WICHITA STATE UNIVERSITY

Program Review Self-Study Template

Academic unit: Chemistry

College: LAS

Date of last review 2007

Date of last accreditation report (if relevant) 2009 (review, not accreditation)

List all degrees described in this report (add lines as necessary)

Degree: BS Chemistry CIP* code: 40.0501

Degree: MS Chemistry CIP code: 40.0501

Degree: PhD Chemistry CIP code: 40.0501

*To look up, go to: Classification of Instructional Programs Website, http://nces.ed.gov/ipeds/cipcode/Default.aspx?y=55

Faculty of the academic unit (add lines as necessary)

Name	Signature
James G. Bann (Associate Professor)	
Moriah R. Beck (Assistant Professor)	
Dennis H. Burns (Professor)	
David M. Eichhorn (Professor and Chair)	
Douglas S. English (Associate Professor)	
William C. Groutas (Professor)	
D. Paul Rillema (Professor)	
Erach R. Talaty (Professor)	
Kandatege Wimalasena (Professor)	

Submitted by: _____ Date _____

(name and title)

1. Departmental purpose and relationship to the University mission (refer to instructions in the WSU Program Review document for more information on completing this section).

a. University Mission:

Wichita State University is committed to providing comprehensive educational opportunities in an urban setting. Through teaching, scholarship and public service the University seeks to equip both students and the larger community with the educational and cultural tools they need to thrive in a complex world, and to achieve both individual responsibility in their own lives and effective citizenship in the local, national and global community.

b. Program Mission (if more than one program, list each mission):

The mission of the undergraduate program in Chemistry is to provide students with a broad understanding of all disciplines in chemistry, to train them in the specific skills required for chemical research and to prepare them for careers in the chemical or chemistry-related industry, for advanced study in chemistry, or for pursuit of professional degrees.

The mission of the Masters of Science program in Chemistry is to provide students with advanced understanding of chemistry, to develop their technical research and analytical skills, and to prepare them for careers in the chemical or chemistry related industry, for teaching careers in chemistry, and for further study in chemistry at the doctoral level.

The mission of the PhD program in Chemistry is to provide students with an in-depth expertise in a specific area of chemistry, to develop the ability to conceive of and carry out an independent research program, and to prepare students for senior-level careers in industry or academic careers at research institutions.

c. The role of the program (s) and relationship to the University mission: Explain in 1-2 concise paragraphs.

The Baccalaureate degree programs in the Department of Chemistry are designed to provide students with a solid background in all areas of chemistry, including organic, analytical, inorganic, physical, and biochemistry. Through traditional coursework, extensive laboratory experience, and independent study research projects, students are provided with the conceptual knowledge base, introduced to the principles of the scientific method, and given the opportunity to apply these while developing critical thinking and problem solving skills. An undergraduate degree in chemistry will prepare the student for immediate employment in industry, government, or primary or secondary education; careers in chemical-oriented business or law; or graduate study in chemistry, biochemistry, or medical professional schools (including medicine, dentistry, optometry, veterinary).

The Masters of Science program in Chemistry is a strong research-based program designed to provide students with advanced instruction in a variety of chemical disciplines, develop students' technical expertise with chemical instrumentation, and further engage them in state-of-the-art original research. Through a core curriculum of advanced courses and a faculty-mentored research project culminating in a thesis, students are prepared for positions in the chemical and pharmaceutical industry, teaching at the high-school and junior college level, and further study at the doctoral level in chemistry or biochemistry.

The PhD program in Chemistry is designed to provide students with advanced instruction over a broad range of chemical disciplines as well as in-depth instruction in a specific area. The expectation is that the student will become an expert in a specific field of study and will develop the skills required to be an independent researcher, including genesis and

development of an idea, formulation of a research strategy, collection and analysis of data, drawing appropriate conclusions, and presentation of results. The degree culminates in the writing and defense of a dissertation based on an original research project. Recipients of the PhD are prepared for employment in senior positions in industry and government, teaching at four-year colleges, and postdoctoral positions leading ultimately to teaching positions at research universities.

d. Has the mission of the Program (s) changed since last review? ☐ Yes ☒ No
   i. If yes, describe in 1-2 concise paragraphs. If no, is there a need to change?

e. Provide an overall description of your program (s) including a list of the measurable goals and objectives of the program (s) (both programmatic and learner centered). Have they changed since the last review? ☐ Yes ☒ No

The undergraduate program in Chemistry offers a number of degrees tailored to prepare students for different career or higher education options. The BS in Chemistry is certified by the American Chemical Society and is geared to students intending to seek employment in chemical or chemistry-related industry or those planning to pursue advanced degrees in chemistry. A biochemistry option is available with this degree, which would be attractive to those students intending to pursue advanced degrees in biochemistry. The BS in Chemistry-Premedicine is designed for students intending to pursue advanced degrees in health-related fields, such as medicine, pharmacy, or dentistry. The BS in Chemistry/Business is a joint venture with the Barton School which is designed for students seeking careers in the pharmaceutical or chemical industries. The Field Major in Biochemistry, shared with the Department of Biological Sciences, also prepares students for graduate study in biochemistry and biomedical fields. The department also offers a BA degree in Chemistry.

The objectives for all degrees are to develop a solid foundation in the principles of chemistry including all major subdivisions of the field, to become familiar with the synthetic and analytical techniques of chemistry, and to gain an understanding of the scientific method and application of the principles learned in classes to chemical research. Measurable outcomes include (i) assessment exams taken following completion of most undergraduate courses and (ii) a written report on the independent research project.

The MS program in chemistry is a strong, research-based program whose intent is to prepare students for employment in the chemical or pharmaceutical industry, for teaching at the high-school or junior college level, and to pursue advanced degrees in chemistry. The objectives of this degree are to build on the undergraduate foundation with advanced instruction in a broad range of chemical disciplines and to master the principles and techniques of chemical research. The measurable outcome is the written thesis based on an original research project and the oral defense thereof.

The PhD program in chemistry is intended to prepare students for careers as independent researchers in the chemical industry and for academic positions at four-year colleges and research universities. The objectives of this degree are to acquire expertise in a specific area of chemistry, establish proficiency in the techniques of chemical research, and develop the ability to conceive of, express, and carry out an independent research project. The measurable outcomes are (i) cumulative exams taken in the 2nd and 3rd years, (ii) preparation and defense of an original research proposal in the 5th semester, and (iii) the written dissertation based on an original research project and the oral defense thereof.

If yes, describe the changes in a concise manner.

2a. Describe the quality of the program as assessed by the strengths, productivity, and qualifications of the faculty in terms of SCH, majors, graduates and scholarly productivity (refer to instructions in the WSU Program Review document for more information on completing this section). Complete a separate table for each program if appropriate.

UG Program - BS (SCH from entire department)

Last 3 Years	Tenure/Tenure Track Faculty (Number)	Tenure/Tenure Track Faculty with Terminal Degree (Number)	Instructional FTE (#): TTF= Tenure/Tenure Track GTA=Grad teaching assist O=Other instructional FTE			Total SCH - Total SCH by FY from Su, Fl, Sp	Total Majors - From fall semester	Total Grads – by FY
			TTF	GTA	O			
Year 1→	11	11	12	10	1.5	9398	159	25
Year 2→	11	11	11.5	11.5	0.7	9512	162	25
Year 3→	11	11	11.5	8.5	2.1	9493	162	35
					Total Number Instructional (FTE) – TTF+GTA+O	SCH/ FTE	Majors/ FTE	Grads/ FTE
					↓			
Year 1→					23.5	399	7	1
Year 2→					23.7	401	7	1
Year 3→					22.1	430	7.3	1.6

Scholarly Productivity	Number Journal Articles		Number Presentations		Number Conference Proceedings		Performances			Number of Exhibits		Creative Work		No. Books	No. Book Chaps.	No. Grants Awarded or Submitted	$ Grant Value
	Ref	Non-Ref	Ref	Non-Ref	Ref	Non-Ref	*	**	***	Juried	****	Juried	Non-Juried				
Year 1	31			57													
Year 2	33			50													
Year 3	33			20													

* Winning by competitive audition. **Professional attainment (e.g., commercial recording). ***Principal role in a performance. ****Commissioned or included in a collection. KBOR data minima for UG programs: Majors=25; Graduates=10; Faculty=3; KBOR data minima for master programs: Majors=20; Graduates=5; Faculty=3 additional; KBOR data minima for doctoral programs: Majors=5; Graduates=2; Faculty=2 additional.

a. Provide a brief assessment of the quality of the faculty/staff using the data from the table above as well as any additional relevant data. Programs should comment on details in regard to productivity of the faculty (i.e., some departments may have a few faculty producing the majority of the scholarship), efforts to recruit/retain faculty, departmental succession plans, course evaluation data, etc.

Provide assessment here:

The Department of Chemistry at Wichita State University is a vibrant, research-active department whose primary missions are to enhance and sustain a highly competitive undergraduate and graduate training program in all areas of chemistry and to make significant scholarly contributions to the body of chemical knowledge. All faculty members hold a PhD and have received further postdoctoral training before joining the WSU faculty. All maintain active research programs, all are involved in teaching undergraduate and graduate courses, and all serve on MS thesis and PhD dissertation committees. By its nature, research in chemistry involves student researchers – therefore nearly all publications by a faculty member include one or more student (undergraduate or graduate) or postdoctoral authors.

The high level of research activity among the faculty of the Department of Chemistry is important for all three degree programs. An education in chemistry requires engagement in original laboratory research. At the graduate level, this is obvious, since the major portion of the graduate degree (MS or PhD) is the research project, which is carried out in close collaboration with the student's major advisor – students in these programs embark on their final research project no later than their second semester in the program. This is, however, no less true at the undergraduate level – even at institutions without high-level research programs, faculty are encouraged to engage in research so as to expose their students to this aspect of chemistry. At WSU, participation in undergraduate research is a requirement for all BS chemistry majors and the availability of research programs operating at the highest levels makes this a more fruitful endeavor. Furthermore, given the rapidly changing nature of chemistry, the fact that faculty are operating at the frontiers of chemical research allows them to bring that knowledge back into the classroom – even at the most introductory levels, instruction is informed by the current state of the discipline.

Research productivity in chemistry is best assessed by an analysis of the papers published in peer-reviewed academic journals. The goal set for faculty members in our department, and a reasonable expectation for an institution such as WSU, is one paper per year. It is clear that this goal is far exceeded, on average, by our faculty, with a ratio of approximately three publications per year per faculty member. It is also important to address the quality of the journals in which these papers are published. All are published in highly regarded journals and many have appeared in particularly high-impact journals, such as the *Journal of the American Chemical Society*, *Nature* Methods, *Chemical Communications*, the *Journal of Organic Chemistry*, *Inorganic Chemistry*, *Biochemistry*, *Protein Science*, *Proceedings of the National Academy of Science*, *Bioorganic and Medicinal Chemistry*, and the *European Journal of Medicinal Chemistry*. Faculty members and students are also encouraged to present research findings at regional, national, and international meetings. Such activity not only allows for personal interactions with others in the field, but also brings recognition to the department and the university. WSU always brings a large contingent of graduate and undergraduate students to present at the Midwest Regional Meeting of the American Chemical Society. In addition, presentations were made at prestigious meetings such as the national meetings of the American Chemical Society and the Electrochemical Society, the Interscience Conference on Antimicrobial Agents and Chemotherapy, and international meetings such as Gordon Research Conferences, the International Conference on Bioinorganic Chemistry, the International Society for Electrochemistry, and the International Chemical Congress of Pacific Basin Societies.

The other metric by which to assess a research program is that of external funding. With the exception of one faculty member who was on phased-retirement during the period of this review, all faculty members in the Department of Chemistry have actively pursued external funding. The period of this review coincides, of course, with a national and global economic crisis which has affected the level of funds available. Even investigators at top-ranked research intensive institutions have seen their level of grant funding reduced. Still, faculty in the WSU Department of Chemistry have maintained a high level of success in securing external funding from federal and state sources (NIH, NSF, COBRE, KINBRE, etc.) and from local industrial sources (Boeing, Spirit). The table below shows the total dollar amounts of grant proposals submitted and funded in the past three years by WSU Chemistry Department faculty members:

WSU Chemistry Department external grant activity, 2009 – 2011 ($)

	submitted	funded	still pending
2009	10,191,029	2,834,028	0
2010	8,320,443	322,500	1,899,842
2011	2,522,743	292,243	2,230,500

Finally, the scholarly standing of the faculty can be addressed by their participation in review of papers and grant proposals and service on editorial boards and as officers in professional societies. Without exception, all the faculty members in the Department of Chemistry are actively engaged in such activities, serving as reviewers for many of the journals and funding agencies listed above. Board and officer positions held by members of the WSU chemistry faculty during the period of review include chair of the Wichita section of the American Chemical Society, associate editor of the *Journal of Porphyrins and Phthalocyanines*; editorial advisory board member of *Fullerenes, Nanotubes and Carbon Nanostructures*, *Chemistry – an Indian Journal*, *Chemtracts – Inorganic Chemistry*, and *The Open Enzyme Inhibition Journal*; *member* of the American Chemical Society Divisional Activities Committee and Chemical Education Committee

During the period of review, the Department of Chemistry has seen the loss of five active faculty members, two anticipated due to retirement and three unexpected (one death and two departures). This circumstance has required us to utilize the services of instructors for our introductory courses at a rate higher than we would desire. However, we have been fortunate to have at our disposal highly qualified individuals. One has a Masters degree and has taught very effectively in our department for many years. The rest of the instructors have PhD degrees in chemistry. The quality of the instruction for our students has, therefore, been maintained at a high level. We are aggressively addressing the loss of faculty members by the addition of highly promising young faculty members to the department – we added a physical chemist in Fall 2008 and a biochemist in Fall 2010. In addition, we initiated two faculty searches in Fall 2011, one of which has been successful in adding an analytical chemist who will begin his appointment in Fall 2012. The other search is still ongoing. We are confident that the new additions to our faculty will allow the department to continue its high level of teaching and research.

2b. Describe the quality of the program as assessed by the strengths, productivity, and qualifications of the faculty in terms of SCH, majors, graduates and scholarly productivity (refer to instructions in the WSU Program Review document for more information on completing this section). Complete a separate table for each program if appropriate.

Graduate - MS

Last 3 Years	Tenure/Tenure Track Faculty (Number)	Tenure/Tenure Track Faculty with Terminal Degree (Number)	Instructional FTE (#): TTF= Tenure/Tenure Track GTA=Grad teaching assist O=Other instructional FTE			Total SCH - Total SCH by FY from Su, Fl, Sp	Total Majors - From fall semester	Total Grads – by FY
			TTF	GTA	O			
Year 1→	11	11	12	0	0	N/A	14	6
Year 2→	11	11	11.5	0	0	N/A	15	3
Year 3→	11	11	11.5	0	0		10	5
					Total Number Instructional (FTE) – TTF+GTA+O	SCH/ FTE	Majors/ FTE	Grads/ FTE
Year 1→					N/A	N/A	N/A	N/A
Year 2→					N/A	N/A	N/A	N/A
Year 3→					N/A	N/A	N/A	N/A

Scholarly Productivity	Number Journal Articles		Number Presentations		Number Conference Proceedings		Performances			Number of Exhibits		Creative Work		No. Books	No. Book Chaps.	No. Grants Awarded or Submitted	$ Grant Value
	Ref	Non-Ref	Ref	Non-Ref	Ref	Non-Ref	*	**	***	Juried	****	Juried	Non-Juried				
Year 1	Same as 2a																
Year 2	Same as 2a																
Year 3	Same as 2a																

* Winning by competitive audition. **Professional attainment (e.g., commercial recording). ***Principal role in a performance. ****Commissioned or included in a collection. KBOR data minima for UG programs: Majors=25; Graduates=10; Faculty=3; KBOR data minima for master programs: Majors=20; Graduates=5; Faculty=3 additional; KBOR data minima for doctoral programs: Majors=5; Graduates=2; Faculty=2 additional.

*From the table on page 3, indicate number of faculty (and instructional FTE) teaching in the graduate program.

a. Provide a brief assessment of the quality of the faculty/staff using the data from the table above as well as any additional relevant data. Programs should comment on details in regard to productivity of the faculty (i.e., some departments may have a few faculty producing the majority of the scholarship), efforts to recruit/retain faculty, departmental succession plans, course evaluation data, etc.

Provide assessment here:

The faculty teaching in the MS program are the same as those teaching in the undergraduate program and the assessment described in the previous section applies equally to the MS program.

2c. Describe the quality of the program as assessed by the strengths, productivity, and qualifications of the faculty in terms of SCH, majors, graduates and scholarly productivity (refer to instructions in the WSU Program Review document for more information on completing this section). Complete a separate table for each program if appropriate.

PhD Program

Last 3 Years	Tenure/Tenure Track Faculty (Number)	Tenure/Tenure Track Faculty with Terminal Degree (Number)	Instructional FTE (#): TTF= Tenure/Tenure Track GTA=Grad teaching assist O=Other instructional FTE			Total SCH - Total SCH by FY from Su, Fl, Sp	Total Majors - From fall semester	Total Grads – by FY
			TTF	GTA	O			
Year 1→	11	11	12	0	0	N/A	24	3
Year 2→	11	11	11.5	0	0	N/A	24	5
Year 3→	11	11	11.5	0	0	N/A	27	4
					Total Number Instructional (FTE) – TTF+GTA+O	SCH/ FTE	Majors/ FTE	Grads/ FTE
Year 1→					N/A	N/A	N/A	N/A
Year 2→					N/A	N/A	N/A	N/A
Year 3→					N/A	N/A	N/A	N/A

Scholarly Productivity	Number Journal Articles		Number Presentations		Number Conference Proceedings		Performances			Number of Exhibits		Creative Work		No. Books	No. Book Chaps.	No. Grants Awarded or Submitted	$ Grant Value
	Ref	Non-Ref	Ref	Non-Ref	Ref	Non-Ref	*	**	***	Juried	****	Juried	Non-Juried				
Year 1	Same as 2a																
Year 2	Same as 2a																
Year 3	Same as 2a																

* Winning by competitive audition. **Professional attainment (e.g., commercial recording). ***Principal role in a performance. ****Commissioned or included in a collection. KBOR data minima for UG programs: Majors=25; Graduates=10; Faculty=3; KBOR data minima for master programs: Majors=20; Graduates=5; Faculty=3 additional; KBOR data minima for doctoral programs: Majors=5; Graduates=2; Faculty=2 additional.

*From the table on page 3, indicate number of faculty (and instructional FTE) teaching in the graduate program.

a. Provide a brief assessment of the quality of the faculty/staff using the data from the table above as well as any additional relevant data. Programs should comment on details in regard to productivity of the faculty (i.e., some departments may have a few faculty producing the majority of the scholarship), efforts to recruit/retain faculty, departmental succession plans, course evaluation data, etc.

Provide assessment here:

The faculty teaching in the PhD program are the same as those teaching in the undergraduate program and the assessment described in the previous section applies equally to the PhD program.

3. Academic Program: Analyze the quality of the program as assessed by its curriculum and impact on students. Complete this section for each program (if more than one). Attach updated program assessment plan (s) as an appendix (refer to instructions in the WSU Program Review document for more information).

a. For undergraduate programs, compare ACT scores of the majors with the University as a whole.

Last 3 Years	Total Majors - From fall semester	ACT – Fall Semester (mean for those reporting)	
		Majors	All University Students - FT
Year 1→	159	22.4	22.66
Year 2→	162	23.0	22.72
Year 3→	162	23.9	22.81

KBOR data minima for UG programs: ACT≤20 will trigger program.

b. For graduate programs, compare graduate GPAs of the majors with University graduate GPAs.*

Last 3 Years	Total Admitted - By FY		Average GPA (Admitted) – Domestic Students Only (60 hr GPA for those with ≥54 hr reported) By FY					
					Comparisons			
	MS	PhD	MS GPA	PhD GPA	College – MS	College – PhD	Univ - MS	Univ PhD
Year 1→08	6	13	3.46	3.65	3.44	3.75	3.48	3.62
Year 2→09	2	19	3.10	3.53	3.41	3.61	3.48	3.62
Year 3→10	4	11	3.11	3.53	3.32	3.67	3.48	3.67

*If your admission process uses another GPA calculation, revise table to suit program needs and enter your internally collected data.

c. Identify the principal learning outcomes (i.e., what skills does your Program expect students to graduate with). Provide aggregate data on how students are meeting those outcomes. Data should relate to the goals and objectives of the program as listed in 1e. Provide an analysis and evaluation of the data by learner outcome with proposed actions based on the results.

In the following table provide program level information. You may add an appendix to provide more explanation/details. Definitions:
Learning Outcomes: Learning outcomes are statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire in their matriculation through the program (e.g., graduates will demonstrate advanced writing ability).
Assessment Tool: One or more tools to identify, collect, and prepare data to evaluate the achievement of learning outcomes (e.g., a writing project evaluated by a rubric).
Criterion/Target: Percentage of program students expected to achieve the desired outcome for demonstrating program effectiveness (e.g., 90% of the students will demonstrate satisfactory performance on a writing project).
Result: Actual achievement on each learning outcome measurement (e.g., 95%).
Analysis: Determines the extent to which learning outcomes are being achieved and leads to decisions and actions to improve the program. The analysis and evaluation should align with specific learning outcome and consider whether the measurement and/or criteria/target remain a valid indicator of the learning outcome as well as whether the learning outcomes need to be revised.

Undergraduate - BS

Learning Outcomes (most programs will have multiple outcomes)	Assessment Tool (e.g., portfolios, rubrics, exams)	Target/Criteria (desired program level achievement)	Results	Analysis
Know principles and applications of organic, inorganic, physical, analytical, and biochemistry	American Chemical Society exams in each field are administered at the conclusion of the appropriate course	85% of students will demonstrate satisfactory performance on exam*	AY09 – Analytical – 95% Instrumental – 75% Organic – 65% Thermo – 92% Quantum – 64% Inorganic – 89% Biochemistry – 84% AY 10 – Analytical – 90% Organic – 82% Quantum – 100% Biochemistry – 91%	In general, students are performing at or near the target level s. See below for detailed analysis.
Be able to apply techniques and concepts of chemistry in a research project	Research report submitted at the conclusion of the mandatory independent study research course			Quantitative analysis has not been carried out to date, but in the future reports will be analyzed according to AACU Inquiry and Analysis rubric

* Exams are administered at the conclusion of Chem 523 (analytical), Chem 524 (instrumental), Chem 532 (organic), Chem 545/548 (physical – thermodynamics), Chem 546 (physical – quantum), Chem 615 (inorganic), and Chem 663 (biochemistry). Chem 523, 524, and 532 contain a large number of non-chemistry majors, rendering results from those exams less useful for assessing the students in the chemistry program. Satisfactory performance is considered those who fall within 10% of the national norms on the exam.

Detailed analysis of ACS exam results: Students in three classes did not meet the target for the AY09 exams. As indicated above, Chem 532 and Chem 524 have many students who are not chemistry majors – it would be expected that, on average, these students would tend to have lower scores. It is likely, therefore, that the chemistry majors in these classes did meet the target. Chem 546 is generally a relatively small class, rendering one-year statistics from such a class less meaningful. Therefore, any remediation should be based on a multiyear assessment. However, for both 532 and 546, the results in AY10 do show that the target has been met.

Graduate - MS

Learning Outcomes (most programs will have multiple outcomes)	Assessment Tool (e.g., portfolios, rubrics, exams)	Target/Criteria (desired program level achievement)	Results	Analysis
Demonstrate proficiency at carrying out and analyzing chemical research	Written thesis based on original research and defense thereof	100% successful defense of thesis	100% of students defending thesis have passed	

Graduate - PhD

Learning Outcomes (most programs will have multiple outcomes)	Assessment Tool (e.g., portfolios, rubrics, exams)	Target/Criteria (desired program level achievement)	Results	Analysis
Demonstrate proficiency at carrying out and analyzing chemical research	Written dissertation based on original research and defense thereof	100% successful defense of dissertation	100% of students defending dissertation have passed	
Demonstrate ability to conceive of a research project	Written Original Research Proposal and defense thereof – completed during fifth semester	100% successful defense of proposal	100% of students defending proposal have passed – a few required a second defense	
Demonstrate ability to read and analyze current chemical literature	Cumulative examinations – students are required to pass 6 exams in two years starting in student's third semester	100% pass rate	100% of students have passed required number of exams.	

d. Provide aggregate data on student majors satisfaction (e.g., exit surveys), capstone results, licensing or certification examination results, employer surveys or other such data that indicate student satisfaction with the program and whether students are learning the curriculum (for learner outcomes, data should relate to the goals and objectives of the program as listed in 1e).

Undergraduate - BS

Student Satisfaction (e.g., exit survey data on overall program satisfaction).* If available, report by year, for the last 3 years			Learner Outcomes (e.g., capstone, licensing/certification exam pass-rates) by year, for the last three years				
Year	N	Result (e.g., 4.5 on scale of 1-5, where 5 highest) Exit survey completed by all graduating majors	Year	N	Name of Exam	Program Result	National Comparison±
1	13	11 of 13 indicated they would recommend program	1				
2	25	25 of 25 indicated they would recommend program	2				
3	22	20 of 22 indicated they would recommend program	3				

*Available for graduate programs from the Graduate School Exit Survey. Undergraduate programs should collect internally. ± If available.

Graduate - MS

Student Satisfaction (e.g., exit survey data on overall program satisfaction).* If available, report by year, for the last 3 years			Learner Outcomes (e.g., capstone, licensing/certification exam pass-rates) by year, for the last three years				
Year	N	Result (e.g., 4.5 on scale of 1-5, where 5 highest) Graduate School Exit Survey	Year	N	Name of Exam	Program Result	National Comparison±
1	58	73% reported being satisfied or very satisfied – note this	1				
2		number is combined MS and PhD students for the 5-year	2				
3		period from F06 – S11	3				

*Available for graduate programs from the Graduate School Exit Survey. Undergraduate programs should collect internally. ± If available.

Graduate - PhD

Student Satisfaction (e.g., exit survey data on overall program satisfaction).* If available, report by year, for the last 3 years			Learner Outcomes (e.g., capstone, licensing/certification exam pass-rates) by year, for the last three years				
Year	N	Result (e.g., 4.5 on scale of 1-5, where 5 highest) Graduate School Exit Survey	Year	N	Name of Exam	Program Result	National Comparison±
1	58	73% reported being satisfied or very satisfied – note this	1				
2		number is combined MS and PhD students for the 5-year	2				
3		period from F06 – S11	3				

*Available for graduate programs from the Graduate School Exit Survey. Undergraduate programs should collect internally. ± If available.

e. Provide aggregate data on how the goals of the *WSU General Education Program* and *KBOR 2020 Foundation Skills* are assessed in undergraduate programs (optional for graduate programs).

Goals/Skills Measurements of: -Oral and written communication -Numerical literacy -Critical thinking and problem solving -Collaboration and teamwork -Library research skills -Diversity and globalization	Results	
	Majors	Non-Majors
Written Communication – all BS Chemistry, BS Chemistry – Biochemistry option, BS Chemistry – Pre-medicine, FM Biochemistry students are required to submit a final report describing their undergraduate research project. This report will be assessed according to AACU Written Communication rubric	Reports have not been assessed in this manner in the past – we will start to do this.	

Note: Not all programs evaluate every goal/skill. Programs may choose to use assessment rubrics for this purpose. Sample forms available at: http://www.aacu.org/value/rubrics/

f. Indicate whether the program is accredited by a specialty accrediting body including the next review date and concerns from the last review.

Provide information here:

The department is not accredited, per se. However, the Bachelors of Science degree in Chemistry and the BS Chemistry - ACS Biochemistry degree are certified by the American Chemical Society. In addition, the department is reviewed by the American Chemical Society every five years. The last review was submitted in June, 2009. The reviews were overall very positive. The major concerns were the following: (i) the fact that the faculty is composed "entirely of Caucasian males," although it was acknowledged that we had attempted to diversify our faculty. Our faculty at that time included two members from India, one from Cyprus, one from Scotland, and one from Sri Lanka. However, we did not have any women or historically underrepresented minorities among our faculty. We have since hired a female faculty member and will continue to strive to further diversify. (ii) Only one faculty member had taken sabbatical during the previous 5 years. (iii) "Student research reports do not reflect a strong research experience with content more appropriate to a laboratory report." We have provided more guidance to our students regarding the preparation of the research reports associated with their independent study research projects.

g. Provide a brief assessment of the overall quality of the academic program using the data from 3a – 3f and other information you may collect, including outstanding student work (e.g., outstanding scholarship, inductions into honor organizations, publications, special awards, academic scholarships, student recruitment and retention).

Provide assessment here:

The data above show that, for the most part, students are very satisfied with the education they receive as Chemistry majors at WSU and that they are successful in achieving their learning objectives. An additional metric by which to assess the quality of the programs is through an analysis of the participation of students (undergraduate and graduate) in written and oral presentation of research results. Due to the nature of the discipline, original research is by far the best way to incorporate the material learned in the classroom and in organized labs. The MS and PhD curricula are centered around the original research project – all students in these programs begin their research projects no later than their second semester in residence. This is common in most MS and PhD programs in chemistry. At the undergraduate level, the American Chemical Society recommends undergraduate research and such an experience is widely viewed as a valuable component of an undergraduate chemistry degree. However, many institutions do not require it for the degree. At WSU, all BS degrees in chemistry require a minimum of one semester of undergraduate research, in which students work closely with a faculty member (and often a graduate student or postdoc) on an original research project.

In item 2a were listed the number of journal articles (average 32/yr) and research presentations (average 42/yr) submitted by faculty in the Department of Chemistry. Almost all of these include at least one student author – either undergraduate or graduate. Each year the Chemistry Department contributes on the order of 15-20 presentations (oral or poster) to the Midwest Regional meeting of the American Chemical Society – the majority of these not only include student authors, but are presented by students. Chemistry students are also well represented at campus research events (URCAF and

GRASP). Over the past 3 years, undergraduate chemistry students have received four first place and two second place awards at URCAF -undergraduate students have also received one first place, two second place, and two honorable mention awards in the Alvin and RosaLee Sarachek Award competition at URCAF. Graduate students have garnered two second place and one fifth place award in GRASP and have twice won first place in the Capitol Graduate Research Summit in Topeka. Finally, one Chemistry PhD student received the Dora Wallace Hodgson Outstanding Doctoral Dissertation Award during the past three years.

4a. Analyze the student need and employer demand for the program. Complete for each program if appropriate (refer to instructions in the WSU Program Review document for more information on completing this section).

a. Utilize the table below to provide data that demonstrates student need and demand for the program.

Undergraduate - BS

Majors						Employment of Majors*						
Last 3 FYs – Su, Fl, and Sp	No. new applicants or declared majors	No. who enter or are admitted in the major	No. enrolled one year later	1 Year Attrition %	Total no. of grads	Average Salary	Employment % In state	Employment % in the field	Employment: % related to the field	Employment: % outside the field	No. pursuing graduate or professional education	Projected growth from BLS**
Year 1→	†	†	†		25							Current year only
Year 2→	†	†	†		25							↓
Year 3→	†	†	†		35							3.8%

	Race/Ethnicity by Major***									Race/Ethnicity by Graduate***								
	NRA	H	AI/AN	A	B	NH/PI	C	MR	UNK	NRA	H	AI/AN	A	B	NH/PI	C	MR	UNK
Year 1→	12	9	2	44	11	0	69	0	12	3	2	1	10	1	0	8	0	0
Year 2→	11	7	3	41	5	0	82	0	13	3	0	0	6	1	0	13	0	2
Year 3→	5	11	2	27	8	0	97	3	11	3	0	1	8	1	0	21	0	2

† See table below

* May not be collected every year

** Go to the U.S. Bureau of Labor Statistics Website: http://www.bls.gov/oco/ and view job outlook data and salary information (if the Program has information available from professional associations or alumni surveys, enter that data)

*** NRA=Non-resident alien; H=Hispanic; AI/AN=American Indian/ Alaskan Native; A=Asian; B=Black; NH/PI=Native Hawaiian/Pacific Islander; C=Caucasian; MR=Multi-race; UNK=Unknown

KBOR data minima for UG programs: Majors=25; Graduates=10; Faculty=3; KBOR data minima for master programs: Majors=20; Graduates=5; Faculty=3 additional; KBOR data minima for doctoral programs: Majors=5; Graduates=2; Faculty=2 additional.

Retention & Graduation Rates within Chemistry												
Cohort Year	Class	Count	Continued to 2nd Year	Continued to 3rd Year	Continued to 4th Year	Graduated in 1 Year	Graduated in 2 Years	Graduated in 3 Years	1st Year Yield*	2nd Year Yield*	3rd Year Yield*
2009	Freshmen	40	55.0%	37.5%	27.5%	0.0%	0.0%	0.0%	55.0%	37.5%	27.5%
	Sophomore	25	60.0%	52.0%	28.0%	0.0%	0.0%	4.0%	60.0%	52.0%	32.0%
	Junior	22	68.2%	31.8%	9.1%	0.0%	9.1%	18.2%	68.2%	40.9%	27.3%
	Senior	25	56.0%	28.0%	8.0%	4.0%	16.0%	28.0%	60.0%	44.0%	36.0%
2010	Freshmen	61	49.2%	36.1%		0.0%	0.0%		49.2%	36.1%	
	Sophomore	36	55.6%	30.6%		0.0%	0.0%		55.6%	30.6%	
	Junior	19	73.7%	36.8%		0.0%	10.5%		73.7%	47.4%	
	Senior	26	50.0%	19.2%		0.0%	19.2%		50.0%	38.5%	
2011	Freshmen	52	65.4%			0.0%			65.4%		
	Sophomore	37	54.1%			0.0%			54.1%		
	Junior	27	55.6%			0.0%			55.6%		
	Senior	41	51.2%			9.8%			61.0%		
2012	Freshmen	42									
	Sophomore	34									
	Junior	22									
	Senior	12									

* yield = number retained + number that graduated

Provide a brief assessment of student need and demand using the data from the table above. Include the most common types of positions, in terms of employment, graduates can expect to find.

Provide assessment here:

Graduates with the BS in chemistry are prepared for a number of different career/educational paths. Many recent graduates from the WSU Chemistry Department have gone on to graduate school in chemistry, both at WSU and at other institutions such as Yale, Iowa State, Texas Tech, Oklahoma State, and the University of Utah. Other graduates have gone on to professional schools in medicine, veterinary medicine, dentistry, and pharmacy. Graduates have also gone on to employment in industry - recent graduates have had success in obtaining positions in the pharmaceutical chemistry industry and in medicine-related fields. Unfortunately, although we interview all of the undergraduate majors prior to their receiving their degrees, most are unsure of exactly where they will be going at that time. Therefore, our data are incomplete as to where they actually end up. It would be more useful to survey alumni one or two years after graduation. The information we have represents only those students who did know at the time of the exit interview what their plans were or with whom we have maintained informal contact. Certainly, employment of students with a chemistry undergraduate degree has been affected in recent years in the same way that employment across disciplines has. The increasing reliance on high-tech manufacturing and the continued search for new and better medicines, however, bode well for future employment prospects for chemists.

4b. **Analyze the student need and employer demand for the program. Complete for each program if appropriate (refer to instructions in the WSU Program Review document for more information on completing this section).**

a. Utilize the table below to provide data that demonstrates student need and demand for the program.

Graduate - MS

Majors						Employment of Majors*						
Last 3 FYs – Su, Fl, and Sp	No. new applicants or declared majors	No. who enter or are admitted in the major	No. enrolled one year later	1 Year Attrition %	Total no. of grads	Average Salary	Employment % In state	Employment % in the field	Employment: % related to the field	Employment: % outside the field	No. pursuing graduate or professional education	Projected growth from BLS**
Year 1→	†	†	†	†	6		67	67	33	0	0	Current year only
Year 2→	†	†	†	†	3		67	67	0	0	1	
Year 3→	†	†	†	†	5						1	N/A

Race/Ethnicity by Major***										Race/Ethnicity by Graduate***								
	NRA	H	AI/AN	A	B	NH/PI	C	MR	UNK	NRA	H	AI/AN	A	B	NH/PI	C	MR	UNK
Year 1→	8	0	0	0	0	0	6	0	0	3	0	0	1	0	0	2	0	0
Year 2→	9	0	0	1	0	0	5	0	0	1	0	0	0	0	0	2	0	0
Year 3→	6	0	0	1	1	0	2	0	0	4	0	0	0	0	0	1	0	0

† See table below

* May not be collected every year

** Go to the U.S. Bureau of Labor Statistics Website: http://www.bls.gov/oco/ and view job outlook data and salary information (if the Program has information available from professional associations or alumni surveys, enter that data)

*** NRA=Non-resident alien; H=Hispanic; AI/AN=American Indian/ Alaskan Native; A=Asian; B=Black; NH/PI=Native Hawaiian/Pacific Islander; C=Caucasian; MR=Multi-race; UNK=Unknown

KBOR data minima for UG programs: Majors=25; Graduates=10; Faculty=3; KBOR data minima for master programs: Majors=20; Graduates=5; Faculty=3 additional; KBOR data minima for doctoral programs: Majors=5; Graduates=2; Faculty=2 additional.

Chemistry Graduate - Retention & Graduation Rates within Chemistry

Cohort Year	Class	Count	Continued to 2nd Year	Continued to 3rd Year	Continued to 4th Year	Graduated in 1 Year	Graduated in 2 Years	Graduated in 3 Years	1st Year Yield	2nd Year Yield	3rd Year Yield
2009	MAST	8	75.0%	37.5%	0.0%	0.0%	12.5%	50.0%	75.0%	50.0%	50.0%
2010	MAST	2	50.0%	50.0%		50.0%	50.0%		100.0%	100.0%	
2011	MAST	5	60.0%			40.0%			100.0%		
2012	MAST	6									

Provide a brief assessment of student need and demand using the data from the table above. Include the most common types of positions, in terms of employment, graduates can expect to find.

Provide assessment here:

Students obtaining MS degrees in chemistry from WSU have been very successful in obtaining employment in chemistry or related fields or admission to programs for further education in chemistry. Graduates from the MS program in the past three years went on to the following positions:

John Bullinger – high-school physics teacher, Wichita Collegiate School
Justin Lygrisse – analytical scientist – Novartis OTC Pharmaceticals, Lincoln, NE
Guijia He – research assistant – WSU chemistry department
Dale Kerstetter – Chemist – Hospira Pharmaceuticals, McPherson, KS
Ryan Dain – PhD student – University of Utah
Hong Aw – Chemist – Hospira Pharmaceuticals, McPherson, KS
Anusha Dissanayake - Chemist – Hospira Pharmaceuticals, McPherson, KS
Anu Amin – unknown
Mohammad Islam – unknown
Ritu Gurung – PhD student – WSU

4c. Analyze the student need and employer demand for the program. Complete for each program if appropriate (refer to instructions in the WSU Program Review document for more information on completing this section).

a. Utilize the table below to provide data that demonstrates student need and demand for the program.

Graduate – PhD

Majors						Employment of Majors*						
Last 3 FYs – Su, Fl, and Sp	No. new applicants or declared majors	No. who enter or are admitted in the major	No. enrolled one year later	1 Year Attrition %	Total no. of grads	Average Salary	Employment % In state	Employment % in the field	Employment: % related to the field	Employment: % outside the field	No. pursuing graduate or professional education	Projected growth from BLS**
Year 1→	†	†	†	†	3		14	57	0	0	2	Current year only ↓
Year 2→	†	†	†	†	5		0	25	0	0	2	
Year 3→	†	†	†	†	4		0	50	0	0	1	N/A

	Race/Ethnicity by Major***									Race/Ethnicity by Graduate***								
	NRA	H	AI/AN	A	B	NH/PI	C	MR	UNK	NRA	H	AI/AN	A	B	NH/PI	C	MR	UNK
Year 1→	17	1	0	1	0	0	5	0	0	1	1	0	0	0	0	1	0	0
Year 2→	18	0	0	1	0	0	5	0	0	3	0	0	0	0	0	2	0	0
Year 3→	21	0	0	2	0	0	4	0	0	4	0	0	0	0	0	0	0	0

* May not be collected every year

** Go to the U.S. Bureau of Labor Statistics Website: http://www.bls.gov/oco/ and view job outlook data and salary information (if the Program has information available from professional associations or alumni surveys, enter that data)

*** NRA=Non-resident alien; H=Hispanic; AI/AN=American Indian/ Alaskan Native; A=Asian; B=Black; NH/PI=Native Hawaiian/Pacific Islander; C=Caucasian; MR=Multi-race; UNK=Unknown

KBOR data minima for UG programs: Majors=25; Graduates=10; Faculty=3; KBOR data minima for master programs: Majors=20; Graduates=5; Faculty=3 additional; KBOR data minima for doctoral programs: Majors=5; Graduates=2; Faculty=2 additional.

Chemistry Graduate - Retention & Graduation Rates within Chemistry

Cohort Year	Class	Count	Continued to 2nd Year	Continued to 3rd Year	Continued to 4th Year	Graduated in 1 Year	Graduated in 2 Years	Graduated in 3 Years	1st Year Yield	2nd Year Yield	3rd Year Yield
2009	DOCR	6	100.0%	100.0%	66.7%	0.0%	0.0%	0.0%	100.0%	100.0%	66.7%
2010	DOCR	7	85.7%	57.1%		0.0%	0.0%		85.7%	57.1%	
2011	DOCR	3	33.3%			0.0%			33.3%		
2012	DOCR	6									

Provide a brief assessment of student need and demand using the data from the table above. Include the most common types of positions, in terms of employment, graduates can expect to find.

Provide assessment here:

Students obtaining PhD degrees in chemistry from WSU have been very successful in obtaining postdoctoral positions or employment in chemistry or related fields. Graduates from the PhD program in the past three years went on to the following positions:

Warren Samms- Drug Chemistry Manager at Harris County Institute of Forensic Sciences – Houston, TX
Frederick Meece – postdoctoral research at University of Minnesota
Inoka Hewawitharana – Chemist – Hospira Pharmaceuticals – McPherson, KS
Rama Gandikota – Chemist – Wilko Paint, Wichita, KS
Travis Cooper – unknown
Joshua Zimmerman – postdoctoral research – University of Nevada
Arvin Cruz – chemistry instructor – Pittsburg State University, Pittsburg, KS
Dengfeng Dou – postdoctoral research – Mayo Clinic, Rochester, MN
Manjula Koraldegedara – tenure-track chemistry faculty – McPherson College, McPherson, KS
Eranda Maligaspe – postdoctoral research – University of Michigan
Wei Huang – unknown
Yamuna Kollalpitiya – faculty – Warren Wilson College, Swannanoa, NC
Kankani Rajapaksha – postdoctoral research – Mercer University, Savannah, GA

5. **Analyze the cost of the program and service the Program provides to the discipline, other programs at the University, and beyond. Complete for each program if appropriate (refer to instructions in the WSU Program Review document for more information on completing this section).**

Percentage of SCH Taken By (last 3 years)			
Fall Semester	Year 1	Year 2	Year 3
UG Majors	19.9	22.0	20.5
Gr Majors	5.4	5.3	4.9
Non-Majors	74.7	72.7	74.6

a. Provide a brief assessment of the cost and service the Program provides. Comment on percentage of SCH taken by majors and non-majors, nature of Program in terms of the service it provides to other University programs, faculty service to the institution, and beyond.

Provide assessment here:

The Department of Chemistry offers a number of classes which are populated largely by non-majors. These include Chem 211/212 (General Chemistry), Chem 103 (Introductory Chemistry), and Chem 531/532 (Organic Chemistry). Because they require labs and because we endeavor to teach them with tenure-track faculty, these courses have a rather high per-student cost. Some of this is offset by a laboratory fee and we have made changes which reduced the amount that we spend on disposable supplies. These classes are requirements for a number of majors, including Biological Sciences (211, 212, 531, 532), Engineering (211), Physics (211), Geology (211, 212), Athletic Training (211), Med Tech (211, 212), and Nursing (103). In addition, General Chemistry and Organic Chemistry are necessary for students intending to apply to professional schools such as medical, pharmacy, and veterinary schools. Students receiving degrees in Curriculum and Instruction, with an emphasis in Secondary Education in Chemistry, must take Chem 211, 212, 523, 524, 531, 532, and 661. A new one-semester Organic Chemistry course (Chem 533) has been added in the past two years specifically for students majoring in bioengineering, who must also take Chem 211, 212, and 661. It is clear that some recent university and statewide initiatives in other colleges (especially aimed at increasing the number of students graduating with degrees in Nursing and Engineering) affect the Department of Chemistry in terms of increased demand for these courses.

The majority of the SCH in upper division courses (with the exception of Chem 531/532/533) are taken by chemistry majors and almost all SCH in 700- and 800-level courses are taken by chemistry graduate students. The 500- and 600-level courses offered by the Department of Chemistry are those which are required for the Chemistry BS degree to be certified by the American Chemical Society. The department has, over the past 6 years, developed and refined a Core Curriculum for graduate students at both the MS and PhD level, which serves the dual purpose of providing the students with a unified broad-based graduate education and maximizing the efficiency of faculty utilization.

6. **Report on the Program's goal (s) from the last review. List the goal (s), data that may have been collected to support the goal, and the outcome. Complete for each program if appropriate (refer to instructions in the WSU Program Review document for more information on completing this section).**

(For Last 3 FYs)	Goal (s)	Assessment Data Analyzed	Outcome
	No goals were identified in previous review		

7. **Summary and Recommendations**

a. Set forth a summary of the report including an overview evaluating the strengths and concerns. List recommendations for improvement of each Program (for departments with multiple programs) that have resulted from this report (relate recommendations back to information provided in any of the categories and to the goals and objectives of the program as listed in 1e). Identify three year goal (s) for the Program to be accomplished in time for the next review.

Provide assessment here:

Overall, the Department of Chemistry continues to be a very strong program from the standpoint of both teaching and research. Our faculty, in collaboration with graduate and undergraduate students, are carrying out frontier level research, publishing at a high rate in premier journals, presenting their research at major conferences, and obtaining external funding for their research programs. Our undergraduate students are performing well compared to national norms on course-specific assessment examinations and are well-prepared, upon graduation, to obtain employment in a chemistry-related field or to pursue advanced professional or graduate degrees. Our graduate students have been successful in moving on to industrial, academic, or postdoctoral positions. The department successfully occupies a middle ground between four-year or masters-only institutions and major research institutions. With a successful PhD program and external funding, we are able to offer our graduate students the opportunity to engage in the highest level of scholarly research; our undergraduate students are exposed to the same and are afforded the chance to experience a true research experience and use state-of-the-art instrumentation. At the same time, our undergraduate classes are, for the most part, taught by tenured and tenure-track faculty and the size of our research groups are small enough to allow more personalized attention from the faculty member to the student researchers.

The major concerns regarding the department are (i) the decreasing availability of federal grant money and (ii) the increasing competition for new faculty members. The vast majority of external funding received by chemistry faculty members comes from federal agencies, i.e., NIH and NSF. These funds are increasingly difficult to obtain for researchers across the country at all levels. We have been fortunate to have access to programs in Kansas such as NIH-funded COBRE and KINBRE, and NSF-funded EPSCoR. We have also leveraged funding from local industry and we have continued to be successful in receiving major NIH and NSF grants. However, the present economic conditions suggest that budgets for these and other federal funding agencies will, at best, be flat for the foreseeable future. With respect to

recruitment of new faculty members, we remain committed to hiring individuals who show promise of excelling at both teaching and research. We have been fortunate that our recent searches have ultimately resulted in excellent hires. However, it has sometimes taken two or three rounds to successfully recruit a candidate. This is partly due to the somewhat limited resources of the university to offer competitive startup packages.

Goals for the next three years include:

1- Improve program assessment. We have made progress in assessment of our undergraduate, MS, and PhD programs, but we need to do more in that area. This will include implementation of the AACU rubrics for assessing the undergraduate research reports and formulation of better feedback loops to incorporate assessment results in our planning.

2- Improve tracking of undergraduate alumni. We have instituted a semiannual Chemistry Department newsletter which is sent to all alumni of and donors to the Department of Chemistry. It is anticipated that this will help to reconnect alumni to the department and the university.