

Council Approval

Note: This form is intended to track the progress of a proposal (whether from Academic Affairs or Health Sciences) through the Undergraduate and Graduate Councils.

Proposal: Emphasis in Atmospheric & Environmental Chemistry for the Chemistry BA/BS

This proposal needs to go through:

Undergraduate Council
Graduate Council
Both Approvals
Grad Approval/Undergrad Notification

X

☐☐☐

This proposal has been approved by:

Chair of Undergraduate Council



Date: 9.26.17

Chair of Graduate Council

Date: _____

Once the appropriate signature(s) have been obtained, please forward this completed form to the Office of the Senior Vice President for Academic Affairs. *(NOTE: The SVP-AA is the Chief Academic Officer for the University of Utah and reports to the Board of Regents in this capacity. When necessary, the CAO will get a signature from the SVP-HSC.)*

Chief Academic Officer



Date: 9-27-17

Once the Chief Academic Officer's signature has been obtained, this approval document will be forwarded to the **Office of the Academic Senate**.

Utah System of Higher Education
New Academic Program Proposal
Cover/Signature Page - Abbreviated Template

Institution Submitting Request: University of Utah
Proposed Program Title: BA/BS in Chemistry with emphasis in Atmospheric and Environmental Chemistry
Sponsoring School, College, or Division: College of Science
Sponsoring Academic Department(s) or Unit(s): Department of Chemistry
Classification of Instructional Program Code¹ :
Min/Max Credit Hours Required of Full Program: 86 / 86
Proposed Beginning Term²: Fall 2018
Institutional Board of Trustees' Approval Date:

Program Type:

<input type="checkbox"/>	Certificate of Proficiency	<input type="checkbox"/>	Entry-level CTE CP	<input type="checkbox"/>	Mid-level CP
<input type="checkbox"/>	Certificate of Completion				
<input type="checkbox"/>	Minor				
<input type="checkbox"/>	Graduate Certificate				
<input type="checkbox"/>	K-12 Endorsement Program				
<input checked="" type="checkbox"/>	NEW Emphasis for Regent-Approved Program <i>Credit Hours for NEW Emphasis Only:</i> 28 / 28 <i>Current Major CIP:</i> 6 - Digit CIP <i>Current Program Title:</i> <i>Current Program BOR Approval Date:</i>				
<input type="checkbox"/>	Out of Service Area Delivery Program				

Chief Academic Officer (or Designee) Signature:

I, the Chief Academic Officer or Designee, certify that all required institutional approvals have been obtained prior to submitting this request to the Office of the Commissioner.

Please type your first and last name _____ Date: _____

☐ I understand that checking this box constitutes my legal signature.

¹ For CIP code classifications, please see <http://nces.ed.gov/ipeds/cipcode/Default.aspx?y=55>.

² "Proposed Beginning Term" refers to first term after Regent approval that students may declare this program.

Utah System of Higher Education
Program Description - Abbreviated Template

Section I: The Request

University of Utah requests approval to offer the following Emphasis: BA/BS in Chemistry with emphasis in Atmospheric and Environmental Chemistry effective Fall 2018. This program was approved by the institutional Board of Trustees on .

Section II: Program Proposal/Needs Assessment

Program Description/Rationale

Present a brief program description. Describe the institutional procedures used to arrive at a decision to offer the program. Briefly indicate why such a program should be initiated. State how the institution and the USHE benefit by offering the proposed program. Provide evidence of student interest and demand that supports potential program enrollment.

Chemistry is broad field, which has many subdisciplines and connections to other sciences. This is reflected in the large number of emphases that are currently available within the chemistry B.A. and B.S. degrees at the University of Utah. In order to facilitate cross-disciplinary training, which we believe is beneficial to students whose interests lie at the boundaries between fields, we currently have degree programs allowing students to major in chemistry with emphases in biology, business, chemical engineering, geology, materials science and engineering, physics, professional chemistry, and teaching. A number of students are interested in learning chemistry so they can work to reduce atmospheric pollution or otherwise improve and protect the environment, and have asked if it would be possible to develop an emphasis in atmospheric and environmental chemistry. Several incoming freshmen are clamoring for us to offer such an emphasis, which could provide an entry to graduate programs in Atmospheric or Environmental Chemistry. We have discussed the possibility of such an emphasis with colleagues in the Department of Atmospheric Sciences (College of Mines and Earth Sciences), and in the Environmental & Sustainability Studies Program (College of Social & Behavioral Science), and believe that the time is ripe to offer such an emphasis. Our colleagues in these units are enthusiastic about this interdisciplinary emphasis. While we do not anticipate the Atmospheric and Environmental Chemistry Emphasis to be heavily enrolled, we feel that the desire of some students to enroll in such a program is easy to accommodate, and well worth our effort to do so.

The chemistry faculty reviewed and voted for the proposal on the emphasis in Atmospheric and Environmental Chemistry on March 28, 2017 and the outcome was 21 in favor, 0 not in favor, and 0 abstentions.

Expected Student Learning Outcomes

In addition to the current Chemistry BS/BA student learning outcomes, students will be able to:

- Examine how fundamental principles in chemistry are related to atmospheric and environmental phenomena and issues.
- Use critical thinking and problem-solving skills to analyze and solve current challenges related to the local and global atmosphere and environment (such as photochemical smog, toxic

metal pollution, greenhouse gas chemistry, and global warming).

Labor Market Demand

Provide local, state, and/or national labor market data that speak to the need for this program. Occupational demand, wage, and number of annual openings information may be found at sources such as Utah DWS Occupation Information Data Viewer (jobs.utah.gov/jsp/wi/utalmis/gotoOccinfo.do) and the Occupation Outlook Handbook (www.bls.gov/oco).

The Bureau of Labor Statistics' Occupation Outlook Handbook reports that the labor category of Environmental Scientists and Specialists is expected to grow by 11% over the time frame 2014 to 2024, a rate which is higher than the average predicted rate of occupational growth (7%). Thus, this is a growing field. In 2014, there were 94,600 workers in this field; 10,200 are expected to be added by 2024. Typically, an entry-level position requires a Bachelor's degree. The 2015 median pay for this type of employment is \$67,460/year. (See information at <https://www.bls.gov/ooh/life-physical-and-social-science/environmental-scientists-and-specialists.htm>). The Utah Occupational Report predicts that the statewide employment in this category will grow from 629 to 756 over the 2014-2024 time frame, a 20% increase over 10 years. Within the state of Utah, entry-level salaries of \$47,260 and median salaries of \$64,980 are reported. (See information at <http://jobs.utah.gov/jsp/wi/utalmis/gotoOccinfo.do>).

In the related area of Atmospheric Scientists, including Meteorologists, the Bureau of Labor Statistics again predicts a greater than average growth in employment, with a 9% predicted growth over the 2014-2024 period. It is expected that 1,100 additional workers will be required in this field by 2024. For atmospheric scientists, the typical entry-level position requires a Bachelor's degree, and the 2015 median pay for atmospheric scientists was \$89,820/year. (See information at <https://www.bls.gov/ooh/life-physical-and-social-science/atmospheric-scientists-including-meteorologists.htm#tab-1>). Projections from the Utah Occupational Report indicate that over the 2014-2024 time frame, 65 additional Atmospheric and Space Scientists will be added to the workforce, corresponding to a 6.1% annual growth rate. Across the state, the annual starting salary averages about \$63,060 and the median salary for all workers in this job category is \$91,250. (See information at <http://jobs.utah.gov/jsp/wi/utalmis/gotoOccinfo.do>).

Another related area of employment is Environmental Engineering. Environmental Engineers use the principles of engineering, soil science, biology, and chemistry to develop solutions to environmental problems. Students desiring to go into this field would benefit by having the opportunity to major in chemistry, with an emphasis in Atmospheric and Environmental Chemistry, perhaps as a double major with Civil and Environmental Engineering. Again, the Bureau of Labor Statistics predicts a greater than average growth in employment, with a 12% predicted growth over the 2014-2024 time frame. It is expected that 6,800 additional environmental engineers will be required by 2024. The typical entry-level position requires a bachelor's degree. The 2015 median pay is \$84,560 per year. (See information at <https://www.bls.gov/ooh/architecture-and-engineering/environmental-engineers.htm>.) Projections from the Utah Occupational Report indicate a more rapid growth rate for this employment category in Utah, with a projected 10-year employment growth rate of 24%. Utah salaries run a bit below the median of U.S. salaries, with a median pay in Salt Lake City of \$61,230 for an entry-level position, and \$76,460 for all environmental engineers. (See information at <http://jobs.utah.gov/jsp/wi/utalmis/gotoOccinfo.do>).

The Utah Occupational Report also lists the employment category of Environmental Science Teachers, Postsecondary. Nationally, this occupation is expected to add 600 jobs, of which 30 are projected for the state of Utah over the 2014-2024 time frame. Entry-level openings, across the state of Utah, provide a salary of \$55,840. The median salary, across the state, is \$91,130. These positions generally require a doctorate. (See information at <http://jobs.utah.gov/jsp/wi/utalmis/gotoOccinfo.do>).

This new Emphasis will assist in meeting the Governor's goal of 66% of Utahans aged 20-64 having a postsecondary degree or certificate by 2020 by providing an educational program designed to meet projected needs in the growing fields of atmospheric and environmental chemistry.

Consistency with Institutional Mission/Impact on Other USHE Institutions

Explain how the program is consistent with the institution's Regents-approved mission, roles, and goals. Institutional mission and roles may be found at higheredutah.org/policies/policyr312/. Indicate if the program will be delivered outside of designated service area; provide justification. Service areas are defined in higheredutah.org/policies/policyr315/.

The University of Utah's mission statement reads (<http://higheredutah.org/policies/policyr312/>): “The University of Utah fosters student success by preparing students from diverse backgrounds for lives of impact as leaders and citizens. We generate and share new knowledge, discoveries, and innovations, and we engage local and global communities to promote education, health, and quality of life. These contributions, in addition to responsible stewardship of our intellectual, physical, and financial resources, ensure the long-term success and viability of the institution.”

The proposed new emphasis in Atmospheric and Environmental Chemistry will provide the educational background that is necessary for future leaders to preserve and improve our environment and our air quality. We anticipate that students who are trained in this discipline will gain the knowledge required for good stewardship of our air quality and other aspects of our environment, which are in turn necessary for the health of our Utah citizens. Well-trained and knowledgeable citizens in these areas are of crucial importance to the well-being of our state.

Finances

What costs or savings are anticipated in implementing the proposed program? If new funds are required, indicate expected sources of funds. Describe any budgetary impact on other programs or units within the institution.

This proposal to create an Atmospheric and Environmental Chemistry emphasis utilizes courses that are already in existence, so no additional courses are required to create this emphasis. Thus, the creation of this new emphasis is expected to have no impact on the finances of the institution.

Section III: Curriculum

Program Curriculum

List all courses, including new courses, to be offered in the proposed program by prefix, number, title, and credit hours (or credit equivalences). Indicate new courses with an X in the appropriate columns. The total number of credit hours should reflect the number of credits required to receive the award. **For NEW Emphases, skip to emphases tables below.**

For variable credits, please enter the minimum value in the table below for credit hours. To explain variable credit in detail as well as any additional information, use the narrative box below.

Course Number	NEW Course	Course Title	Credit Hours
General Education Courses (list specific courses if recommended for this program on Degree Map)			
General Education Credit Hour Sub-Total			
Required Courses			
Add Another Required Course			
Required Course Credit Hour Sub-Total			
Elective Courses			
Add Another Elective Course			
Elective Credit Hour Sub-Total			
Core Curriculum Credit Hour Sub-Total			0

<i>Are students required to choose an emphasis for the already-existing degree?</i> X Yes or No

Course Number	NEW Course	Course Title	Credit Hours
Name of Emphasis:		Atmospheric and Environmental Chemistry Emphasis	
CHEM 3070		Thermodynamics	4
ENVST 2100		Intro to Environment and Sustainability	3
ATMOS 5000		Intro to Atmospheric Science	3
ATM/ENV Elec		At least 14 credits from: 3100, 5020, 5040, 5050, 5100, 5130, 5140, 5270	14
Adv Lab		Select from CHEM 5700, 5710, 5720, 5730, 3200	2
Adv Lab		Select from CHEM 5700, 5710, 5720, 5730, 3200	2
Add Another Emphasis Course			
Emphasis Credit Hour Sub-Total			28
Total Number of Credits to Complete Program			28

Propose a NEW Emphasis to an existing Regent approved program

Program Curriculum Narrative

Describe any variable credits. You may also include additional curriculum information, as needed.

For ATM/ENV elective, students have the option to focus their emphasis in atmospheric science or environmental and sustainability studies. They may select:

ATMOS	3100	Atmospheric Chemistry and Air Pollution
ATMOS	5020	Environmental Programming
ATMOS	5040	Environmental Statistics
ATMOS	5050	Environmental Instrumentation
ATMOS	5100	Introduction to Atmospheric Dynamics
ATMOS	5130	Physical Meteorology I: Thermodynamics
ATMOS	5140	Physical Meteorology II: Atmospheric Radiation
ATMOS	5270	Wind Power Meteorology
ATMOS	5400	The Climate System
ATMOS	5495	Biophysical Ecology
ATMOS	5520	Remote Sensing of the Environment
GEOG	3140	Introduction to Geographic Information Systems
ENVST	3210	Global Climate Change
POLS	5322	Environmental & Sustainability Policy
ENVST	3364	Challenges to Global Sustainability (IR)
ENVST	3365	Environmental Justice (DV)
ENVST	3368	Energy Choices for the 21st Century

Within the elective options, students may have up to 2 credit hours of research count toward their electives. This could be in CHEM, ATMOS, or ENVST departments:

ENVST	5000	Undergraduate Research
CHEM	4800	Undergraduate Research
CHEM	4999	Honors Thesis

ATMOS 3910 Undergraduate Research

For the Adv Lab options, students can choose from CHEM 5700 (Adv Analytical Chemistry Lab), CHEM 5710 (Adv Organic Chemistry Lab), CHEM 5720 (Adv Physical Chemistry Lab), and CHEM 5730 (Adv Inorganic Chemistry Lab), CHEM 3200 (Radiochemistry Lab)

Degree Map

Degree maps pertain to undergraduate programs ONLY. Provide a degree map for proposed program. Degree Maps were approved by the State Board of Regents on July 17, 2014 as a degree completion measure. Degree maps or graduation plans are a suggested semester-by-semester class schedule that includes prefix, number, title, and semester hours. For more details see <http://higheredutah.org/pdf/agendas/201407/TAB%20A%202014-7-18.pdf> (Item #3).

Please cut-and-paste the degree map or manually enter the degree map in the table below

Fall 1st year
CHEM 1210 4
CHEM 1215 1
MATH 1210 (QR) 4
CHEM 2000 1
Gen Ed (WR2) 3
Total Credits 13

Spring 1st year
CHEM 1220 4
CHEM 1225 1
MATH 1220 4
Gen Ed (AI) 3
Gen Ed (BF) 3
Total Credits 15

Fall 2nd year
CHEM 2310 4
CHEM 2315 2
MATH 2210 3
PHYS 2210 4
PHYS 2215 1
Total Credits 14

Spring 2nd year
CHEM 2320 4
CHEM 2325 2
PHYS 2220 4
PHYS 2225 1
ENVST 2100 (BF) 3
Total Credits 14

Fall 3rd year
CHEM 3000 (CWQI) 4
CHEM 3060 (QI) 4
ATMOS 5000 3
Gen Ed (FF) 3
Total Credits 14

Spring 3rd year
CHEM 3100 5
CHEM 3070 (QI) 4
ATM/ENV Elec 3

Gen Ed (FF) 3
Total Credits 15

Fall 4th year
Adv Lab 2
ATM/ENV Elec 3
ATM/ENV Elec 3
Gen Ed (HF) 3
Gen Ed (DV) 3
Total Credits 14

Spring 4th year
Adv Lab 2
ATM/ENV Elec 3
ATM/ENV Elec 3
Gen Ed (HF) 3
Gen Ed (IR) 3
Total Credits 14



April 11, 2017

Dear Senate,

As the Director and Associate Director of the Environmental and Sustainability Studies program, we write in support of the proposed emphases within the Chemistry program. We are excited to have our classes integrated as potential electives within one of the proposed emphases. We also view this as an important part of furthering interdisciplinary connections across campus. We have met with the Chemistry Department and discussed the courses that would be added and again fully support this collaboration.

Sincerely,

Brett Clark
Director of Environmental and Sustainability Studies

Jennifer Watt
Associate Director of Environmental and Sustainability Studies

Environmental and Sustainability Studies Program

260 S. Central Campus Dr., Rm. 252
Salt Lake City, Utah 84112-9155
(801) 585-5403
FAX (801) 585-6402

To: Academic Senate

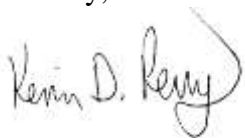
From: Dr. Kevin D. Perry, Chair
Department of Atmospheric Sciences

Date: August 25, 2017

Re: Letter of Support for Chemistry Emphases

As chair of the Department of Atmospheric Sciences, I fully support the proposed Chemistry emphases. We have met with representatives from the Department of Chemistry to discuss the proposal and are very pleased with the breadth of courses which are included. This effort should help break down the barriers that exist between Departments/Colleges and will allow students to explore topics in a truly interdisciplinary manner. As a result, we are very enthusiastic about this collaboration.

Sincerely,



Dr. Kevin D. Perry



September 6, 2017

David B. Kieda
The Graduate School
University of Utah
201 Presidents Circle, Room 302
Salt Lake City, UT 84112

Dear Dean Kieda:

I fully endorse the proposal to create new BA/BS in Chemistry with an emphasis in Atmospheric and Environmental Chemistry. This is an area of great interest to our students, especially those in chemistry, where the core scientific concepts provide essential context for atmospheric and environmental issues affecting our local and global communities.

Environmental science represents a fast-growing area of academic research and sector of industry, meaning that this emphasis would both respond to our students' expressed desires while also providing them with improved access to career opportunities.

Atmospheric and environmental issues are interdisciplinary by nature; therefore, an important aspect of this emphasis will be exposure to a broader selection of topics in allied areas. For this reason, we have secured the endorsement not only of the Chemistry faculty, but also Kevin Perry, Chair of the Department of Atmospheric Sciences, and Brett Clark, Director of Environmental and Sustainability Studies.

The creation of this emphasis will enhance our ability to serve students within the College of Science and throughout the University of Utah. There is no additional cost to the University. For these reasons, it is my pleasure to add the College of Sciences endorsement to those of Drs. Burrows, Perry, and Clark and their respective departments.

Sincerely,

A handwritten signature in black ink that reads 'Henry S. White'. The signature is written in a cursive, flowing style.

Henry S. White
Dean, College of Science, and
Distinguished Professor of Chemistry



Committee on Admissions Standards and Degree Programs
College of Science
1430 Presidents Circle, Room 220
Salt Lake City, UT 84112-0140
Attn: Lisa Batchelder

August 21, 2017

Dear Committee Members:

Over the past several years, we have been finding an increasing number of students majoring in chemistry who would like to emphasize topics that are particularly relevant to atmospheric and environmental chemistry. These topics are of great current interest, both on a global basis (greenhouse gas chemistry and global warming) and a more local basis (photochemical smog; toxic metal pollution). Our Undergraduate Education Committee has looked into the possibility of offering an Emphasis within our B.A. and B.S. degree programs in Atmospheric and Environmental Chemistry, and has developed a proposal for this Emphasis that is reasonable in scope, has high academic standards, and which is enthusiastically supported by our colleagues in the Department of Atmospheric Sciences (College of Mines and Earth Sciences) and in the Environmental & Sustainability Studies Program (College of Social & Behavioral Science).

I have reviewed the proposal, which has been approved by our faculty, and add my enthusiastic support for it. These topics are highly relevant to our societal needs, and students are clamoring for such an emphasis. The proposed Atmospheric and Environmental Chemistry Emphasis does not remove any required courses from our basic Chemistry degree, but does allow certain electives to be replaced by solid science courses selected from the Department of Atmospheric Sciences or the Environmental Studies program. In addition, students are able to take up to 2 credit hours of research toward the degree; this research can be done in the Chemistry, Atmospheric Sciences, or Environmental Studies programs.

I hope that the College of Science (and the University as a whole) will share my enthusiasm for this new proposed Emphasis, and will approve the proposal.

Sincerely yours,

Cynthia J. Burrows
Distinguished Professor of Chemistry
Thatcher Presidential Endowed Chair of Biological Chemistry and
Chair, Department of Chemistry
burrows@chem.utah.edu
(801) 585-7290

DEPARTMENT OF CHEMISTRY
315 SOUTH 1400 EAST ROOM 2020
SALT LAKE CITY UT 84112-0850
(801) 581-6681
(801) 581-8433 FAX

List each of your program's learning outcomes, and then provide a narrative and/or attach a table to describe the evidence - surveys, assignments, exams, questions, etc. - that will be used to measure each outcome.

Expected Student Learning Outcomes

In addition to the current Chemistry BS/BA student learning outcomes, students will be able to:

- Examine how fundamental principles in chemistry are related to atmospheric and environmental phenomena and issues.
- Use problem-solving skills to analyze current challenges related to the local and global atmosphere and environment (such as photochemical smog, toxic metal pollution, greenhouse gas chemistry, and global warming).

A student majoring in the Atmospheric & Environmental Chemistry emphasis will write a capstone paper during their last two semesters addressing a particular atmospheric or environmental issue of their choice. A mentor will be assigned to provide guidance. This paper must demonstrate how fundamental principles in chemistry apply to their selected topic and will use problem-solving skills to analyze the issues related to that topic.

How will evidence be collected?

Students will submit their capstone paper to the academic advisor in chemistry at the end of the semester preceding their graduation. There will be a required checkbox on the degree audit to indicate successful completion of this requirement.

Describe (or attach using the uploader below) the rubric or assessment tool you will use to measure each piece of evidence:

A rubric will be developed to evaluate the capstone project to determine the extent to which the expected learning outcomes are met. The capstone paper will be evaluated by a different faculty member (not the assigned mentor) based on the rubric. Successful completion of the capstone paper will be noted in the student's record.

How will you analyze and present the analysis of your evidence?*

When sufficient students have completed this emphasis to merit an overall review, the results of the capstone paper evaluations will be reviewed by the Chemistry Undergraduate Education Committee. The committee will report to the general faculty the results of this review, along with proposed changes in the curriculum in the event that the ELOs are not being achieved.