B19

"Big Ideas" Funding Proposal
One-Time Non-Base Investment Proposal: Step 2

(Please limit the proposal narrative and attachments to 10 pages)

Proposal Name: Redesign of Chemistry Programs

1. Provide a description of the project being proposed. (5 points)

This proposal is to redesign and realign the academic programs in chemistry to meet new American Chemical Society (ACS) standards. It will include redesign of chemistry programs, redesign and development of courses to meet new standards and increase persistence, and development of advising materials.

MSU, Mankato offers two bachelor degree options in chemistry, an ACS-approved emphasis and a Generalized emphasis. These programs were developed years ago following a traditional curricular structure which was prominent and encouraged by ACS standards in the last several decades. The format and structure of the programs results in a highly pre-requisite oriented and rigid academic experience. The current ACS approved emphasis includes the following courses:

Required General Education:

MATH 121 Calculus I (4)
PHYS 221 General Physics I (4)

Major Common Core:

CHEM 201 General Chemistry I (5)
CHEM 202 General Chemistry II (5)
CHEM 305 Analytical Chemistry (4)
CHEM 320 Organic Chemistry I (5)
CHEM 321 Organic Chemistry II (3)
CHEM 331 Organic Chemistry II Lab (1)
CHEM 381 Introduction To Research (2)
CHEM 413 Advanced Inorganic Chemistry (3)
CHEM 423 Spectroscopic Determination of Structure (4)
CHEM 440 Physical Chemistry I (3)
CHEM 441 Physical Chemistry II (3)
CHEM 450 Physical Chemistry Lab I (1)
CHEM 451 Physical Chemistry Lab II (1)
CHEM 495 Senior Seminar (1)
MATH 122 Calculus II (4)
PHYS 223 General Physics III (3)
PHYS 233 General Physical III Lab (1)

Major Emphasis: ACS approved

CHEM 415 Inorganic Preparations (2)
CHEM 475 Instrumental Analysis (4)

Chose 3-4 credits:
CHEM 360 Principles of Biochemistry (4)
CHEM 460 Biochemistry I (3) (For students choosing this course, they must enroll in another upper division chemistry course for at least 1 credit.)

Required MATH/PHYSICS electives for ACS approved emphasis:

Chose 3-4 credits: Choose a minimum of 3 credits from the following courses.

MATH 321 Ordinary Differential Equations (4)
MATH 455 Theory of Statistics I (4)
PHYS 441 Mechanics (4)
PHYS 447 Electricity and Magnetism I (3)
PHYS 453 Solid State Physics (3)
PHYS 473 Statistical Physics (3)

(From the 2011-2012 Undergraduate Bulletin, page 110-113)

The student who wishes to graduate with a BS in Chemistry-ACS approved emphasis must enroll in the following chemistry courses in the specified order and the "gen ed and common core" math and physics supporting courses during their sophomore year. Additional chemistry courses, math and physics and general education courses are filled in around this skeleton.

Freshman year, Fall Chem 201* *College Algebra must be completed to meet the math pre-req.	**Freshman year, Spring** Chem 202 math (Calculus I, to meet physics pre-req)
Sophomore year, Fall Chem 320 and 305 math, physics	**Sophomore year, Spring** Chem 321, 331 and if needed 305 math, physics
Junior year, Fall Chem 381, 440**, 450 **General Physics III and Calculus II must be completed to meet the pre-reqs	**Junior year, Spring** Chem 441, 451
Senior year, Fall Chem 413	**Senior year, Spring** Chem 415, 495

This traditional format is based on historical patterns and expectations that assume students who are interested in a chemistry major:

- are calculus ready upon enrolling in the University,
- are able to persist and pass all coursework on the first attempt to meet "C" or higher pre-requisites set up in subsequent courses,
- are able to persist and pass chemistry, math and physics heavy semesters as freshman and sophomores,
- will complete their degree at the same institution where it is started.

In late 2008, the ACS Committee on Professional Training (ACS-CPT) published a substantially revised set of Guidelines and Evaluation Procedures for Bachelor Degree Programs (a pdf file is available upon request). This publication marked a major shift in the curricular structure needed for ACS approval to undergraduate programs. It moved from the traditional "ordering" of topics structure, such as we use, to a structure that recognizes general chemistry, followed by foundation areas with a minimum of 15 credits. Further, these guidelines allow students to build on any foundation area with 12 more credits that can be based on student interest or programmatic needs. Also, the new guidelines are less rigid in math and physics support course requirements to allow for greater flexibility by departments. With the implementation of these guidelines, the ACS also clearly allowed for existing approved programs to maintain their traditional curricular structure if a department/program determined that it would prefer to.

At the time the 2008 guidelines were published, the bachelor degrees in chemistry at MSU were showing a modest growth and the chemistry faculty members believed that the growth trend would be sustainable and continue. Since 2008, the drive to establish more efficient teaching due to budgetary issues and the evolving demographic and needs of our students has changed perspectives for many of us. We are proposing a redesign of the chemistry programs to meet the ACS-CPT guidelines rather than follow the traditional structure. Using the new guidelines we propose redesigning our chemistry programs with the following overall structure:

Intro or General Chemistry
Chem 201 (5)*, Chem 202 (5)

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Foundation Coursework
5- courses (3 credit minimum) in each area:

Analytical:	Biochemistry:	Inorganic:	Organic:	Physical:
Chem 305 (4)	Chem 360 (4) or Chem 460 (3)	Chem 316 (3) **	Chem 320 (4)*	Chem 340 (2)** Chem 440 (3)* 450 (1)*

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In depth Coursework
4- courses (3 credits minimum) that hold foundation as pre-req

Analytical:	Biochemistry:	Inorganic:	Organic:	Physical:
Chem 475 (4) Chem 407 (3)	Chem 461 (3) Chem 465 (1) Chem 466 (2) Chem 474 (2)	Chem 317 (3)** Chem 419 (2)**	Chem 321 (4)* Chem 331 (1)* ? Chem 423 (4) Chem xyz (1)**	Chem 441 (3)* & Chem 451 (1)*

Other Chemistry courses:
Chem 381 (2) and Chem 495 (1)
Research credits: Note these cannot exceed 4 total and for a student using research to meet in-depth course requirement for the ACS certification "must include a well-written comprehensive, and well documented research report including safety considerations." (pg13)
Lab must have a minimum of 400 hours after gen chem

*existing courses that will undergo curricular revision, **new courses

Supplementary/Support areas:
Physics-1 year with laboratory Phys 211, 212 (8)
Math 121, 122, (recommends additional courses Math 223, 247 and/or 321)

MnSCU requirements:
120 credits including gen ed, 40 credits must be upper division, 30 credits must be taught by faculty awarding degree

Redesigning and realigning the curriculum to a three-tier format will necessitate the rethinking of how and when we offer courses to maximize enrollment and efficiency. It must also allow for faculty to maintain and grow laboratory-based research programs for the health and growth of CSET. We have a lot to balance and think about to achieve this. For example, currently in the fall semester General Chemistry I is offered with 3 lecture times at enrollments of 96 students maximum per time and General Chemistry II is offered with 1 lecture time at an enrollment maximum of 96 students. This format allows the department to meet typical enrollment demand and allows flexibility for the schedule needs/constraints of the various student populations who enroll in General Chemistry. However, this format also means that four faculty members (1/4 the department) are tied with the demands of the larger general chemistry lecture. Normally, two of the four instructors also have upper division laboratory and lecture load which has no laboratory support. This creates a variety of different productivity and efficiency problems in load and upper division course offerings and caps effective ongoing laboratory-based research for faculty. Attempts in the past to create even larger lectures that were to be rotated among faculty to decrease persisting high SCH levels did not result in rotation and only burnt out the few faculty who taught the larger lectures. This is only the general chemistry sequence; similar situations exist throughout our department due to the service nature of our courses. Any new approach we ultimately choose to schedule high enrollment, high demand lectures and the associated load will need to reconsider how to meet the student demand in our large enrollment service courses without sacrificing student scheduling constraints or course completion rates. Additionally and importantly we also have to develop a template that allows our upper division courses to be taught on a regular rotating schedule for the health of our majors. All of this needs to also give these faculty members a chance to develop sustainable research that isn't thwarted by persistently high 800 SCH levels within the standards of the contact hours both addressed in the contract and the contact hour standard set by the ACS-CPT guidelines.

2. Describe how the project will drive positive transformational change. (5 points)
Transformational change: A shift in the business culture of an organization resulting from a change in the underlying strategy and processes that the organization has used in the past. A transformational change is designed to be organization-wide and is enacted over a period of time. (http://www.businessdictionary.com/definition/transformational-change.html)

This project will drive transformational change by:

1-Shifting to a less restrictive core of courses.

The new foundation approach includes one course in each of the five major sub-disciplines. This perspective allows for students to tailor their interests into specific areas at a much earlier stage than currently and if implemented in this fashion represents a significant change from current curricular philosophy in chemistry programs.

The current core also includes support courses in calculus and calculus-based physics. Our proposed change will maintain the same calculus level support core, but will switch to an algebra-based physics core. This allows our students the opportunity to enroll in a sequence that has a greater variety of lecture and laboratory times eliminating some existing scheduling conflict issues. Further, our students will be able to enroll in a complete two semester sequence and will have greater continuity and breathe of physics than they are able to obtain from the first and third semesters of the calculus-based sequence currently. Since most of our majors declare mathematics as their minor, the upper division support needs will be unchanged.

2-Streamlining student pre-requisites.

As noted in the description, the redesign of the chemistry programs' curricula will result in substantial change from the traditional format used here at MSU since at least 1986 when the Biochemistry courses were first developed. Redesigning courses or "packets" of the program to rely on fewer or different pre-requisites rather than the current, rigid eight semester sequencing signals a transformational approach to the big picture design of our chemistry programs.

As a consequence of this proposed format, students will be able to streamline their pre-requisites into smaller course groupings which would create substantial flexibility for them. For example, as noted in the current program advising table above, a student must take Chem 413 with inorganic topics in his senior year, fall term due to tradition. In the new structure after completion of Chem 202 (with a "C" or higher), a student could enroll in the new inorganic course Chem 316 which would allow him to meet a foundation requirement. Then, after completion of Chem 320 (another foundation requirement), a student could enroll in the new course Chem 317 which would allow him to meet an in-depth requirement for the program. Theoretically, a student could take both inorganic courses by the end of his third fall term.

Similar streamlining potential exists in each of the other foundation and in-depth areas for our students.

3-Shifting perspective from traditional sub-disciplines to foundation and in-depth structure concepts and creating opportunity for more inter- and intra-disciplinary approaches to chemistry topics.

Another transformational change will result from the ACS-CPT guidelines perspective that in-depth courses must build on ideas introduced in foundation courses, but do not have to follow specific foundation areas. As proposed, current and new courses will be modified or designed to meet the foundation or in-depth requirements that the new ACS-CPT guidelines address. This allows for a more rapid change to the new guidelines, but does not limit future ideas. For example a future in-depth course could combine the organic and physical foundations to create a new course that explores theoretical modeling, synthetic organic molecule design or the derivation of energy from organic molecules. These ideas represent long term transformational change opportunity.

4-Allowing a greater diversity of approaches to curriculum to meet student needs or interests and incorporating use of on-line teaching to help 'at risk' students or increase persistence among all students.

Online teaching for chemistry courses is challenging due to the hands on laboratory component in almost all of our courses. For many of us, the weekly experiments are integrated into lecture and the discussion that occurs immediately before and following a laboratory. As on-line ideas have evolved at MSU, we have often struggled to find a manner to incorporate this approach while not losing the coherency in the integrated lecture and laboratory. This new structure allows for opportunity to start the process of integrating online teaching into our programs. For example, in the redesign of Chem 201, members of the general chemistry team have addressed developing modules specifically designed to help at risk students. These modules would be delivered online and address areas that augment student learning such as remedial algebra skills, solving mathematical word problems and critical reading of scientific writing. Additionally, an online course is being proposed that would bridge the gap between algebra-based general chemistry, algebra-based general physics and calculus-based physical chemistry. These ideas represent just the start of online development and could lead to greater incorporation of online learning in a manner that is cohesive with our integrated lecture, discussion, laboratory model. While this approach does not create a program or certificate that is entirely online, it does represent a transformational shift to a more hybridized learning environment which is a significant perspective change.

5-Creating opportunity for study abroad.

The current curriculum makes it nearly impossible for a Chemistry major to study abroad during the academic year. Since most international programs are not structured following the traditional ACS format that we use, students are faced with choosing between studying abroad and the opportunities and experiences associated with it or completing their degree in a "normal" amount of time. For advising purposes, we generally point out that study abroad will add one additional year to the undergraduate chemistry program. The new curriculum will still present some challenges for study abroad participants, but should allow new opportunity for the motivated student.

3. Explain how the project addresses student recruitment, retention, persistence, and/or completion or one or more of the 12 Challenges. (10 points)

As noted in the response to question #1, the current chemistry programs are extremely rigid and offer minimal flexibility in sequencing. This traditional format is based on historical patterns and expectations that assume students who are interested in a chemistry major:

- are calculus ready upon enrolling in the University,
- are able to persist and pass all coursework on the first attempt to meet "C" or higher pre-requisites set up in subsequent courses,
- are able to persist and pass chemistry, math and physics heavy semesters as freshman and sophomores,
- will complete their degree at the same institution where it is started,
- will not study abroad during the academic year.

These expectations are out of touch with the needs, preparation level and expectations of the typical student of today. By staying the tradition course, we have increased persistence and lost opportunity to grow. This project addresses recruitment, retention, persistence, completion and creates an opportunity for Chemistry majors to pursue study abroad opportunities without sacrificing persistence.

Recruitment, Retention and Persistence: Over the last several years, the Bachelor's degrees in Chemistry have maintained constant smaller sized enrollment. One of the factors that have limited student interest is the lack of flexibility in the course schedule. As noted, current students must keep on track in their courses and must register for their chemistry courses in the correct term or risk the addition of at least one year to their academic career. For many students who must work while attending college, this creates stress when work schedules conflict with course times. While some of these situations cannot be eliminated, it may be possible to reduce them by allowing students a greater flexibility in tailoring upper division chemistry courses and labs to both their interests and possibly their scheduling constraints. Further conflicts arise within the University scheduling. In the last two years the University based conflicts have included General Physics III lab and upper level Biology courses with labs being offered at a time that conflicts with core Chemistry courses and Honors courses or seminar time conflicts and so on. While we do not believe all of these types of conflicts can be resolved, simply creating a less rigid framework for our students' chemistry courses will ease some of that burden. In some cases right now these issues cannot be simply resolved. Meaning for our students they must add extra time to degree or in some cases, it is just simpler for them to switch to a major that is more flexible and viewed to be less academically difficult as well.

Another limiting factor is the rigor of coursework in the first two years when NEF students are trying to adjust to college life and the associated responsibility. They are often over-whelmed by the amount of chemistry, mathematics and calculus-based physics that must be taken simultaneously in the first two years. In our current program, NEF are assumed to be calculus ready. Typical incoming freshman, who are science majors at MSU, are enrolled in either college algebra level or pre-calculus level math courses; only about 20% of the NEF science majors are calculus ready. The proposed program allows our students to more time to complete Calculus I (possibly as late as the junior year, fall term) and still graduate within four years. It also will decrease the intensity of coursework in those early years making start to the chemistry major less daunting. Additionally and of growing note, our transfer students are frustrated in learning that they must enroll in at least one course (typically Chem 305) before they can begin the "junior year" of the schedule which effectively adds one year to their program. So frequently, these students switch to other majors immediately to reduce the number of years to graduation.

In addition, the proposed realignment would ease some stresses due to unsuccessful first attempts in courses. The typical drop and failure rate in general chemistry has fluctuated between 30% and 50% in the last five years (program review data, 2011) while the drop and failure rate in the current 5 credit Organic I course is about 25%. This proposal includes different features to address these rates. General Chemistry I will be modified to include a "readiness measure" most likely in the form of a placement exam, along with a companion online "entity" (possibly an elective course) that helps at risk students and lowers the drop/failure rates. Organic I and Organic II will be modified to redistribute topics more evenly through the sequence and a new course will address specific preparation needs for students who precede from Organic I to Biochemistry (without taking Organic II). We believe that decreasing the intensity of Organic I should serve to increase success rates for this course. Combining the greater flexibility of the proposed program realignment with summer course offerings, students could in principle repeat these early courses if needed and still be able to proceed through the program without adding another year of study.

While our initial perception of course placement could follow a plan such as:

Freshman year, Fall Chem 201* *College Algebra must be completed to meet the math pre-req.	**Freshman year, Spring** Chem 202 math
Sophomore year, Fall Chem 305, 320 physics, math as needed	**Sophomore year, Spring** Chem 321 & 331, 340 physics
Junior year, Fall Chem 381, 440, 450	**Junior year, Spring** Chem 360, 3 credits of in depth Chem
Senior year, Fall Chem 316, 3 credits of in depth Chem	**Senior year, Spring** Chem 495, 3 credits of in depth Chem

The ability to move Chem 316, 360/460, 440 and 450, (all foundation courses) between junior and senior year semesters opens the door for transfer students to complete a degree in two years if all general chemistry and organic chemistry courses are completed prior to transfer. They would just need to select in depth courses with appropriate pre-requisites in their first year at MSU. Further, this new, more innovative approach to the curriculum in the chemistry programs should allow our enrolled students a greater flexibility to incorporate research (possibly including summer REU programs) as part of their in-depth studies without hurting persistence.

Challenge 9-Cultural Graduation Requirement: The ability to mix and match the junior and senior year course schedules also allows our students to pursue other interests such including study abroad. In our current programs, most students minor in math; other minors generally add time to degree. Students who do choose to study languages or pursue more diverse minors initially generally are discouraged by the time they complete the second year of our chemistry program and drop that supporting area. Working with the study abroad requirement for honors students has also been particularly challenging. It is possible to arrange coursework in the proposed alignment to group in-depth study courses into one year as outlined below:

Freshman year, Fall Chem 201* *College Algebra must be completed to meet the math pre-req.	**Freshman year, Spring** Chem 202 math
Sophomore year, Fall Chem 305, 320 physics, math as needed	**Sophomore year, Spring** Chem 321 & 331, 340 physics
Junior year, Fall 3 to 6 credits of in depth Chem	**Junior year, Spring** 6 credits of in depth Chem
Senior year, Fall Chem 316, 381, 440, 450	**Senior year, Spring** Chem 360, 495

This creates a number of possibilities for students to pursue study abroad courses in their junior year. This type of rearrangement is not available in the traditional programmatic structure we follow now, truly forcing our chemistry majors to either add year(s) to their study or simply not seek these important opportunities for growth and learning.

We are hopeful that the opportunity to redesign our chemistry programs into a more dynamic curriculum will also lead to greater creativity and innovative approaches to other directly related areas such as advising, scheduling, student-centered research and multidisciplinary courses. Developing more detailed materials to support and encourage these types of academic plans is included in this proposal.

4. Describe the impact this project will have on students and/or others whom we serve. (10 points)

This project will impact a variety of students. Those who are interested in pursuing or are pursuing a major in chemistry will be significantly affected. They will:

- Benefit from online content modules or companion courses to aid 'at risk' or mainstream students,
- Experience greater flexibility in their coursework due to the reduction in pre-requisites,
- Increase their opportunities to seek other minors or to work to help support their education without sacrificing persistence,
- Have an opportunity to study abroad without sacrificing persistence,
- Have greater opportunity to use undergraduate research or summer REU programs in the curriculum,
- Be able to visualize a three-tiered pyramid to the program so that the baccalaureate degree is viewed as more achievable.

Additionally, the General Chemistry sequence and Organic Chemistry I courses serve several of the high enrollment Biology programs and a large number of other programs throughout the University (Chem 201 is required in 38 programs in CSET, COE and CSBS; retrenchment rebuttal data Feb 2010). These students will also benefit from this project. The impacts for this audience include:

- Benefit from online content modules, readiness testing and/or companion courses to aid 'at risk' or mainstream students. This is notable since a large number of our repeat students fall into the service group categories.
- Decrease in the intensity of Organic I which should increase success rates for this course.
- Experience greater flexibility in their coursework due to the reduction in pre-requisites which should help them achieve a flexible balance between their chemistry courses and the courses in their major.
- Increase their opportunities to seek other minors (several biology programs require a minor in chemistry) or to work to help support their education without sacrificing persistence.

5. Identify the "SMART" outcomes for the project (specific, measurable, achievable, relevant, and time-bound). (5 points)

- Development and submission (where required) of *thirteen* either new or redesigned chemistry courses to reflect the new ACS-CPT guidelines and philosophy.
- Development of a placement test for General Chemistry I to increase success rate in this course; along with the development of supplementary materials to improve performance of "at risk" students.
- Development and submission of redesigned chemistry programs.
- Development of advising materials.
- Redesign of load templates and course scheduling materials.
- Increased success rates in General Chemistry and Organic I Chemistry courses.
- Growth in the number of students in chemistry programs.

6. Discuss what this project will do for the university that warrants the investment. (5 points)

This project will have a strong return on investment for the University. It will directly increase the success rate and persistence by creating stronger support in readiness testing and companion material for General Chemistry I and reallocated content in Organic Chemistry I and II. This will lead to fewer repeated enrollments in General Chemistry and Organic Chemistry courses, which will also create more room for demand on these courses and increased productivity by faculty. Additionally, the higher success rate will help promote retention and recruitment into critical STEM fields. This proposal will result in the creation of online and hybrid courses and modules used in the chemistry programs; by doing so, one of the traditional science areas in CSET will move towards this venue and hopefully help change attitudes by some of our sister departments towards using online. It will take a highly structured, traditional curriculum and redesign it to a more flexible, more dynamic curriculum which will allow students to pursue other interests such as study abroad without sacrificing persistence. The increased flexibility should also allow faculty to incorporate research opportunities into the curriculum thereby driving demand to establish and/or maintain undergraduate research projects. The opportunity for faculty to rethink and redesign course scheduling and load in an area such as chemistry with its significant dependence on "wet" laboratory work (work involving chemicals and equipment) would signify a commitment to allowing us to drive the innovation and redesign. If we can be allowed to address these complicated interwoven scheduling, load and curricular issues during the summer or between terms when we are not generating the ~800 average SCH load our chemistry and biochemistry faculty produce, we can start the process with greater attention to details and fewer distractions. This too will allow us to be more productive wince we will not have to balance all of the large enrollment service course demands, experimental laboratory work demands and numerous other academic term demands with redesigning these programs.

7. Describe how the activities generated by this project would be sustained after one-time funding has ended, or if applicable, explain why the project does not need to be sustained. (5 points)

The activities and products generated by this project create a marked shift in the chemistry programs offered at MSU, Mankato in a short period of time. By the end of the funding period, none of the activities created by this project should require on-going funding. The new programs will be created and in the Undergraduate Bulletin. Redesigned load templates and teaching schedules for faculty will be developed, but may require modification as staffing continues to change and evolve. Advising materials will be developed and our undergraduates will be transitioned into a different curricular approach to their Chemistry degrees. All of these subsequent activities are typical components in the maintenance of programs. Further, the activities will serve as the foundation for growth in the programs in the future and importantly as the foundation for a new normal.

8. Budget (5 points):

Outline the funding requested using the categories listed below. Please identify any additional or matching funds that may available to support the project. Please note, budget revisions beyond 10% total change from the initial proposal require approval. Budget revisions of more than 20%, constitutes a major change in the project scope and will not be approved.

(table moved to next page for coherency.)

	FY12	FY 12 Matching Funds	FY13	FY 13 Matching Funds	FY14	FY14 Matching Funds
Personnel						
Unclassified Salary (in-load, overload)	10,477.80		25404.98		4957.35	
Classified Salary						
Fringe[a] (Classified and Unclassified)	1571.67		3810.74		743.60	
Graduate Assistant Salary						
Graduate Assistant Tuition Reduction/Waiver[b]						
Non-Salary						
Student Help						
Purchased Services/Travel Expenses						
Supplies and Materials						
Building Improvement/Construction Costs						
Equipment						
Total Budget Requested	12,049.46		29,215.70		5700.95	

[a] Note: All current employees must be paid fringe benefits. Fringe should be estimated based on salary and position classification: Unclassified 30%, Classified 37%, Adjunct 7.65%.
[b] Estimated Tuition Reduction/Waiver for full-year enrollment: Masters $5,858, Doctoral $10,000.

9. Identify any special considerations or needs required for this project (e.g. physical space, contractual obligations, IT support, or collaborations with/implications for other units). (5 points)

IT support will be used as needed by Drs. Groh and Thoemke who are both developing online courses as part of this proposal.

10. Provide a project timeline outlining key tasks, milestones and dates for completion. (5 points)

Summer 2012

Faculty retreat to be scheduled tentatively for May 8, 2012 (FY2012): Retreat goals:

- Review three-tiered curriculum approach and new ACS guidelines.
- Discuss course changes needed to create new programs to meet new guidelines.
- Review and identify where pre-requisites may be able to be changed.
- Brainstorm on other possible transformational curricular changes.
- Brainstorm on approach to load and high enrollment service courses and possible rotation for upper division lecture/lab classes. (May use breakouts)

Lyuda Ardanova: 5 duty days to be worked between May 9 and June 29 (FY2012) and 5 duty days to be worked between July 2 and August 17 (FY2013). During this time she will complete these tasks:

- Design Chemistry 316 by creating specific learning outcomes, finding feasible textbook(s) and a sample syllabus.
- Identify possible experiments for students to conduct in Chem 316. Determine approximate feasibility (cost, reagents, glassware, safety, haz waste disposal & time versus learning outcomes).
- Prepare the new course CDS proposal to be submitted during the Fall 2012 term.

Brian Groh: 11 duty days to be worked between July 2 and August 17 (FY2013). During this time he will complete these tasks:

- Re-design Chemistry 320 and 321 by creating specific learning outcomes, finding feasible textbook(s) and creating sample syllabi that will be in line with a typical year-long course in organic chemistry. This redesign will result in three new courses, yet to be numbered, for CDS submission.
- Identify possible experiments for students to conduct in the re-designed Chem 320 and Chem 331 laboratories. Determine approximate feasibility (cost, reagents, glassware, safety, hazardous waste disposal & time versus learning outcomes). This lab will be coordinated with the lecture content in the redesigned Chem 320 and Chem 321 courses, respectively. Create a sample syllabus for the new Chem 331 lab.
- Prepare the new course CDS proposals for these three new courses to be submitted during the Fall 2012 term.

- Design a new online course, Chem 3xx, for students entering Chem 360 with less than one year of organic chemistry (Chem 320, 321) by creating specific learning outcomes, a course outline and a sample syllabus for this course.
- Begin formulating course materials and assignments to address these outcomes.
- Prepare the CDS proposal for Chem 3xx for submission during the Fall 2012 term.

Marie Pomije: 10 duty days to be worked between May 9 and June 29 (FY2012) and 10 duty days to be worked between July 2 and August 17 (FY2013). During this time she will complete these tasks:

- Design Chem 317 by creating specific learning outcomes, a course outline and a sample syllabus.
- Identify possible experiments for students to conduct in Chem 317 and determine approximate feasibility (cost, reagents, glassware, safety, haz waste disposal & time versus learning outcomes.)
- Prepare the CDS proposal for Chem 317.
- Design Chem 419 by creating specific learning outcomes, a sample syllabus and identifying an appropriate textbook.
- Prepare the CDS proposal for Chem 419.
- Create/Modify teaching load rotations for general chemistry to bring to the department for review in August/September 2012 based on retreat brainstorming.
- Create/Refine program structures based on feedback ideas from faculty retreat of May 2012 to bring to the department for review in August/September 2012.
- Create advising drafts for new programs to bring to the department for review in August/September 2012.

John Thoemke: 10 duty days to be worked between July 9 and August 17 (FY2013). During this time, he will complete these tasks:

- Develop a more detailed list of specific outcomes for each course, and begin formulating course materials and assignments to address these outcomes.
- Become familiar with web-based "Calibrated Peer Review" (CPR) program (http://cpr.molsci.ucla.edu/), and assess its suitability for use in Chem 340.
- Explore possibilities for on-line mathematical work by students such as "Maxima" (http://maxima.sourceforge.net/) which is available via the GNU general public license, or "Mathematica" which is licensed for student use on campus. This is likely to be a more challenging issue since ideally, he would like to come up with a way to have effective review and peer interaction requiring more than simply submitting an Excel spreadsheet to a D2L dropbox. He will consult with Matt Clay and other IT personnel as necessary.
- Develop at least one "pilot" assignment that will be used in Chem 450 during the Fall 2012 semester. This assignment will employ CPR as students write the portion of a lab report in which they interpret their data. This will provide an opportunity to gauge the effectiveness of this software tool and student response to this approach.
- Develop at least one "pilot" assignment that will be used in Chem 440 or Chem 450 during the Fall 2012 semester, employing on-line mathematical work and approaches the ideal described earlier.
- Upon completion of these "pilot" assignments, their effectiveness will be assessed on the basis of student surveys specifically addressing these issues and on measures of student learning.

<u>Fall 2012</u>

- Submission of curricular proposals.
- Continued development of new courses and modifications of existing courses.

<u>Winter Break 2012 – 13</u>

John Thoemke: 2 duty days to be worked between December 18 and January 4 (FY2013). This time will be used for thoughtful assessment of student performance on the two pilot assignments completed during Fall 2012, and informed by the outcomes, to plan for the work on the remaining components of Chem 340 and 341.

<u>Spring 2013</u>

- Continued development of new courses and modifications of existing courses.
- Continued identification and development of new laboratory experiments.

<u>Summer 2013</u>

Lyuda Ardanova: 5 duty days to be worked between May 14 and June 28 (FY2013). During this time she will complete these tasks:

- Create support material for experiments needed to conduct the first Chem 316 course. This includes preparation sheets, chemical/glassware orders, haz waste lists and the like.
- Conduct trial runs for the new experiments in Chem 316.
- Modify laboratory manual or experiment handouts as needed based on trial run through.

Brian Groh: 8 duty days to be worked between May 14 and June 28 (FY2013). During this time he will complete these tasks:

- Assess outcomes of the new courses (which replaced Chem 320, 321, and 331) and refine syllabi and modify experiments as needed.
- Finalize development of the online materials and assignments that will be used in Chem 3xx for Fall 2013.
- Create the online course within D2L. The design of the course website will be done with assistance from the instructional design team in IT.

Marie Pomije: 3 duty days to be worked between May 14 and June 28 (FY2013). During this time she will complete these tasks:

- Prepare annual report.
- Assess progress in course development, lab experiments and modify.
- Refine modified course rotations and/or load rotations for general chemistry, inorganic and physical chemistry areas based on program development.
- Create advising plans for new programs including ideas for transfer students.

John Thoemke: 10 duty days (FY2013) to complete the development of on-line course materials and assignments that will be used in the initial offering of the course, slated for Spring 2014. These days will be scheduled to avoid conflict with any summer teaching or other duties to which Dr. Thoemke may be assigned.

Fall 2013:

- New program schedule is started.
- New/modified courses are offered.
- New advising materials are used.

Spring 2014:

- New program schedule continues.
- New/modified courses are offered.
- New advising materials are used.

Summer 2014

Faculty retreat to be scheduled tentatively for May 14, 2014 (FY2014): Possible retreat goals:

- Review three-tiered curriculum approach and new programs.
- Assess effectiveness of changes.
- Review and identify where strengths and weaknesses exist in curricular approach.
- Brainstorm on other possible transformational curricular changes.
- Review and discuss course rotation, load to faculty, impact into research and other scholarly activities.
- Draft annual report. (May use breakouts.)