (ACS) Chemical Education Subject Examinations | **Outcome/Objective:** Students will demonstrate and apply fundamental and intermediate-level chemistry knowledge  
**Measure:** Oral Thesis Defense | **Outcome/Objective:** Knowledge of Research Methods and Demonstration of Productivity  
| Students will demonstrate and apply fundamental and intermediate-level chemistry knowledge  
**Measure:** Research Seminar | **Outcome/Objective:** Knowledge of Research Methods and Demonstration of Productivity  
| Students will select and express chemical terminology appropriately  
**Measure:** Written Thesis | **Outcome/Objective:** Students will select and express chemical terminology appropriately

**Projected Completion Date:** 07/2013  
**Responsible Person/Group:** Department Assessment Coordinator/Chemistry Faculty
Curriculum Maps: Plan I M.S. (Thesis Option)

Curriculum Maps #I (In which courses or in what activities or assignments are Student Learning Outcomes Addressed?)

Use “Introduce” when outcome is first address; “Reinforce” when outcome is reinforced; and “Master” when outcome is expected to be mastered. Note that you do not need to obtain a measure from every course in which an outcome is addressed (see Map #2)

<table>
<thead>
<tr>
<th>Student Learning Outcome 1</th>
<th>Student Learning Outcome 2</th>
<th>Student Learning Outcome 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundamental and intermediate-level chemistry knowledge</td>
<td>Oral and written technical communication skills</td>
<td>Knowledge of research tools and methodologies and demonstration of research productivity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Required Task</th>
<th>Introduce</th>
<th>Master</th>
<th>Master</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Task</td>
<td>ACS Standardized (Entrance) Exams</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required Task</td>
<td>Departmental Research Seminar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required Task</td>
<td>Thesis Preparation/Defense</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Curriculum Map II (What assessment measures will be employed in which courses/activities/assignments for each Student learning Outcome?)

Student learning outcomes must be assessed at least once within a 2 ½ year period. Note that a measure does not need to be obtained from every course in which an outcome is covered (see Map #1).

<table>
<thead>
<tr>
<th>Required Task</th>
<th>Student Learning Outcome 1</th>
<th>Student Learning Outcome 2</th>
<th>Student Learning Outcome 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACS Standardized (Entrance) Exams</td>
<td>Fundamental and intermediate-level chemistry knowledge</td>
<td>Oral and written technical communication skills</td>
<td>Knowledge of research tools and methodologies and demonstration of research productivity</td>
</tr>
<tr>
<td>Required Task</td>
<td>ACS Chemical Education Subject Exams upon program entry (Fall 2013/Spring 2014)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required Task</td>
<td>Departmental Research Seminar</td>
<td>30 min oral presentation + written summary graded using a rubric (Fall 2013/Spring 2014)</td>
<td>Thesis research oral presentation graded using a rubric. (Fall 2013/Spring 2014)</td>
</tr>
<tr>
<td>Required Task</td>
<td>Thesis Preparation/Defense</td>
<td>written thesis graded using a rubric (Fall 2013/Spring 2014)</td>
<td>thesis defense graded using a rubric (Fall 2013/Spring 2014)</td>
</tr>
</tbody>
</table>

Optional Additional Narrative:
Program Name: non-Thesis (Plan II) Master's Degree

Program Outcomes (For both Plan I and Plan II Master’s Degrees)

Methods: The University of Alabama conducts a Program Review of departments and their degree programs every eight years. The last program review for the Department of Chemistry was in 2006-2007. Internal committee members were selected jointly by Dr. David Francko, Dean of the Graduate School, and Dr. Robert Olin, Dean of the College of Arts and Sciences. The committee was tasked with reviewing the department’s mission, goals (i.e., 5-year plans), curriculum, teaching/research/service mix, quality of department and its programs, distinguishing characteristics of the department and its programs, and institutional effectiveness (i.e., department outcomes and assessment). The committee also analyzed the strengths of the department and its degree programs, areas of opportunity for the department and its degree programs, and recommendations to improve the department and its degree programs (in ranked order, low or no-cost, mid cost, and high cost improvements). The information below (measures and results) comes directly from the report of the Internal Program Review Committee.

The review committee consisted of Dr. J.W. Harrell (Physics and Astronomy), committee chair, Dr. Ernie Mancini (Geological Sciences), and Dr. Robert Taylor (Mechanical Engineering). The external reviewer was Dr. Gary Schuster (Provost and Dept. of Chemistry and Biochemistry, Georgia Institute of Technology). The committee began the review process by meeting with Assoc. Dean John Schmitt (Graduate School), Assoc. Dean Joe Benson (A&S), and Prof. Joseph Thrasher (Chemistry dept. chair), where Dean Schmitt provided an overview of the review. Documents provided to the committee included program review forms completed by the department chair, student satisfaction survey results, the previous departmental review report, the departmental academic profile, the departmental annual report for 2005-06, a list of individual grant awards for 2002-03 through 2005-06, and the department’s successful White Paper Graduate Enhancement Proposal from the late 1990s. Prof. Thrasher also provided the committee with a “State of the Department” PowerPoint type document and results of a 2006 Southeast Departmental Chairs Survey and a 2006 Council for Chemical Research (CCR) survey.

The committee met with Dr. Schuster, Dean David Francko (Graduate School), Dean Robert Olin (A&S), and Prof. Thrasher. It had numerous meetings with various clusters of chemistry faculty members. The meetings with interdisciplinary groups included faculty from other programs such as MINT, Biological Sciences, and Engineering. The committee also met with the chemistry staff and had separate meetings with graduate students and undergraduate students. All members of the committee contributed to writing the report and the report represents a consensus of the committee.

Finding(s) describing the extent to which the outcome is achieved
The report generated by the Internal Program Review Committee is extensive. Only those elements that are directly related to the current program outcome are presented: quality of program, strengths of degree program, areas of opportunities for the program, including recommendations to improve the degree program.

**Quality of M.S. Degree Program:**
The average GRE scores and GPA for entering graduate students has increased from 1067/3.0 in Fall 2003 to 1103/4.0 in Fall 2006, and the number of conditional admissions has decreased (2005-06 Annual Report). The annual admission success rate has been highly variable, ranging from 21-64% from 2003-07. The percent of incoming graduate students who are U.S. citizens and women is variable for the 2003-07 period. The department has an active recruiting strategy to increase the diversity of the graduate student population. Within the past 2 years, international students have entered the program from seven countries. Ethnic and gender diversity among graduate students, especially with domestic students, remains a challenge and a priority.

The number of graduate students enrolled is currently reduced compared to enrollment during the 2003-05 period. The faculty members attribute this reduction to the availability of GTAs. In Fall 2005, 31 (27%) students were supported by GTAs and 40 (48%) were supported by GRAs.

In 2005, the department offered 21 graduate-level courses—14 at the 500 level and 7 at the 600 level. This is down slightly from the two preceding years where the total was 24 in each year. In our interviews, the graduate students expressed the need for more upper-level graduate courses. This complaint continues from the previous, 1998, internal review.

Graduate chemistry majors have won college, university, national and international awards: attendance at the 2005 Nobel Laureate Meeting, attendance at the 2005 ACS-DRF Summer Graduate School in Green Chemistry at McGill University (2), NASA Space Grant Fellowship, College of Arts and Sciences Outstanding Dissertation Award, Dean’s Merit Assistantship, Alabama Power Fellowship (2), National Alumni Association Graduate Fellowship, Future Faculty Fellowship, Graduate Council Fellowships (3), and Graduate School Student Travel Awards (8). Most graduating students obtain postdoctoral positions, college/university faculty positions, and employment in industry.

Interviews with graduate students were mixed. Concerns voiced included the need for more class offerings and improved teaching methods in certain courses, more access to faculty to discuss department matters, consistency in the duties of teaching assistants, and evaluation of the effectiveness of cumulative examinations. Overall the graduate program is strong but must be further strengthened to attain the status of a nationally renowned program.

The Program Outcome improvement actions and measures indicated in this plan are derived from the findings and recommendations in the 8-year program review.
Curriculum Maps #1  (In which courses or in what activities or assignments are Student Learning Outcomes Addressed)

Use “Introduce” when outcome is first address; “Reinforce” when outcome is reinforced; and “Master” when outcome is expected to be mastered. Note that you do not need to obtain a measure from every course in which an outcome is addressed (see Map #2)

<table>
<thead>
<tr>
<th></th>
<th>Student Learning Outcome 1</th>
<th>Student Learning Outcome 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fundamental and intermediate-level chemistry knowledge</td>
<td>Oral and written technical communication skills</td>
</tr>
<tr>
<td>ACS Standardized (Entrance) Exams</td>
<td>Introduce</td>
<td></td>
</tr>
<tr>
<td>Departmental Literature Seminar</td>
<td></td>
<td>Introduce</td>
</tr>
<tr>
<td>ACS Standardized (Exit) Exams</td>
<td>Master</td>
<td></td>
</tr>
<tr>
<td>Oral Exit Exam/Written Research Synopsis</td>
<td>Reinforce</td>
<td>Reinforce</td>
</tr>
</tbody>
</table>

Curriculum Map II  (What assessment measures will be employed in which courses/activities/assignments for each Student learning Outcome)

Indicate which measure is being obtained in which course by typing “Measure n.n” in the appropriate cell. If you’d rather use a description of the measure, that is fine. Also, indicate the year/semester in which the measure will be obtained (e.g., Fall 2011). Student learning outcomes must be assessed at least once within a 2½ year period. Note that a measure does not need to be obtained from every course in which an outcome is covered (see Map #1).

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<tr>
<td>ACS Standardized (Entrance) Exams</td>
<td>ACS Chemical Education Subject Exams upon program entry (Fall 2011/Spring 2012)</td>
<td></td>
</tr>
<tr>
<td>Departmental Literature Seminar</td>
<td>30 min oral presentation + written summary graded using rubric (Fall 2011/Spring 2012)</td>
<td></td>
</tr>
<tr>
<td>ACS Standardized (Exit) Exams</td>
<td>ACS Chemical Education Subject Exam in designated area of specialization upon program exit (Fall 2011/Spring 2012)</td>
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<td>-------------------------------</td>
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<tr>
<td>Oral Exit Exam/Written Research Synopsis</td>
<td>oral exit exam (short defense) (Fall 2011/Spring 2012)</td>
<td>written research summary and oral exit exam graded using rubric (Fall 2011/Spring 2012)</td>
</tr>
</tbody>
</table>