

## 2012-13 Program Review

Name of Program: Chemistry  
Name of Unit: Math & Sciences  
Name of Area: Academic Affairs  
Date Completed: 2/9/2012

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### Program's Mission Statement

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The Chemistry Department at Rio Hondo College provides a challenging academic experience for students with diverse backgrounds and educational goals. The Department supports enrollment in other programs at the College, particularly the Biological Sciences and Nursing, through its offering of Chemistry 110, a key prerequisite course. The program provides a safe and engaging laboratory experience for students to learn the fundamentals of the subject through quality instruction using modern techniques and equipment. Common themes are addressed in all courses, including the relevance of chemistry to everyday life; its connections with the life sciences and human health; the use of the scientific method to solve problems; and the ability to communicate technical data and results.

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### Program's Overarching Outcomes - SLOs / SAOs

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Student learning outcomes are associated with each course in the program. These SLOs are typically assessed on an annual basis for the introductory courses (i.e. Chemistry 110 and 120), and each time the more advanced courses are taught. At this time the Chemistry program does not offer a degree, so there is no need for degree outcomes. While SLOs have been informative in our courses, particularly in assessing and improving students' abilities to accurately measure and report quantities, no additional requests for resources can be directly based on these assessment results.

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### Program's Characteristics, Performance and Trends

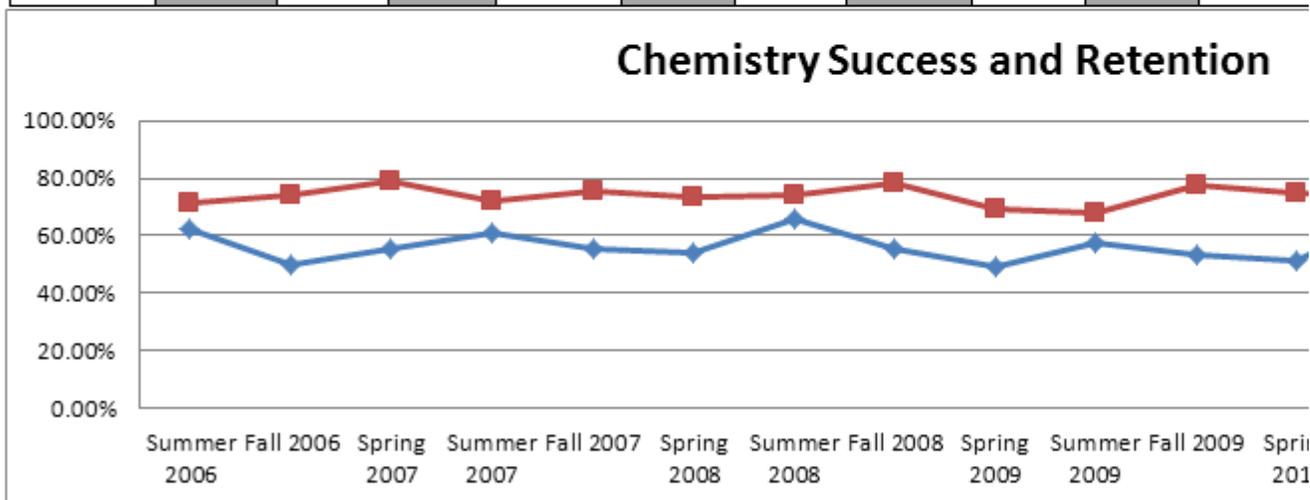
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\*\*Updated Data for: 2012-2013 Program Year\*\*

Chemistry Enrollment By Course									
	Summer 2006	Fall 2006	Spring 2007	Summer 2007	Fall 2007	Spring 2008	Summer 2008	Fall 2008	Spring 2009
CHEM101	21	33	42	22	56	40		19	
CHEM101L	16	16	20	12	21			13	
CHEM110	27	120	113	30	124	125	43	131	132
CHEM120	23	65	73	23	80	71	27	72	86
CHEM130		40	44		52	42		43	50
CHEM131		13	21		24	26		27	22
CHEM131L		12	17		18	22		23	17
CHEM230		15			15			9	
CHEM231			13			21			
CHEM299	1								
Total	88	314	343	87	390	347	70	337	307

Chemistry Success										
	Summer 2006	Fall 2006	Spring 2007	Summer 2007	Fall 2007	Spring 2008	Summer 2008	Fall 2008	Spring 2009	Summer 2009
Success	62.50%	50.00%	55.39%	60.92%	55.64%	53.89%	65.71%	55.19%	49.19%	57.65%

Chemistry Retention										
	Summer 2006	Fall 2006	Spring 2007	Summer 2007	Fall 2007	Spring 2008	Summer 2008	Fall 2008	Spring 2009	Summer 2009
Retention	71.59%	74.20%	79.01%	72.41%	75.38%	73.78%	74.29%	78.04%	69.06%	68.24%



Chemistry Grade Distribution															
Grade	Summer 2006	Fall 2006	Spring 2007	Summer 2007	Fall 2007	Spring 2008	Summer 2008	Fall 2008	Spring 2009	Summer 2009	Fall 2009	Spring 2010	Summer 2010	Fall 2010	Spring 2011
A	18	46	64	19	64	42	19	60	46	17	48	52	13	64	71
B	20	63	58	18	76	71	10	64	51	17	75	53	18	72	74
C	17	48	67	16	77	72	17	58	53	13	69	66	9	87	61
CR			1			2		4	1	2					
D	6	37	24	5	27	32	5	40	30	5	48	35	1	23	16
F	2	39	55	5	50	36	1	34	28	4	32	44	2	28	23
IP															1
NC			2			1		3	3						
NP											5	1		1	1
P												2	1	2	2
W	25	81	72	24	96	91	18	74	95	27	81	85	16	82	83
<b>Grand Total</b>	<b>88</b>	<b>314</b>	<b>343</b>	<b>87</b>	<b>390</b>	<b>347</b>	<b>70</b>	<b>337</b>	<b>307</b>	<b>88</b>	<b>358</b>	<b>340</b>	<b>60</b>	<b>359</b>	<b>332</b>

Chemistry % Grade of Distribution															
Grade	Summer 2006	Fall 2006	Spring 2007	Summer 2007	Fall 2007	Spring 2008	Summer 2008	Fall 2008	Spring 2009	Summer 2009	Fall 2009	Spring 2010	Summer 2010	Fall 2010	Spring 2011
A	20.45%	14.65%	18.66%	21.84%	16.41%	12.10%	27.14%	17.80%	14.98%	20.00%	13.41%	15.29%	21.67%	17.83%	21.39%
B	22.73%	20.06%	16.91%	20.69%	19.49%	20.46%	14.29%	18.99%	16.61%	20.00%	20.95%	15.59%	30.00%	20.06%	22.29%
C	19.32%	15.29%	19.53%	18.39%	19.74%	20.75%	24.29%	17.21%	17.26%	15.29%	19.27%	20.00%	15.00%	24.23%	18.37%
CR	0.00%	0.00%	0.29%	0.00%	0.00%	0.58%	0.00%	1.19%	0.33%	2.35%	0.00%	0.00%	0.00%	0.00%	0.00%
D	6.82%	11.78%	7.00%	5.75%	6.92%	9.22%	7.14%	11.87%	9.77%	5.88%	13.41%	10.29%	1.67%	6.41%	4.82%
F	2.27%	12.42%	16.03%	5.75%	12.82%	10.37%	1.43%	10.09%	9.12%	4.71%	8.94%	12.94%	3.33%	7.80%	6.93%
IP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.30%
NC	0.00%	0.00%	0.58%	0.00%	0.00%	0.29%	0.00%	0.89%	0.98%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
NP	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	1.40%	0.29%	0.00%	0.28%	0.30%
P	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.59%	1.67%	0.56%	0.60%
W	28.41%	25.80%	20.99%	27.59%	24.62%	26.22%	25.71%	21.96%	30.94%	31.76%	22.63%	25.00%	26.67%	22.84%	25.00%
<b>Grand Total</b>	<b>100.00%</b>														

Chemistry														
FTES														
Summer 2006	Fall 2006	Spring 2007	Summer 2007	Fall 2007	Spring 2008	Summer 2008	Fall 2008	Spring 2009	Summer 2009	Fall 2009	Spring 2010	Summer 2010	Fall 2010	Spring 2011
16.60	81.85	91.03	15.54	102.47	105.24	16.06	100.73	99.01	21.62	114.02	92.15	15.01	95.00	95.00

Source: CCCC Data Mart (by TOP Code)

Chemistry Section Delivery								
Time Taught	Winter 2010	Spring 2010	Summer 2010	Fall 2010	Winter 2011	Spring 2011	Summer 2011	Fall 2011
Day	0	12	2	11	0	12	2	11
Evening	0	3	0	3	0	2	0	3
Weekend	0	0	0	0	0	0	0	0
Online	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0

Chemistry										
Success by Course										
Course	Summer 2006	Fall 2006	Spring 2007	Summer 2007	Fall 2007	Spring 2008	Summer 2008	Fall 2008	Spring 2009	Summer 2009
CHEM101	61.90%	33.33%	45.24%	63.64%	48.21%	50.00%		68.42%		
CHEM101L	62.50%	62.50%	75.00%	58.33%	66.67%			84.62%		
CHEM110	62.96%	55.83%	54.87%	60.00%	54.03%	49.60%	69.77%	47.66%	42.64%	56.67%
CHEM120	60.87%	41.54%	59.72%	60.87%	55.00%	49.30%	59.26%	58.33%	54.65%	60.00%
CHEM130		50.00%	38.64%		46.15%	56.10%		32.56%	54.00%	
CHEM131		38.46%	45.00%		58.33%	57.69%		62.96%	40.91%	
CHEM131L		66.67%	76.47%		77.78%	77.27%		91.30%	76.47%	
CHEM230		60.00%			86.67%			77.78%		
CHEM231			92.31%			71.43%				
CHEM299	100.00%									

Enrollment in the Program's introductory courses (Chemistry 110 and 120) is stable, with all courses essentially full at the time of the census date. The data shown above is not accurate, and effectively overcounts the number of students enrolled in each course due to the fact that students enroll in multiple sections (i.e. lecture, lab, and discussion) for a given course. Enrollment in Chemistry 101 and 101L experienced a sharp decline in recent semesters; in response, neither of these classes were offered in Spring 2009, and an additional section of Chemistry 110 was offered in their place.

Enrollment in the Program's higher-level courses (131, 131L, 230, and 231) has been inconsistent from semester to semester. Student success in the preceding course-Chemistry 130-varies considerably between terms, propagating this instability. Enrollment in Chemistry 231 in Spring 2009 was so low as to justify the cancellation of the course. Goal #1 attempts to address this concern.

While student success in the Chemistry program is low relative to the College as whole, this trend is hardly uncommon in higher education and can be attributed to the exceptionally demanding nature of the subject matter relative to that encountered in most other academic disciplines.

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## Program's Strengths

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The faculty and staff of the Chemistry Program are all exceptionally knowledgeable in their area of expertise and share a strong commitment to student success. Anecdotal evidence shows that a disproportionately large number of students in our program transfer to the campuses of the University of California, and many have stated that they believed they were

better prepared for advanced chemistry coursework than other students they met. Each Spring, students in Chemistry 231 are evaluated using the American Chemical Society's Final Examination in Organic Chemistry. Student achievement on this exam is extraordinarily high, with the average Rio Hondo student regularly placing between the 65th and 70th percentile relative to other students nationwide. In addition, a disproportionate number of students have placed at or above the 90th percentile.

Starting with the 2009-10 Academic Year, Rio Hondo College started the Math/Engineering/Science Achievement (MESA) Program. The MESA Program is a program that is partially state-funded and aims to help low income and educationally disadvantaged students who are interested in the Science, Technology, Engineering, and Math (STEM) areas of study by providing academic support in the form of a dedicated area to study and additional tutoring assistance. Since the programs inception and through the leadership of the Rio Hondo MESA Director, Dr. Gisela Spieler-Persad, the number of STEM majors on campus has begun to grow. Along with the growth, we have begun to see small incremental increases in retention and success of MESA students' who are taking chemistry courses. We feel this will continue to increase as the MESA program continues to attract and support more students in their pursuit of STEM fields.

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### Program's Weaknesses

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The only concern of the program is that a lack of proper chemical instrumentation will hinder chemistry students from being properly exposed and trained in modern chemical analysis techniques. One of the cornerstones of a proper chemistry education is to be able perform various types of chemical analysis. Some of these types of analysis require analytical instrumentation such as gas chromatographs, infrared and visible/ultraviolet spectrophotometers, and nuclear magnetic resonance machine which are expensive (from \$10,000 to \$60,000 each). The lack of modern instrumentation experience by our students leads to less chemical experience before they transfer.

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### Program's Opportunities

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The greatest opportunity available to this program is the development of the MESA program at Rio Hondo College. The program provides resources (for example: peer-led study sessions, STEM course counseling) to STEM students in a dedicated area only for STEM students. The MESA program provides a great window of opportunity to attract, maintain interest, and shepherd low income and educationally disadvantaged students through rigorous lower-division coursework so that they will be successful upon transferring to a four-year institution that invariably will help them to achieve their undergraduate education goals. The program will also likely facilitate completion of Program Goal #1, as the program will likely collect much of the information which the Chemistry Department may need.

The department also stands to benefit from the current unfavorable economic climate. Evidence during previous economic downturns has shown that enrollment tends to climb in a poor economy as more unemployed workers return to school for additional or new training.

This provides an excellent opportunity for the Chemistry Department to attract students as more unemployed workers in low employment areas seek to be retrained in future high-employment fields such as health-related fields (such as physicians, nurses, pharmacists, etc.) and those that require technology training (such as environmental/green technologies and nanotechnology).

The Chemistry program also has the chance to lessen the impact on the environment. Green chemistry principles and guidelines were designed to assist in developing labs that use smaller amounts and less hazardous chemicals. The eventual conversion of the current chemistry laboratory curriculum to green(er) chemistry labs will not only lessen the environmental impact of chemical disposal but will also save the College dollars in less waste that needs to be disposed off at the end of each semester.

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### Program's Threats

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There are several obstacles that may hinder the further growth of the Chemistry Department. One such issue is the cost to purchase chemicals and laboratory equipment/instrumentation. First, as chemical prices are commonly tied to the costs of such commodities as crude oil and precious metals, these fluctuations in price make it difficult to adequately project the program's future financial needs. For example, in the past two years the cost of hydrochloric acid has risen by 16.8%, acetone has risen by 49.8%, and platinum wire has risen by 230%. All of these chemicals are essential for the successful operation of our teaching laboratories. This does not account for the shipping costs of these heavy and hazardous items. As for glassware replacement, the department is exploring legally acceptable mechanisms that will make funding replacement glassware a shared cost between the College and the students. We feel that students who know that they will be assessed a portion of the cost of the glassware they break will handle glassware more safely and with greater care and thus promoting greater laboratory safety.

The lack of instrumentation with the increase in enrollment has lead to instructional difficulties. Chemistry laboratories, besides using glassware, rely on electronic milligram balances (used for weighing out to milligram precision) and analytical instruments such as infrared and ultraviolet/visible spectrophotometers and nuclear magnetic resonance machines for chemical analysis. The department has been using, for the lower-level laboratories which have the largest enrollment per laboratory section, balances (totaling 15) that are between fifteen- and thirty-years old. These balances have begun to break down. Milligram balances are expensive to replace (approximately \$800 to replace each balance) and the Division of Math and Sciences and the College do not have the funds to replace all of the balances all at once or even a few at a time. The lack of balances will therefore increase the amount of time students have to wait to weigh their samples instead of allocating time to performing the actual experiment. In the higher-level laboratories taken by STEM majors (students enrolled in the MESA program and those who are not eligible for MESA), current and complete hands-on laboratory education needed by the students has not been provided due to the lack of modern analytical instrumentation. These instruments (ranging in cost from \$10,000 to \$60,000 each) are crucial because they give students experience in spectroscopic analysis needed at Rio Hondo and the upper-division laboratory coursework the students will enroll in upon transferring to a four-year institution. Just as in the case of the balances, the Division of Math

and Sciences and the College do not have the funds to purchase these instruments, let alone one of them. This may require a concerted effort among the different Science Departments to write grants to outside agencies to fund these purchases.

Another impediment to increasing the quality of the chemistry program is the lack of state funding for additional lecture and laboratory sections, a dedicated room to place instrumentation, and the need for more space for the chemistry stockroom and its growing space needs. The College has seen an increase in enrollment in all areas but due to the dire state budget situation, there are no funds from the state or anywhere to increase the number of sections to accommodate these students even though the Department does have laboratory rooms available during certain scheduled time blocks. Before the renovation of the Science Building, there were four rooms dedicated to chemistry laboratories but one of the rooms, S330, was taken away during the renovation. If S330 was still available, it could be used as an additional lab or even better, an instrumentation room that will alleviate crowding around the existing laboratory instruments. Additionally, the chemistry stockroom also had space taken away (the room that is now S326) during the remodel. The stockroom does not have room to properly and securely place the current equipment and setups for the labs that are prepared each week. This lack of space in the stockroom can lead to accidents which the faculty and College want to prevent.

Recently, though, the Chemistry Department was subject to an inspection by the Los Angeles County Fire Department Hazardous Materials Specialist. The Chemistry Stockroom was found to be in violation of codes for chemical storage and disposal. The chemistry faculty and the Dean of the Division of Math and Sciences have since been diligently and purposefully working on remedying the conditions. The fixes required by the safety codes have required relocating and disposing of many chemicals but the lack of proper storage cabinets in the stockroom has not allowed the relocation of all of the chemicals. The College has been very generous in purchasing the necessary storage containers and getting rid of chemical wastes required by the Hazardous Materials Specialist but there still exist problems due to space limitations. In one case, highly corrosive acids and bases are currently being stored in the same small room as the natural gas water heater that heats water in the stockroom. There is absolutely no place to move these acids and bases away from the water heater. The threat (which in this instance is the correct usage of the word) to the Chemistry Department and the College is that when (not if) the Fire Marshall returns to re-inspect the stockroom, he/she may notice additional violations or deems the implemented fixes are insufficient which may lead to fines. Possible solutions to these problems are under discussion between the Division of Math and Sciences and the Facilities Department.

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## Program's Accomplishments and Recommendations for Improvement

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The chemistry program takes pride in the success of the students it has prepared for transfer to numerous prestigious four-year institutions and professional programs, including the campuses of the University of California, California State University, the University of Southern California, and many others. The program completely fulfills its intended mission and is introspective in its attempts to constantly improve student learning. Analysis of data

collected on program student learning outcomes will be conducted in order to further improve this outstanding program.

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## Program's Strategic Direction

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Strategic Direction 1: Over the next 3-5 years, Chemistry will review all current safety-related protocols and procedures and implement improvements as necessary to ensure the well-being of all program constituents.

Strategic Direction 2: Over the next 3-5 years, Chemistry will evaluate its non-consumable equipment and instrumentation needs for the foreseeable future and attempt to secure external funding to purchase any necessary items.

Strategic Direction 3: Over the next 3-5 years, Chemistry will evaluate its space usage and efficiency, and attempt to expand its footprint to regain space lost in the retrofit of the Science building.

### Cost Savings

The Chemistry program is currently experiencing greater financial challenges than it has at any previous time in its history. In the wake of numerous terrorist attacks and conflicts, the cost of chemicals has increased dramatically. Federal and state regulations have made it more difficult to obtain some materials and concomitantly increased shipping, storage, and disposal costs for these items. Enrollment in all courses is at a peak, adding further strain to the Program and the Division as a whole. To keep costs down, the Chemistry program is pursuing a two-prong approach: (1) develop and implement "small-scale" and "mini-scale" experiments which require reduced amounts of chemicals, and (2) replace certain chemicals with less-expensive alternatives where it is possible to do so.

Although the first strategy appears to be an obvious solution on its face, its implementation is often stymied by the sales practices of chemical suppliers and the small size of our department relative to their other customers. For example, we recently attempted to secure 50 grams of a chemical needed for a particular experiment. The chemical is sold in bottles containing 10 grams at \$30 per unit, and in bottles containing 500 grams at \$110 per unit. While "more is better" may be the case for most consumer goods, this is not true for chemicals, which have a limited shelf-life, require specialized storage in scarce space, and often cost more to dispose of than to purchase. As a result we were forced to buy smaller amounts of the chemical at a greater cost.

The second strategy can only be applied in limited situations. For example, we have recently replaced the usage of prohibitively-expensive platinum wire with a nickel-cadmium alloy for chemical flame tests in our introductory laboratory courses. Although the colors of the flames produced by ions heated on the alloy are not as easily identified as with those on platinum, it has proved to be an adequate solution. In another course, we replaced the use of the solvent decane with significantly cheaper hexane. Unfortunately, hexane is also more volatile than decane and its usage is limited to a few chemical fume hoods for this particular experiment.

Consequently, fewer students can carry out these experiments at a given time.

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## Program's Staff Development

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The faculty and staff require additional training in current chemical safety, security, and storage procedures to complete the objectives stated in this document. Activities designed to improve the instructional delivery of adjunct faculty in this area would be helpful in increasing student success.

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## Program Review - Additional Comments

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## Program Review - Executive Summary

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### PROGRAM REVIEW EXECUTIVE SUMMARY

Program: Chemistry  
Date: November 7, 2011

Committee Members Present: Connie Austin, Jim Chandler, Marie Eckstrom, Howard Kummerman, Jim Sass

Program Members Present: Karen Koos, Matt Koutroulis

#### Commendations

- Commendations on the consistent utilization of the American Chemical Society's final examination, and the consistently high level of achievement of students on that exam (65 to 70 percentile; at least one standard deviation above mean).
- Commendations on the successful and meaningful collaboration with the MESA program.
- Commendations on stable enrollment and student performance for several years.
- Commendations on incorporating critical thinking through critical reading and writing into chemistry courses.
- Commendations on the Chemistry Program's efforts to lessen the impact on the environment by implementing green chemistry principles.

### Program-Level Recommendations

- Purchase necessary chemicals and hardware.
- Work with Transfer Center to help chemistry majors to secure financial assistance to both public and private four-year institutions.
- Consider requiring students to purchase their own lab kits.
- Consider writing a degree in chemistry.

### Institutional-Level Recommendations

- Provide sufficient funds for Chemistry Department to purchase necessary chemicals and hardware (specialty cabinets, test tubes, etc).
- Ensure safety of chemicals and equipment.
- Work with Grant Director to secure additional funds.
- The College should initiate a teaching academy to improve the skills of both adjunct and full-time instructors.

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## Program Review - Response to the Executive Summary

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The Chemistry Department and the Dean of Mathematics and Sciences agree with the committee's recommendations and will implement them as soon possible.

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Goal #1	Long term (2-5 years)	Corresponds with Institutional	Status: in
Goal # 1			progress

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### Description of Goal

To document the goals and progress of all students enrolling in courses in the Chemistry Department (except for those students in Chemistry 110). This information will be used to project enrollment demand for higher-level courses (Chemistry 131, 131L, 230, and 231) and potentially improve program retention, as well as to develop a better understanding of the needs of our students.

### Evaluation of Goal

Long term analysis of enrollment trends will be employed to determine whether or not

significant growth has occurred.

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### Objective #1.1

Status: in progress

Construction of a survey instrument and a database to house information obtained.

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### Existing Resources

The faculty have the necessary expertise to execute this objective. Computing equipment is already available. In addition, the Department intends to use data collected by the MESA program as part of its study.

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Goal #2 Long term (2-5 years) Corresponds with Institutional  
Goal # 1

Status: in  
progress

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### Description of Goal

To conduct a thorough review of safety-related practices in the chemistry department.

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### Evaluation of Goal

Final review by faculty, staff, and safety consultants document a satisfactory evaluation on the safety of program laboratories.

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### Objective #2.1

Status: in progress

Prepare an inventory of all chemicals (excluding prepared solutions) currently housed in the chemistry stockroom.

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### Existing Resources

Faculty possess expertise and have access to software (i.e. Microsoft Access) needed to implement this objective. It is possible that additional hourly funding for current faculty and classified staff may be required.

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**Objective #2.2**

Status: in progress

Identify and correct potential safety hazards present in the chemical stockroom and laboratory classrooms.

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**Existing Resources**

Faculty and staff have expertise to identify most potential safety hazards. Some safety equipment, including specialized storage cabinets, are already present, but may require reorganization.

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**Resources Needed: Additional Budget****Requested Item:** Chemical Storage Cabinets**Required for How Long:** 1 time**Requested Amount:** \$2,500.00**Description:**

Storage cabinets for chemicals.

**Supporting Rationale**

Safe storage of all chemical substances is mandated by law. This need is contingent on findings of our safety review which may or may not indicate that some substances are being stored improperly as well as whether or not current storage space is adequate.

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## Appendix A

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## Appendix B

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## Individuals Who Participated in Developing this Plan

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The following people acknowledge that they participated in the development of or reviewed this plan.

<b>Name</b>	<b>Role</b>
1. Leung, Allen	Review Manager
2. Koutroulis, Matt	Participant
3. Koos, Karen	Participant