Department of Chemical Engineering Ten Year Review

Report of the Review Committee

Executive Summary

The Review Committee carried out the bulk of its work during the month of April 2009. The Committee studied the Department's voluminous Self Study document as well as other materials provided by the Graduate School, the Dean of the College of Engineering, the Department, and individual members of the faculty. Information was provided in hardcopy and electronic formats. A teleconference prior to the Site Visit was held with all Review Committee members, representatives of the Graduate School and the Dean of Engineering. Based on these sources, as well as discussions and information acquired during the Site Visit (April 22-24, 2009), the Committee discussed information gathered and issues identified, refined its thinking through vigorous exchange of views, and crafted this Report. Of course, it is well recognized that this report provides a low resolution snapshot of the Department but hopefully provides an accurate overview of the Department and of issues critical to the current and future success of the Department.

Overall, the Department has maintained a stellar record of research and education, particularly when the size of the Department is considered. It ranks 20th among the Departments of Chemical Engineering in the nation. It has a distinguished faculty with an enviable record of accomplishments in research, education, and administration. Indeed, three faculty members have contributed significantly to University of Washington Administration. The Department enjoys the benefits of a good physical plant and research infrastructure and is poised to benefit further from the construction of the new Molecular Engineering building.

The current Chair, Professor Eric Stuve, is very well regarded by the faculty and staff and effectively administers a consensus-driven Department. Professor Stuve plans to serve no more than two additional years and given that the Department must in the future survive a State-wide economic crisis, the transition of leadership is of critical concern. Because of the stress of limited resources, prioritization will be a necessity. The consensus-based operating style appears to have influenced the current Strategic Plan for the Department and can get in the way of identifying the few most promising areas of focus for the future directions of the Department. Strong and decisive leadership will be necessary in times of limited resources. Also, the Department has a unique opportunity to play a central role in the Molecular Engineering Initiative of the School of Engineering and coordination with this initiative should be a priority. Such coordination will require excellent communication with the Leadership of the College of Engineering. The ability to coordinate with the Leadership of the College of Engineering and with the broader University community, together with the ability to provide decisive leadership, should be considerations in identifying the next Chair.

The Department cares deeply about teaching and serves its students well. It has forged a good working relationship between research/graduate education-intensive faculty and undergraduate teaching-intensive faculty assuring that both areas are well-covered. PhD production rates are consistent with peer averages and the number of B.S. students is appropriate for the size of the Department. Undergraduate and graduate students are motivated, knowledgeable, and think highly of the Department. Faculty, students, and staff are collegial and feel that the Department has a friendly and supportive atmosphere.

The staff is excellent, stable, and is uniformly considered to do their jobs extremely well despite being stretched thin. Their tasks of student advising, grants administration, IT support, workshop and laboratory maintenance are critical to the effective operation of the Department and should not be a target of cut-backs arising out of the current economic crisis.

The level of external (largely federal) and endowment funding is significant and laudable. Faculty are involved in a number of research centers and institutes on campus covering topical areas in science and technology, reflecting the multifaceted nature of chemical engineering. Topical areas of coverage of existing centers include energy, environment, nanotechnology, and biotechnology. Members of the Department also participate in IGERT training grants. However, given the talent that exists in the Department, it is somewhat surprising that the Department has not assumed a larger leadership role in securing new multi-investigator grants. Alignment with the Molecular Engineering Initiative will almost certainly provide new opportunities for funding from NIH, NSF-Bio Directorate, and bio-focused foundations. This should provide the Department with opportunities for leadership in new large-scale funding initiatives. Income-producing community (including distance learning) programs may represent an additional source of income for the Department as will be noted in the body of this Report.

Alignment with the Molecular Engineering Initiative of the College of Engineering may be crucial to the future success of the Department and merits focus. The Chemical Engineering faculty see themselves as central players in this Initiative, possessing research strengths congruent with that role. The hiring priorities stated in their Strategic Plan can be justified along these lines. Chemical engineering curriculum reform and research focus emphasize a move toward molecular and biological processes and systems important for molecular engineering. Indeed, Chemical Engineering is the only Department qualified to bring “process engineering” to these emerging engineering disciplines. There are certainly Chemical Engineering faculty who have demonstrated that they are both well-qualified and motivated to both direct and participate in the Molecular Engineering Initiative. The Chemical Engineering Faculty needs to meet with the Dean of Engineering periodically to discuss how to move Molecular Engineering forward on both research and education fronts and to ensure consistency of Departmental and College-wide expectations and perceptions of Molecular Engineering.

The Department is small compared to most top-ranked chemical engineering departments and this clearly adversely affects its national ranking. Attempts to move up in the rankings by implementing changes, such as curriculum modification and increased multi-investigator research activity (e.g., center and training grants), hinge on the current faculty's limited availability to carry out such activities. The small size of the faculty is below a critical mass to permit taking on activities that will promote moving up in national prominence while maintaining continued excellence in educating chemical engineers. In order to align the visions of the Chemical Engineering Department with the nascent Molecular Engineering Institute, it is recommended that hiring of individuals with research interests compatible with both missions be pursued. This recommendation does not pose a constraint as the growing presence of nanotechnology, interface science, and energy science/technology in Chemical Engineering is largely based on the molecular scale. Two or more hires seem to be critical to exploit the potential of the Chemical Engineering Department to be successful in securing large-scale federal funding and participating effectively in the Molecular Engineering Initiative. The process of adding new hires needs to be re-examined and in particular attention should be given to hiring a mid-career person known to the chemical engineering community. An individual with a proven track record and a well-defined research area represents an opportunity for immediate impact and such a hiring approach may be more efficient that one focused on waiting for the best beginning-career candidate to appear. Consideration should also be given to hiring a mid-career person from industry. The current set of conditions in industry of off-shoring and of the lean economy lends itself to providing incentives for industrial researchers to transition to academia. Candidates with industrial backgrounds could provide device and product expertise—skills already identified to complement the basic research expertise of current UW Chemical Engineering Faculty. A notable success is the recent hiring of W. James Pfaendtner, who brings skills in multiscale modeling to many intra- and inter-departmental research programs. He should also be well-poised to pursue funding opportunities associated with the Cyber-Discovery and Matter by Design Initiatives of the National Science Foundation. Heterogeneous catalysis is another area of research that has been identified as coupling well to federally funded campus-wide programs in environment, biomass, and energy engineering.

The Department has decided to integrate molecular and biological processes into its undergraduate curriculum. This decision is motivated partially by the desire to reduce the mismatch between traditional course materials and state-of-the-art research and thinking in chemical engineering. This integration is seen as a way for the Chemical Engineering Department to raise its national prominence by introducing a new "school of thought". Steps to actually implement this decision have been carefully evaluated resulting in slow movement toward implementation. A more incremental approach with a definite and short-term timescale might be more effective. However, the careful deliberation is based on the fact that undergraduate course work in chemical engineering is defensibly rigidly defined nationally. The rigor and value of the basics should not be altered, although updating courses to enhance training for application areas such as nano- and biotechnology seems warranted. An important and well-agreed-upon change is the feasibility for undergraduates to start coursework for the

major in their sophomore year. This would allow more flexibility for electives and expansion of coursework to better cover the bio/nano areas of potential interest to employers of future B.S. graduates.

Cut-backs in TA positions associated with the current State of Washington economic crisis are of grave concern. This action would likely result in a reduction in the number of new graduate students, which, in turn, would compound visibility problems that the Department already faces due to small faculty size. Since ranking is also impacted by the number of PhDs produced this would almost certainly have a negative impact on ranking. Of particular concern is that a reduction in number of graduate students could make recruiting new faculty members much more difficult.

Both undergraduate and graduate students noted that there is little formal mentoring or job/summer intern placement help in the Chemical Engineering Department. Students ultimately seem to find the positions and advice they need through a strong peer network and faculty receptive to informal discussions. Nevertheless, a more systematic presentation of options such as periodic lunches or informal seminary would appear to be more efficient that the current one-by-one discovery process. Presentations could be made by visitors as well. Similar sentiments regarding mentoring were expressed by junior faculty members. Clearly defined goals, expectations, and deadlines along with proactive mentoring would be beneficial to junior faculty member development.

While effective undergraduate and graduate courses are offered, the potential for revenue-producing community-focused educational efforts should be analyzed, particularly since selected members of the faculty have had past success with this type of offering. Several opportunities were identified for Chemical Engineering-sponsored educational programs for the community in fields such as nanotechnology, surfaces & colloids, fermentation process control, and molecular electronics & devices. The Department is encouraged to coordinate with the UW Educational Outreach, taking advantage of their infrastructure and support staff in order to reduce the administrative burden on the Chemical Engineering faculty and staff. One scenario derives from a request from local biotech companies for a course in process control related to fermentation. This topic is suggestive of others that could be identified in the country's third-largest biotech corridor. The continuing education courses need not take the form of a Professional Masters Degree, although this is one option. Other credit and certificate-granting venues can be considered. Another scenario is based on a week-long summer course in surfaces and colloids, successfully taught by Professor Berg in the past. The needed update of undergraduate laboratory facilities that are used by this course could be funded in part by the income derived from this course.

The current Strategic Plan needs revision to make it a more effective document in identifying Department priorities to College and University leadership. It overemphasizes curriculum reform and does not adequately prioritize or justify Departmental hiring priorities. New research is not even mentioned in the abstract of the 2006 Strategic Plan. A new Strategic Plan needs to clearly map Department

priorities onto College initiatives and priorities. Such a plan should be no more than two pages focusing on mission critical priorities.

Respectfully submitted by the Committee:

Christopher S. Bretherton, Professor, UW Atmospheric Sciences and Applied Mathematics
Larry R. Dalton, B. Seymour Rabinovitch Professor, UW Chemistry (Committee Chair)
Jane Frommer, IBM Almaden Research Center, San Jose, California
Dennis W. Hess, Professor, School of Chemical & Bimolecular Engineering, Georgia Institute of Technology
Christina M. Mastrangelo, Associate Professor, UW Industrial Engineering

Recommendations

We recommend that the Department of Chemical Engineering's degree programs be continued and remain on a ten-year review cycle.

We recommend that the Department of Chemical Engineering prepare a new Strategic Plan that is highly focused and concise. This Plan should be carefully integrated with the Molecular Engineering Initiative of the College of Engineering. Clear prioritization of objectives is critical in a time of economic crisis.

We recommend that no further attrition in the size of the Chemical Engineering Faculty be permitted to occur. We recommend that attractive and competitive offers be made to new faculty candidates and faculty who are considering offers from other institutions. It is recognized that this will be difficult in a time of economic crisis but the Chemical Engineering Department holds a pivotal interdisciplinary position in the College of Engineering and hence is critical to the health of the initiatives of the College.

We recommend that the size of the current staff not be reduced. The consequences of reductions in the support staff will be severe and perhaps irreparable.

We recommend that every effort be made to maintain the size of the graduate Ph.D. program and that cuts to the number of TA positions be avoided or minimized. Any cuts will most certainly impact national ranking.

We recommend that the Department explore opportunities to offer revenue-producing continuing education courses. The Department should also pursue training grants when possible.

We recommend that the Department continue to explore up-grading of the undergraduate education program to include topics of contemporary relevance, keeping in mind the need for strength in traditional areas such as processing.

We recommend that more formal mentoring be instituted for undergraduate, graduate, postgraduate students and for junior faculty.

Response to Questions Raised in the Formal Charge

Primary Questions

Question 1. Are they doing what they should be doing? Yes, the Department is maintaining strength in critical traditional subject areas of Chemical Engineering while up-grading courses to be responsive to the evolving market for chemical engineers. Research is being pursued at the forefront of the discipline. Department Faculty are proactive in pursuing interdisciplinary research efforts and contributing to the well-being of the College of Engineering.

Question 2. Are they doing it well? By and large, yes. The Department is ranked 20th among chemical engineering departments in the nation, which is quite impressive given the small size of the Department. The undergraduate education program is of high quality and an effort is being made to maintain traditional strength while evolving the program to be more responsive to the current marketplace for chemical engineers. The Department, although small by national standards, has outstanding faculty at all levels—beginning, mid, and late career. The Staff is excellent and contributes to the efficient running of the Department. Undergraduate, graduate, and postdoctoral students are of high quality, engaged, and have a favorable opinion of the Department. The Department is clearly very collegial.

Question 3. How can they do things better? In a time of economic crisis, prioritization and clear statement of the mission and objectives of the Department is critical. Alignment with the priorities and objectives of the College of Engineering is essential. Development of a short, clear, and concise Strategic Plan should be undertaken.

Question 4. How should the University assist them? Financial support to avoid contraction in size of the Faculty and the Graduate Program is critical. The Office of the Dean of the College can assist by promoting better communication with the Department so that the Department can better align with the initiatives of the College.

Additional Questions

Question 1. What is the appropriate ratio between faculty and undergraduate majors, and how might this be attained? Given the current economic crisis facing the Department, the current ratio is appropriate and should be maintained. Reduction in number of faculty, staff, or number of TAs could seriously impact the quality of the undergraduate program.

Question 2. How can the Department most effectively implement its planned changes to the undergraduate curriculum? Facilitating admission to the chemical engineering major in the sophomore year is important. The Department's strategy of adding modern material to traditional courses is likely the correct initial strategy; the modification of the undergraduate curriculum can benefit from correlation with the Molecular Engineering Initiative of the College of Engineering as this initiative can contribute significantly to the identification of new course material.

Question 3. Do additional revenue streams exist, either through self-sustaining programs or other sources? Might the Department pursue a professional master's program, possibly in partnership with other units? The Department should investigate/consider the possibility of continuing education courses, certificate programs, and ultimately of a professional master's program, although such courses can clearly be offered without implementing a professional master's program. A formal study to access benefits and limitations of such programs might be carried out with assistance from the College leadership.

Question 4. How might the Department best leverage and embrace new initiatives moving forward, for example molecular engineering or doctoral training programs? Development of good communication with the leadership of the College of Engineering is essential for effective integration with the molecular engineering initiative. The small size of the Department inhibits development of training programs such as those based on IGERT grants; nevertheless, strong mid-career faculty are capable of providing leadership for involvement in interdepartmental institutes and programs.

Question 5. In what ways can the department better engage industry? The Department in development of its new Strategic Plan can consider how selection of areas of focus and allocation of faculty hires would impact the engagement of industry. For example, hiring expertise from industry related to targeted areas of focus could position the Department to be more successful with respect to securing federal topic-related multi-investigator grants and developing connections to industry producing products in targeted areas. Participation of Department faculty in federally-funded, university-wide multi-investigator centers and institutes may lead to better engagement with industry. Continuing education courses offered by the Department could be another vehicle of involvement.

Ten Year Review of the Chemical Engineering Department University of Washington

Site Visit: April 22-24, 2009

The Review Context:

The Review Committee (RC) was appointed in mid March 2009. An organizing teleconference was held on Tuesday, March 31, 2009 with members of the RC, representatives of the Graduate School, and the Dean of the College of Engineering participating. The Charge to the RC was given verbally during that teleconference and the Charge Letter (See Appendix A) was provided to the members of the RC shortly thereafter. During March and April, the members of the RC reviewed voluminous documents including the February 2009 Self Study prepared by the Department of Chemical Engineering, the 1999 Review Committee Report, the Response to that Report, Administrative Action, GSR Report-General Exam, GSR Report-Final Exam, Master's Exit Questionnaire Summaries, and Doctoral Exit Questionnaire Summaries. The Site Visit (See Appendix B for the Final Site Visit Agenda) began on the evening of April 22nd with a dinner meeting that included participation of the Dean of the College of Engineering and concluded on the late afternoon of April 24th.

Background:

Chemical Engineering, like Chemistry, is a scientific discipline that is characterized by a highly refined educational curriculum that has been developed over many decades. Changes have occurred only infrequently and are defined by the introduction of "new schools of thought". Chemical engineering is one of the few divisions of engineering that deals with the scale-up of materials production to commercial scales and with topics such as materials processing. Historically, the focus of chemical engineering has evolved from the production of fine chemicals and polymers (textiles)—from what could be termed the chemical engineering of petroleum--to the production of a vast array of materials for applications ranging from electronics to medicine. The great diversity of chemical engineering is evident in the employment records of the graduates of the Department (see Appendix C—OAP Summary Data and Graduate Student Placement Data). Since core topics such as process control and reaction engineering are not taught or researched by other engineering disciplines, chemical engineering is a critical discipline for many scientific disciplines ranging from chemistry to medicine and can be considered to represent a vital link among engineering disciplines such as biomedical engineering, materials science & engineering, electrical engineering, aerospace engineering, and mechanical engineering. More than a decade ago (see 1999 RC

Report), the Department developed a strong and effective focus in chemical engineering related to biomedical technology and nanotechnology. This has promoted strong interdisciplinary interactions involving members of the Department with faculty throughout the College of Engineering, the Medical School, and the College of Arts and Sciences.

Chemical engineers work with molecules and are thus well-positioned to participate in emerging areas of focus such as molecular engineering, biomedical engineering, and nanoscience/nanotechnology. Members of the Department are well positioned to interact with and contribute to the College-wide Molecular Engineering Initiative.

Current Status of and Issues in the Department:

***The Undergraduate Program*:** The current RC concurs with the view espoused by the 1999 RC that this is a very strong undergraduate program. The fears of the 1999 RC that abandonment of the dual track options do not appear to have been realized and the health of the program appears to have been well maintained in the decade following the 1999 RC Report.

Some issues raised by the 1999 RC Report relating to the course demands of the major limiting options for internships and elective courses continue to be of concern. Transitioning admission to the major from the student's junior year to the student's sophomore year may help. The lack of formal mentoring is another on-going concern. Both the 1999 RC and the current RC Reports speak to this concern, particularly with respect to identifying internships and assisting students with career planning. The RC recommends that the Department think broadly concerning mechanisms of providing improved mentoring to students including special seminars (including those involving individuals from industry) focused on providing students with improved information and resources related to career planning.

For more than 2 years, the Department has been considering curriculum modification, particularly to achieve better alignment with the Molecular Engineering Initiative of the College. The consideration has most certainly been deliberate reflecting the consensus driven nature of Department management. This has lead to a conservative approach to curriculum modification whereby material from emerging disciplines such as biomedical and nanotechnology are integrated into existing courses. This curriculum modification is thus quite different from a "new school of thought" approach. However, given the need for graduates well-trained in traditional topics such as process control, such a conservative approach is likely not an unwise approach. Given that two years have been expended already in the planning of curriculum modification, the faculty needs to focus on implementation and evaluation of curriculum modification.

The current economic crisis poses a severe risk to the undergraduate program in many ways including the potential of reducing the number of TAs below a level required for effective delivery of courses. Attention must be given to maintaining an adequate number of TAs and providing effective training for TAs.

The addition of W. James Pfaendtner to the faculty represents a unique opportunity to bring multi-scale modeling and modern computational methods to the undergraduate program.

***The Graduate Program*:** Again, the current RC concurs with the 1999 RC that a surprisingly strong graduate program has been maintained given the size of the Department. The graduate education program appears healthy and the problems identified in the 1999 RC Report appear to have been reasonably well addressed. The current economic crisis certainly puts this program at risk, e.g., by cutting the number of TAs. It will likely be several years before State funding and endowment earnings return to pre-recession levels. The impact on the graduate program will be somewhat buffered by the strong track record of Department faculty in securing federal funding. However, even greater success will likely be required in the future and this increased funding will likely have to come from training grants and multi-investigator (e.g., Center) grants.

The addition of W. James Pfaendtner to the faculty is a unique opportunity for the graduate program as well. Cyber-discovery is clearly a topic of growing focus at the National Science Foundation and the addition of Pfaendtner positions the department well to benefit from this new trend in the chemical, physical, and engineering disciplines.

***Continuing Education Courses, Certificate Programs, and the Professional Masters Program*:** The Department has some track record of success with professional education courses (e.g., Professor Berg's course on surface and colloid science). Moreover, there is some external interest from Seattle-based biotechnology companies in such courses (e.g., for biotechnology processing). The small size of the Department is a liability when considering continuing education activities; nevertheless, these activities should be considered because of the many potential benefits that they may afford, e.g., connections with industry, revenue, etc.. To minimize the demand on resources that production of such vehicles require, the Department should take advantage of other resources on campus dedicated to such activities.

***Faculty Research*:** The 1999 RC Report paints a picture of a distinguished senior faculty and a group of talented young faculty. The 2009 RC sees a very comparable picture with the promise of the young faculty of the 1999 RC Report being fulfilled. Indeed, faculty such as Mary Lidstrom, Buddy Ratner, Daniel Schwartz, Francois Baneyx, Rene Overney, Stuart Adler, David Castner, Shaoyi Jiang, and Samson Jenekhe established themselves as mid-career and senior scientists of international reputation and distinction. They have also played critical leadership roles on campus. These individuals, together with Danilo Pozzo, either lead or play major roles in ten interdisciplinary research efforts on campus. The addition of W. James Pfaendtner brings expertise in multi-scale modeling and modern computational efforts to the Department and positions the Department and the College to effectively compete for increasing cyber-discovery-related funding at NSF. This is an exceptionally strong faculty particularly in the emerging areas of biomedical engineering, nanotechnology, and molecular engineering. It should be capable of assuming leadership in continuing

and new initiatives in these areas including the acquisition of major center and training grants. Given the size of the Department, the faculty will likely thrive by continued participation in interdisciplinary research grants. Indeed, all of the ten multi-investigator programs cited above involve faculty from multiple departments in the College of Engineering and in many cases faculty from the College of Arts and Sciences and from the School of Medicine.

Because of the small size of the Department and because of the financial restrictions imposed by the current State economic crisis, future hires must be strategic. This should be dictated by the new Strategic Plan which the Department is encouraged to develop and by initiatives of the College of Engineering. Despite the current economic crisis, additional hires for the Department of Chemical Engineering must be a priority if the national ranking and the viability of programs at all levels are to be maintained.

Infrastructure and Facilities:

The infrastructure of the Department is, in general, good and with the construction of the planned Molecular Engineering Building should be even better. Space in the Molecular Engineering Building should be an important incentive for the recruitment of new faculty and the retention of highly research active members of the current faculty.

Maintenance of the quality of equipment in key laboratories will be a continuing issue and will likely be made more difficult by the current economic crisis. The faculty will need to spend effort to write equipment proposals to both federal agencies and private foundations.

Administration:

The Department has been characterized by effective leadership during the past decade (initially Rogers and more recently Stuve). The mode of governance has been largely consensus driven, which was commented on favorably by adjunct faculty who observed the mode of operation of Chemical Engineering in the context of other departments within the College of Engineering.

It is clear from the Site Visit that a transition of leadership of the Department will take place within two years time. Finding a replacement for Dr. Stuve must be a critical priority of the Department and it will be important, in the current difficult economic times, that the new Chair of the Department develop excellent communication and coordination with the College Administration. Fortunately, several mid-career members of the Department have demonstrated exceptional skills in administration.

Gender and Ethnic Diversity:

While the gender and ethnic diversity of the Department (undergraduate, graduate, postdoctoral, faculty, staff) is not out of line with that of peer chemical engineering departments, it does not reflect the National diversity. An exception to this remark is the

fact that 50% of the 16 new graduate students are female. Admittedly, it is difficult for a small department to improve diversity, particularly in difficult economic times. Nevertheless, improvement of diversity in academia is a priority for Federal agencies such as the National Science Foundation. While the Engineering Directorate at NSF has not been as proactive as other directorates at NSF (for example, the chemical instrumentation grant program of the Directorate of Mathematical and Physical Sciences requires Chemistry Departments to develop a diversity plan), clearly diversity must be an increasing concern for those entrusted to produce future technology workforces.

Given the current economic crisis, there is only so much that the Department can do in the short term; however, there are low or no cost activities that should be considered. First, the Department should establish awareness and participate in diversity related activities on campus. In promoting improved mentoring and recruitment through activities such as lunch time seminars (leadership lunches with participating industrial speakers), consideration should be given to inviting speakers from under-represented groups. Development of a department diversity plan and creation of a department diversity committee could be useful exercises, particularly in terms of elevating awareness of diversity related activities and plans on campus and at peer institutions.

Attachments: Appendices

Appendix A. Charge to the Committee

Appendix B. Site Visit Agenda

Appendix C. Undergraduate and Graduate Employment Statistics

THE GRADUATE SCHOOL
UNIVERSITY OF WASHINGTON

Box 353770 G-1 Communications Seattle, WA 98195-3770
Telephone: 206-543-5900 Fax: 206-685-3234 Web: http://grad.washington.edu

DRAFT

April 1, 2009

Department of Chemical Engineering Review Committee
Larry R. Dalton, Professor, UW Chemistry (Committee Chair)
Christopher S. Bretherton, Professor, UW Atmospheric Sciences and Applied Mathematics
Christina M. Mastrangelo, Associate Professor, UW Industrial Engineering
Jane Frommer, IBM Almaden Research Center, San Jose, California
Dennis W. Hess, Professor, School of Chemical & Biomolecular Engineering, Georgia Institute of Technology

RE: Charge to Committee for the Department of Chemical Engineering Review

Dear Review Committee:

Thank you once again for agreeing to serve on the committee to review the degree programs offered in the Department of Chemical Engineering at the University of Washington (UW). Now that the members of the review committee have had the opportunity to meet with the administrators involved with this review, we are writing to present you with a more detailed charge for the review process.

As background information, the Department of Chemical Engineering currently offers Bachelor of Science in Chemical Engineering (BSChE), Master of Science in Chemical Engineering (MSChE), Master of Science in Engineering (MSE), and Doctor of Philosophy (PhD) degree programs. The last comprehensive review of the School occurred in 1998-1999, with the final recommendation for continuing status of all degree programs and subsequent review in ten years.

For this review, the possible recommendations range from suspension of student entry into the department's degree programs to a recommendation for continuing status with a subsequent review in 10 years. Shorter terms can be recommended if you deem it appropriate. Equally important to this status recommendation, your review can offer the department and the administration an independent assessment of the "health" of the unit and advice on how it can be improved.

Based on our experience, we suggest that the external reviewers be relied upon as content experts who can evaluate the quality of the unit from a national perspective. They are also likely to be able to comment on recent developments in the field and their incorporation into the department. You may wish to initiate your work before the site visit to ensure a thorough and rigorous review. We encourage you to communicate with Eric Stuve, Professor and Chair of the Department, so that he knows your interests and expectations, particularly for the site visit, and to communicate with other key faculty, if time permits.

The two-day site visit on **April 23-24, 2009,** will culminate with an exit discussion, divided into two portions. The Associate Dean of the Graduate School, the Dean of the College of Engineering, the Vice Provost and Dean of Undergraduate Academic Affairs, and the Executive Vice Provost will participate. The first portion of the exit discussion will include the Department Chair and other faculty members he may invite, while the second portion, the executive session, will include only the review committee and administrators. We will request your formal recommendation regarding the continuance of the degree programs early in the second portion of the exit interview. We will also ask you to describe your plan for completing the written report in a timely manner.

The Graduate and Professional Student Senate (GPSS) participates actively in the program review process. The GPSS sends surveys to current graduate students, and a GPSS representative will join the graduate student meeting during the site visit. At the conclusion of the review the GPSS will submit an independent report to the Graduate School based on its findings.

We request that your committee submit its written report within 4 weeks of the site visit. Specifically, the **written report is due May 22, 2009**. A written response will then be provided by the unit and is due on **June 22, 2009.** When the response is available, the report and response will be considered by the Graduate School Council. The Dean of the Graduate School will then write a letter outlining the review and recommendations to the Provost for her consideration and action.

Please note that upon completion of program reviews, the primary review documents become public documents and are placed on the UW Office of the Provost's web site. These documents include the self-study, the review committee report, the unit's response to the report, and the Graduate School Dean's letter to the Provost.

The most important objective of your review is an assessment of the academic and educational quality of the unit. Important questions include:

1) Are they doing what they should be doing?
2) Are they doing it well?
3) How can they do things better?
4) How should the University assist them?

Thank you for your time and effort. Please contact David Canfield-Budde, Academic Program Specialist, at dacan@u.washington.edu with any questions you may have about the review.

Sincerely,

Gerald J. Baldasty
Vice Provost and Dean

James Soto Antony
Associate Dean and Associate Vice Provost for Academic Affairs

cc: Douglas J. Wadden, Executive Vice Provost, Office of the Provost
John D. Sahr, Associate Dean, Undergraduate Academic Affairs
Matthew O'Donnell, Dean, College of Engineering
Eric M.Stuve, Chair, Chemical Engineering
David Canfield-Budde, Academic Program Specialist, The Graduate School
Jake Faleschini, President, GPSS

UNIVERSITY OF WASHINGTON
The Graduate School
Department of Chemical Engineering
April 23-24, 2009

Wednesday, April 22

6:30 p.m.	**Review Committee working dinner** Nell's Restaurant (6804 Greenlake Way N; 206-524-4044)

Thursday, April 23
BENSON 109

8:30–8:45 a.m.	**Eric Stuve**, Chair, Department of Chemical Engineering
8:45–9:15	**Larry Ricker**, Associate Chair & Graduate Program Director, Chemical Engineering
9:15–10:00	**Eric Stuve**, Chair, Chemical Engineering
10:00–10:30	**Brad Holt**, Associate Professor, Chemical Engineering **Dave Drischell,** Academic Advisor, Undergraduate Admissions
10:30–10:45	**BREAK**
10:45–11:15	**Michelle Blanchette**, Administrator, Chemical Engineering
11:15–11:45	**James Bryers**, Professor, Bioengineering; Adjunct Professor, Chemical Engineering
11:45 a.m.–12:00 p.m.	**BREAK**
12:00–1:00	**Lunch with graduate students**: Joe Fairweather et al.
1:00–1:30	**BREAK**
1:30–2:00	**Tour of Benson Hall**: Eric Stuve, Chair, Chemical Engineering
2:00–3:00	**Living/Bio researchers**: François Baneyx, Shaoyi Jiang, Mary Lidstrom, & Hong Shen, Professors of Chemical Engineering
3:00–3:30	**BREAK**
3:30–4:30	**Energy researchers**: Stu Adler, Dan Schwartz, & Eric Stuve, Professors of Chemical Engineering; & Rick Gustafson, Professor of Forest Resources and Adjunct Professor of Chemical Engineering
4:30–5:00	**BREAK**
6:00 p.m.	**Review Committee working dinner** Wild Ginger (1401 Third Ave; 206-623-4450)

UNIVERSITY OF WASHINGTON
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Friday, April 24
BENSON 109

8:30–9:30 a.m.	**Matls/Interf & Electronics researchers**: John Berg, Danilo Pozzo, & Sam Jenekhe, Professors of Chemical Engineering
9:30–10:00	**Undergraduate students**: Matt Gacek, C'Havala Jaramillo, Epiphany Nfr, Sarah Widder et al.
10:00–10:15	**BREAK**
10:15–10:45	**Guozhong Cao**, Professor of Materials Science & Engineering; Adjunct Professor of Chemical Engineering
10:45–11:15	**Advisory Board** (phone call): **Linda Koffenberger**, pres. of Amerchol and vice pres. of Dow (retired); **Tim Anderson**, assoc. dean for research and graduate program, University of Florida; & **Dick Zollars**, professor and interim director of the School of Chemical Engineering and Bioengineering, Washington State University
11:15 a.m.–2:00 p.m.	**Review Committee executive session/lunch** (Boxed lunches catered to room)
2:00–2:30	**BREAK**
2:30–3:30	**Exit Interview** (**BENSON 109)** James Antony, associate dean for academic programs, The Graduate School Douglas J. Wadden, executive vice provost, Office of the Provost John D. Sahr, associate dean, Undergraduate Academic Affairs Matthew O'Donnell, dean, College of Engineering Eric M. Stuve, chair, Department of Chemical Engineering David Canfield-Budde, academic program specialist, The Graduate School
3:30–4:30	**Exit Interview** (**BENSON 109**) As above, no program representatives.
4:30–5:00	**Review Committee Debriefing Session** (review committee only)

By company ...

Name	Advisor	Degree	Year	Company		Company (short)	Type of Work
[Student]	Castner	PhD	2006	3M, St. Paul, MN		3M	Chemical
[Student]	Baneyx	PhD	2006	Amgen, Seattle, WA		Amgen	Biotech
[Student]	Adler	PhD	2007	Argonne National Labs, Argonne, IL		ANL	Govt/Natl Lab
[Student]	Ratner	PhD	2008	Ao Foundation, Switzerland		AO Foundation	Biotech
[Student]	Berg	PhD	2008	Applied Nanotech, Austin, TX		Applied Nanotech	Nanotech
[Student]	Berg	PhD	2006	Ballard Corp., Vancouver, BC, Canada		Ballard	Energy
[Student]	Baneyx	PhD	2005	Benaroya Research Institute, Seattle, WA		Benaroya Research In	Biotech
[Student]	Berg	PhD	2005	Boeing Corp., Houston, TX		Boeing	Aircraft
[Student]	Schwartz	PhD	2005	Cambrios Tech, Mountain View, CA		Cambrios Tech.	Electronics
[Student]	Ricker	PhD	2005	Chulalongkorn University, Thailand	faculty	Chulalongkorn Univ.,	Acad - Fac
[Student]	Castner	PhD	2005	CIBA Corporation, Georgia		CIBA Corp.	Chemical
[Student]	Ratner	PhD	2008	Glycosan		Glycosan	Biotech
[Student]	Ratner/ H	PhD	2006	Harvard	Post-Doc	Harvard	Acad - Pdoc
[Student]	Ratner	PhD	2004	Healionics		Healionics	Biotech
[Student]	Jenekhe	PhD	2006	Hewlett-Packard, San Diego, CA		Hewlett-Packard	Electronics
[Student]	Adler	PhD	2008	Intel, Portland, OR		Intel	Electronics
[Student]	Jenekhe	PhD	2005	Intel, Hillsboro, OR		Intel	Electronics
[Student]	Schwartz	PhD	2006	Ionographics, Seattle, WA		Ionographics	Nanotech
[Student]	Schwartz	PhD	2003	Isotron Corp., Seattle, WA		Isotron	Nanotech
[Student]	Overney	PhD	2004	Micron Techn., Boise, ID		Micron Tech.	Electronics
[Student]	Allan	PhD	2007	Hydro & Agro Informatics Institute, Ministry of S		Ministry of S&T, Thail	Govt/Natl Lab
[Student]	Adler	PhD	2008	NASA-Glenn Research Center, Cleveland, OH (g		NASA	Govt/Natl Lab
[Student]	Overney	PhD	2009	NIST, Boulder, CO		NIST	Govt/Natl Lab
[Student]	Adler	PhD	2007	Parker Messana, Consulting Engineers, Tukwila,		Parker Messana	Consulting
[Student]	Berg	PhD	2004	Battelle PNNL, Richland, WA		PNNL	Govt/Natl Lab
[Student]	Stuve	PhD	2004	PNNL		PNNL	Govt/Natl Lab
[Student]	Adler	PhD	2007	Praxair, Tonawanda, NY		Praxair	Chemical
[Student]	Schwartz	PhD	2005	PureEdge Power, Portland, OR		Pure Edge Power	Energy
[Student]	Stuve	PhD	2004	Symyx		Symyx	Nanotech
[Student]	Berg	PhD	2007	Toray Composites America, Tacoma, WA		Toray Composites	Chemical
[Student]	Ratner	PhD	2005	UCLA	Post-Doc	UCLA	Acad - Pdoc
[Student]	Overney	PhD	2007	stay-at-home mom		Unemployed	
[Student]	Jiang	PhD	2008	Univ. Missouri, Columbia	Faculty	Univ. Missouri	Acad - Fac
[Student]	Ratner	PhD	2004	Univ. of Pennsylvania	Post-Doc	Univ. Pennsylvania	Acad - Pdoc
[Student]	Overney	PhD	2009	unknown		Unknown	
[Student]	Stuve	PhD	2006	United Technologies Research Center		UTRC	Energy

[Student]	Castner	PhD	2008	UW Bioengineering	Post-Doc	UW	Acad - Pdoc
[Student]	Castner	PhD	2007	UW	research scie	UW	Acad - Staff
[Student]	Jenekhe	PhD	2006	UW	Post-Doc	UW	Acad - Pdoc
[Student]	Schwartz	PhD	2003	UW	faculty	UW	Acad - Fac
[Student]	Stuve	PhD	2007	UW	Post-Doc	UW	Acad - Pdoc
[Student]	Baneyx	PhD	2005	UW Tech Transfer	licensing ass	UW Tech Transfer	Acad - Staff
[Student]	Berg	MS	2006	Armorstruxx Corp., Lodi, CA		Armorstruxx	Automotive
[Student]	Horbett	MS	2004	Blood Cell Storage Inc., Seattle, WA		Blood Cell Storage	Biotech
[Student]	Ricker	MS	2006	Chevron		Chevron	Chemical
[Student]	Schwartz	MS	2004	Crown Co., Ontario, Canada		Crown Co.	Chemical
[Student]	Ratner	MS	2004	DENTSPLY Friadent CeraMed		DENTSPLY Friadent C	Biotech
[Student]	Adler	MS	2007	GRT Inc., Santa Barbara, CA		GRT	Electronics
[Student]	Schwartz	MS	2005	Intel, Phoenix, AZ		Intel	Electronics
[Student]	Jenekhe	MS	2005	Peace Corps(?)		Peace Corps	Nonprofit
[Student]	Castner	MS	2006	Shell Technology, India		Shell	Chemical
[Student]	Stuve	MS	2003	Tufts	Student	Tufts	Acad - Stud
[Student]	Adler	MS	2008	job hunting in SF Bay area		Unemployed	
[Student]	Baneyx	MS	2004	unknown		Unknown	
[Student]	Berg	MS	2008	returned to India		Unknown	
[Student]	Jenekhe	MS	2008	unknown		Unknown	
[Student]	Jenekhe	MS	2006	unknown		Unknown	
[Student]	Schwartz	MS	2006	UW	research scie	UW	Acad - Staff

By type of work ...

Name	Advisor	Degree	Year	Company		Company (short)	**Type of Work**
[Student]	Ricker	PhD	2005	Chulalongkorn University, Thailand	faculty	Chulalongkorn Univ.,	Acad - Fac
[Student]	Jiang	PhD	2008	Univ. Missouri, Columbia	Faculty	Univ. Missouri	Acad - Fac
[Student]	Schwartz	PhD	2003	UW	faculty	UW	Acad - Fac
[Student]	Ratner/ H	PhD	2006	Harvard	Post-Doc	Harvard	Acad - Pdoc
[Student]	Ratner	PhD	2005	UCLA	Post-Doc	UCLA	Acad - Pdoc
[Student]	Ratner	PhD	2004	Univ. of Pennsylvania	Post-Doc	Univ. Pennsylvania	Acad - Pdoc
[Student]	Castner	PhD	2008	UW Bioengineering	Post-Doc	UW	Acad - Pdoc
[Student]	Jenekhe	PhD	2006	UW	Post-Doc	UW	Acad - Pdoc
[Student]	Stuve	PhD	2007	UW	Post-Doc	UW	Acad - Pdoc
[Student]	Castner	PhD	2007	UW	research scie	UW	Acad - Staff
[Student]	Baneyx	PhD	2005	UW Tech Transfer	licensing ass	UW Tech Transfer	Acad - Staff

[Student]	Berg	PhD	2005	Boeing Corp., Houston, TX		Boeing	Aircraft
[Student]	Baneyx	PhD	2006	Amgen, Seattle, WA		Amgen	Biotech
[Student]	Ratner	PhD	2008	Ao Foundation, Switzerland		AO Foundation	Biotech
[Student]	Baneyx	PhD	2005	Benaroya Research Institute, Seattle, WA		Benaroya Research In	Biotech
[Student]	Ratner	PhD	2008	Glycosan		Glycosan	Biotech
[Student]	Ratner	PhD	2004	Healionics		Healionics	Biotech
[Student]	Castner	PhD	2006	3M, St. Paul, MN		3M	Chemical
[Student]	Castner	PhD	2005	CIBA Corporation, Georgia		CIBA Corp.	Chemical
[Student]	Adler	PhD	2007	Praxair, Tonawanda, NY		Praxair	Chemical
[Student]	Berg	PhD	2007	Toray Composites America, Tacoma, WA		Toray Composites	Chemical
[Student]	Adler	PhD	2007	Parker Messana, Consulting Engineers, Tukwila,		Parker Messana	Consulting
[Student]	Schwartz	PhD	2005	Cambrios Tech, Mountain View, CA		Cambrios Tech.	Electronics
[Student]	Jenekhe	PhD	2006	Hewlett-Packard, San Diego, CA		Hewlett-Packard	Electronics
[Student]	Adler	PhD	2008	Intel, Portland, OR		Intel	Electronics
[Student]	Jenekhe	PhD	2005	Intel, Hillsboro, OR		Intel	Electronics
[Student]	Overney	PhD	2004	Micron Techn., Boise, ID		Micron Tech.	Electronics
[Student]	Berg	PhD	2006	Ballard Corp., Vancouver, BC, Canada		Ballard	Energy
[Student]	Schwartz	PhD	2005	PureEdge Power, Portland, OR		Pure Edge Power	Energy
[Student]	Stuve	PhD	2006	United Technologies Research Center		UTRC	Energy
[Student]	Adler	PhD	2007	Argonne National Labs, Argonne, IL		ANL	Govt/Natl Lab
[Student]	Allan	PhD	2007	Hydro & Agro Informatics Institute, Ministry of S		Ministry of S&T, Thail	Govt/Natl Lab
[Student]	Adler	PhD	2008	NASA-Glenn Research Center, Cleveland, OH (g		NASA	Govt/Natl Lab
[Student]	Overney	PhD	2009	NIST, Boulder, CO		NIST	Govt/Natl Lab
[Student]	Berg	PhD	2004	Battelle PNNL, Richland, WA		PNNL	Govt/Natl Lab
[Student]	Stuve	PhD	2004	PNNL		PNNL	Govt/Natl Lab
[Student]	Berg	PhD	2008	Applied Nanotech, Austin, TX		Applied Nanotech	Nanotech
[Student]	Schwartz	PhD	2006	Ionographics, Seattle, WA		Ionographics	Nanotech
[Student]	Schwartz	PhD	2003	Isotron Corp., Seattle, WA		Isotron	Nanotech
[Student]	Stuve	PhD	2004	Symyx		Symyx	Nanotech
[Student]	Overney	PhD	2007	stay-at-home mom		Unemployed	
[Student]	Overney	PhD	2009	unknown		Unknown	
[Student]	Schwartz	MS	2006	UW	research scie	UW	Acad - Staff
[Student]	Stuve	MS	2003	Tufts	Student	Tufts	Acad - Stud
[Student]	Berg	MS	2006	Armorstruxx Corp., Lodi, CA		Armorstruxx	Automotive
[Student]	Horbett	MS	2004	Blood Cell Storage Inc., Seattle, WA		Blood Cell Storage	Biotech
[Student]	Ratner	MS	2004	DENTSPLY Friadent CeraMed		DENTSPLY Friadent C	Biotech
[Student]	Ricker	MS	2006	Chevron		Chevron	Chemical
[Student]	Schwartz	MS	2004	Crown Co., Ontario, Canada		Crown Co.	Chemical

[Student]	Castner	MS	2006	Shell Technology, India	Shell	Chemical
[Student]	Adler	MS	2007	GRT Inc., Santa Barbara, CA	GRT	Electronics
[Student]	Schwartz	MS	2005	Intel, Phoenix, AZ	Intel	Electronics
[Student]	Jenekhe	MS	2005	Peace Corps(?)	Peace Corps	Nonprofit
[Student]	Adler	MS	2008	job hunting in SF Bay area	Unemployed	
[Student]	Baneyx	MS	2004	unknown	Unknown	
[Student]	Berg	MS	2008	returned to India	Unknown	
[Student]	Jenekhe	MS	2008	unknown	Unknown	
[Student]	Jenekhe	MS	2006	unknown	Unknown	

Top Employers - Ph	Number
UW	6
Intel	2
PNNL	2

Type of Work	Number
PhD grads	
Acad - Pdoc	6
Govt/Natl Lab	6
Biotech	5
Electronics	5
Chemical	4
Nanotech	4
Acad - Fac	3
Energy	3
Acad - Staff	2
Aircraft	1

Consulting	1

MS grads	
Chemical	3
Biotech	2
Electronics	2
Acad - Staff	1
Acad - Stud	1
Automotive	1
Nonprofit	1

All grads	
Biotech	7
Chemical	7
Electronics	7
Acad - Pdoc	6
Govt/Natl Lab	6
Nanotech	4
Acad - Fac	3
Acad - Staff	3
Energy	3
Acad - Stud	1
Aircraft	1
Automotive	1
Consulting	1
Nonprofit	1

Jobs Taken	2001	2002	2003	2004	2005	2006	2007	**Total**	Type of Job
Intel	5	1		2		2	1	**11**	Electronics
Chevron			1	1	2	3	1	**8**	Petroleum
Micron Technology					1	5	2	**8**	Electronics
Accenture	3						3	**6**	Consulting
Dow Chemical	1	2					1	**4**	Chemical
Puget Sound Naval Shipyard	1		1			1	1	**4**	Government
U S Navy		1	2				1	**4**	Military
Boeing						2	1	**3**	Aircraft
Kimberly-Clark						2	1	**3**	Forest Products
Procter & Gamble			1				2	**3**	Consumer Products
Takata		2	1					**3**	Automotive
General Electric	1	1						**2**	Electronics
Georgia Pacific		1				1		**2**	Forest Products
German DAAD, University of Ulm					2			**2**	Government
Shell Oil		1				1		**2**	Petroleum
Toyota					1	1		**2**	Automotive
Trinity Consultants		1				1		**2**	Consulting
Anvil Corp			1					**1**	Consulting
Bechtel	1							**1**	Engr. Construction
Boise Cascade							1	**1**	Forest Products
Chemithon							1	**1**	Chemical
DMJM Holmes & Narver		1						**1**	Consulting
Edwards Lifesciences			1					**1**	Biotech
EnvIronmntl Field Activities NW			1					**1**	Environmental
EPA			1					**1**	Government
Equiva Services	1							**1**	Petroleum
ExxonMobil			1					**1**	Petroleum
First Energy (Davis-Besse)							1	**1**	Energy
First Presbyterian Church					1			**1**	Non-ChemE
Foster Wheeler Environmental	1							**1**	Consulting
Gore						1		**1**	Chemical
Hercules							1	**1**	Chemical
Hewlett Packard							1	**1**	Electronics
Honeywell	1							**1**	Chemical
IM Flash						1		**1**	Electronics
Imation Corp		1						**1**	Electronics
Isothermal Systems Research			1					**1**	Chemical
Isotron						1		**1**	Chemical
Kennedy/Jenks						1		**1**	Consulting
King County						1		**1**	Environmental
Longview Fiber						1		**1**	Forest Products
Nu Element				1				**1**	Energy
ONDEO-NALCO			1					**1**	Chemical Sales
OSI Software	1							**1**	Software
Peace Corps				1				**1**	Government
Record Company		1						**1**	Non-ChemE
Safe View			1					**1**	Environmental
Sandia Natl Labs		1						**1**	Government
Schlumberger	1							**1**	Petroleum
Secure Biologics			1					**1**	Biotech
SNC Lavalin						1		**1**	Chemical
Steno Trust			1					**1**	Non-ChemE
T3	1							**1**	Consulting
Unisea Inc.				1				**1**	Food
UOP						1		**1**	Petroleum
US Army Corps of Engineers	1							**1**	Environmental
Valero Refining		1						**1**	Petroleum
Veco							1	**1**	Chemical
WasteMinCo				1				**1**	Consulting
Undisclosed	2	1	3	3	1	5	1	**16**	