University of North Alabama

Department of Chemistry and Industrial Hygiene

Department & Program Review

2003 - 2008

Name and Signature of Chair:

____

Dr. Michael B. Moeller

Date of Report: June 30, 2009

2. Five-Year Departmental Enrollment and Faculty Data

➢ ***Statistical Overview***

The statistics listed below are annual average values calculated from data supplied by Institutional Research for the Academic Years 2003-2004 through 2007-2008.

1. Number of Unduplicated Majors (FTE Students, Summer, Fall, and Spring Semesters Combined): 158

2. Number of Degrees Conferred: 17.6

3. Majors/Degrees Conferred Ratio: 12.70

4. Student Credit Hours: 3413.0 (undergraduate)
6.4 (graduate)
3419.4 (total)

5. Average Class Size: 18.34 (undergraduate)
1.46 (graduate)

6. Number of FTE Faculty (Fall Semester): 7.80

7. FTE Student/FTE Faculty Ratio (as per *U.S. News* definition): 20.17

8. Credit Hours/FTE Faculty: 442

Departmental Assessment

The University of North Alabama is committed to ongoing, integrated, and institution-wide research-based planning and evaluation processes. To this end, each department, as a whole, should be evaluated to ensure that departmental goals, strategies, and projected outcomes are congruent to and support the institution's mission and strategic plan.

Specifically, the department should show that it 1) incorporates a systematic review of institutional mission, goals, and outcomes; 2) this review results in continuing improvement in departmental quality; and 3) the departmental goals support the institution's mission and strategic plan.

➢ ***Review Five-Year Report for Trends, Patterns, and/or Significant Changes.***

The average number of unduplicated full-time equivalent majors enrolled in majors offered by the Department of Chemistry and Industrial Hygiene during the five-year review period was 158. Ten-year enrollment trends giving more detail than provided by the five-years' averages are displayed in Figure 2.1 below. The values for total CH or IH are the sum of all chemistry majors, option I and option II, and industrial hygiene majors without counting double majors twice. The values for this plot are from data supplied annually in mid-October by the Department of Computer and Telecommunication Services.

Figure 2.1 shows a slow increase in the numbers of majors which parallels the growth of the general student population at the University of North Alabama. The spike in chemistry majors observed in 2006 is unexplained and lasted only for that year.

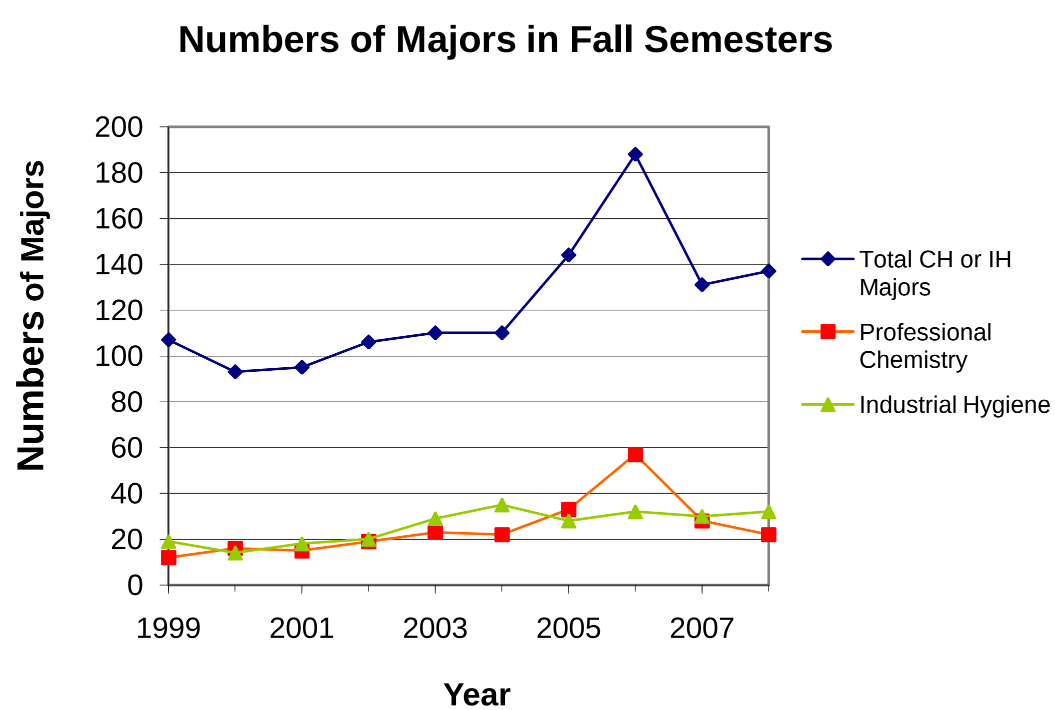


Figure 2.1 Numbers of Chemistry and Industrial Hygiene majors for the decade 1999 – 2008.

3. Assess the Department as it Relates to Students

- ***Enrollment***

Figures 3.1a and 3.1b below show how the numbers of Chemistry and Industrial Hygiene majors typically change with academic classification. These plots are snapshots of the fall semesters of 2007 and 2008 with the data coming from the Department of Computer and Telecommunication Services and show an important aspect of our enrollment distribution. The Department loses a number of Chemistry majors in their freshman year. To a certain extent, this is probably unavoidable because many freshmen students declare a major in a pre-health professional program, even when they have small probability for success as indicated by their ACT scores. For this and other causes, we have many more students leaving the Chemistry major than changing to it. Because students often procrastinate in officially changing their major, the number of majors in Figures 2.1 and 3.1 are probably inflated. This helps explain why the average majors/degrees conferred for the Department is rather large, 12.70.

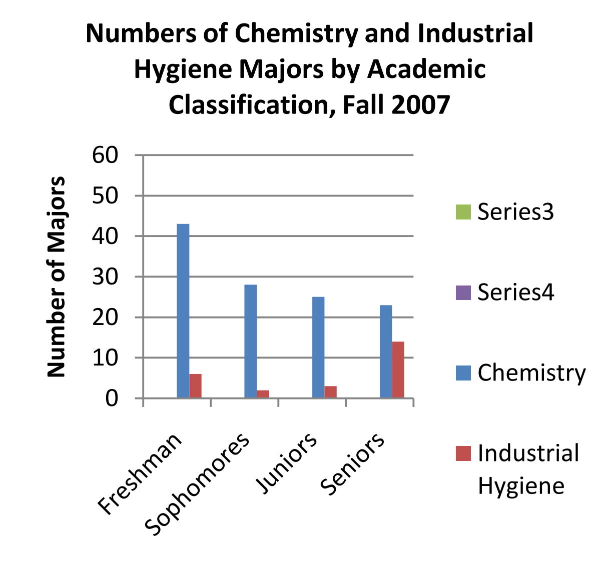


Figure 3.1a Number of majors by academic classification, fall semester 2007

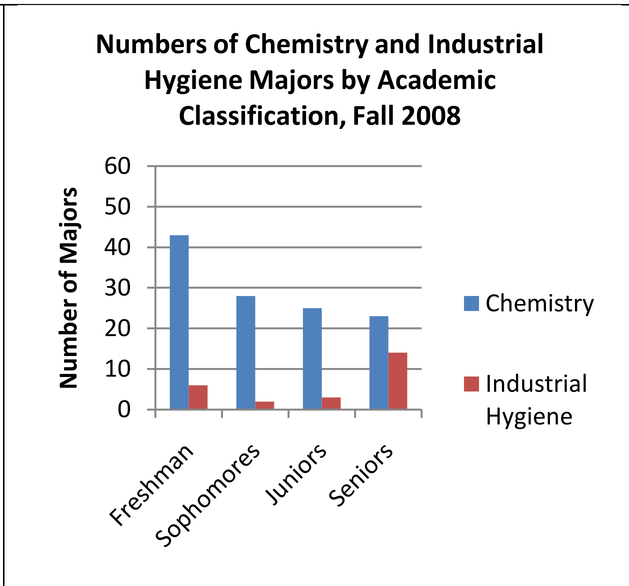


Figure 3.1b Number of majors by academic classification, fall semester 2008

The enrollment distribution by academic classification for Industrial Hygiene is reversed. Most incoming freshmen are not aware of the Industrial Hygiene major or of the opportunities this major affords. The program is brought to the attention of students by instructors or fellow classmates and it becomes increasingly attractive to students in their sophomore and junior years who are starting to consider career employability. Another reason for this inversion of population is that many industrial hygiene majors take significantly more than 132 credit hours in completing their degree and spend more than a single year with senior classification. As the reputation of our Industrial Hygiene program has grown, the Department is finding an increase in the number of incoming freshman declaring a major in Industrial Hygiene.

The statistic for average class size, 18.34, is misleading because our classes are almost always greater than twenty-four or less than twelve. Our General Chemistry classes are large by UNA standards, sometimes having an enrollment of more than seventy-five students at the beginning of a semester. With our current laboratory facilities, we would have difficulty expanding the number of students we service in CH 111 during the fall semester. If we succeed in recruiting more Chemistry and Industrial Hygiene majors who are capable of doing well in the program, we might have to limit enrollment in CH 111. This could be done by adding a math or natural science ACT prerequisite. Our mid-level organic and analytical chemistry courses generally have good populations of students, but they could enroll a few more. Our upper-level courses, with rare exceptions, have a much smaller size. These courses are what lowers our average class size to 18.34.

➢ ***Degree Productivity***

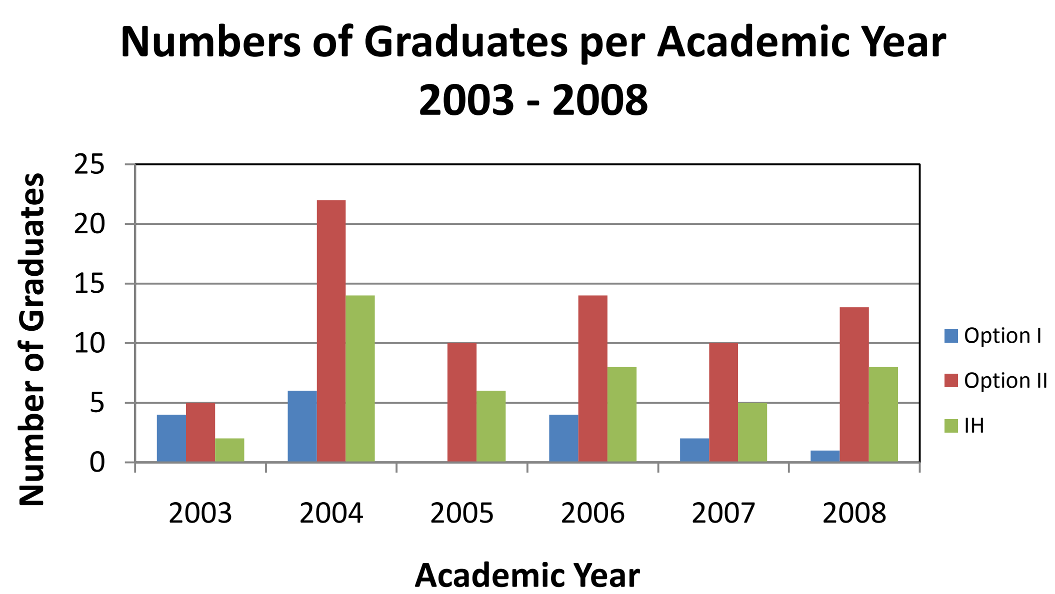


Figure 3.2 Numbers of Chemistry and Industrial Hygiene graduates per academic year.

There is a great variability in the numbers of majors graduating each year as shown in Figure 3.2. Anecdotally, the larger graduating classes are also those with good class personality. In upper division courses, just having one or two personable students may encourage other students to continue in the program and result in significantly larger graduating classes.

The long-term job market for graduates with a degree in either Chemistry or Industrial Hygiene is predicted to be good. The number of chemists employed nationally is expected to grow by nine percent between 2006 and 2016 according to the Bureau of Labor Statistics/Occupational Outlook Handbook (http://www.bls.gov/oco/ocos049.htm#outlook). Job growth will occur in professional, scientific, and technical services firms as manufacturing companies continue to outsource their R&D and testing operations to these smaller, specialized firms. Chemists should experience employment growth in pharmaceutical and biotechnology research, as recent advances in genetics open new avenues of treatment for diseases. Employment of chemists in the non-pharmaceutical chemical manufacturing industries is expected to decline over the projection period, along with overall declining employment in manufacturing.

The Bureau of Labor Statistics also predicts a 9 percent increase in the employment of occupational health and safety specialists and technicians during the 2006-16 decade, reflecting a balance of continuing public demand for a safe and healthy work environment against the desire for smaller government and fewer regulations. Emergency preparedness will continue to increase in importance, creating demand for these workers. More specialists will be needed to cope with technological advances in safety equipment and threats, changing regulations, and increasing public expectations. In private industry, employment growth will reflect overall business growth and continuing self-enforcement of government and company regulations and policies. Over the past two decades, insurance and worker's compensation costs have risen and have become a financial concern for many employers and insurance companies. As a result, job growth should be good for those specializing in loss prevention, especially in construction safety and in ergonomics.

In addition to job openings from growth, job openings in both Chemistry and Industrial Hygiene will arise from the need to replace workers who transfer to other occupations, retire, or leave for other reasons. An aging population paired with a decline in the number of postsecondary students studying the sciences, will create opportunities for those with technical skill.

- ***Student Services***

Chemistry students, especially chemistry majors, are encouraged to join, participate and take leadership positions in the Student Affiliates of the American Chemical Society (SAACS.) The activities of this registered student organization (RSO) include social gatherings, invited speakers, and service activities such as participating in Chemistry Day, UNA Preview Day and Earth Day. SAACS meets approximately once a month during the spring and fall semesters, frequently in conjunction with meetings of the Wilson Dam Section of the American Chemical Society. Parallel to SAACS is the UNA Industrial Hygiene Student Association (UNA IHSA). The UNA IHSA promotes participation of all interested students and holds meetings approximately once a month.

Industrial Hygiene students participate annually in professional meetings organized by the Alabama and Mid-Tennessee sections of the American Industrial Hygiene Association (AL-AIHA and MT-AIHA). The MT-AIHA holds an annual competition of research projects that is open for participation of graduate and undergraduate students enrolled in occupational health and safety programs (Kentucky, Tennessee and North Alabama). In the last two years (2007 and 2008), UNA IH students have been winners of this competition and recipients of a $1,000 cash award each.

During the 2008 – 2009 academic year, six students served as student laboratory assistants. This service gives students an opportunity to gain professional experience while earning a small salary. The program also greatly helps the faculty by relieving them of much laboratory preparation time. The Department's current annual budget for University Workstudy ($3511) is adequate to carry us through a year. Our students also work professionally off-campus. Generally, we have at least one chemistry student per year working part time at TVA's Environmental Research Center in Muscle Shoals, Alabama, and another student working for Southern Environmental Testing, Inc. in Florence, Alabama. The Industrial Hygiene program has a more formal cooperative education program. During the 2008 – 2009 academic year, five industrial hygiene students worked for local companies in industrial hygiene positions. Additionally, two students participated in services provided by the Occupational and Environmental Health Laboratory (OEHL) to local industry.

- ***Outcome Information (including student performance on licensure/certification exams, job placement of graduates, student, alumni and employer surveys)***

Since the spring semester of 1990, the Department has used the Major Field Test for Chemistry (MFT, formerly MFAT), offered by the Educational Testing Service to gauge our students' knowledge and abilities in chemistry near the completion of their degree program. The exam changed format in 1997 when individual scores for sub-disciplines became available. Figure 3.3 shows the nationally normalized percentile scores plotted against academic year for the 163 UNA students who have taken the Chemistry MFT since fall semester 1997. The average percentile score for Option I – Professional Chemistry majors over this period is 62.5% (N= 35). The corresponding score for Option II – General Chemistry majors is 25.1% (N= 128) and the average percentile scores for all chemistry majors taking the exam during this interval is 33.1%. More MFT data and analysis will be given in Section 10 - Program Evaluation, but in summary, the scores for most of our Option I majors are satisfactory while the average score for our Option II majors is unsatisfactory.

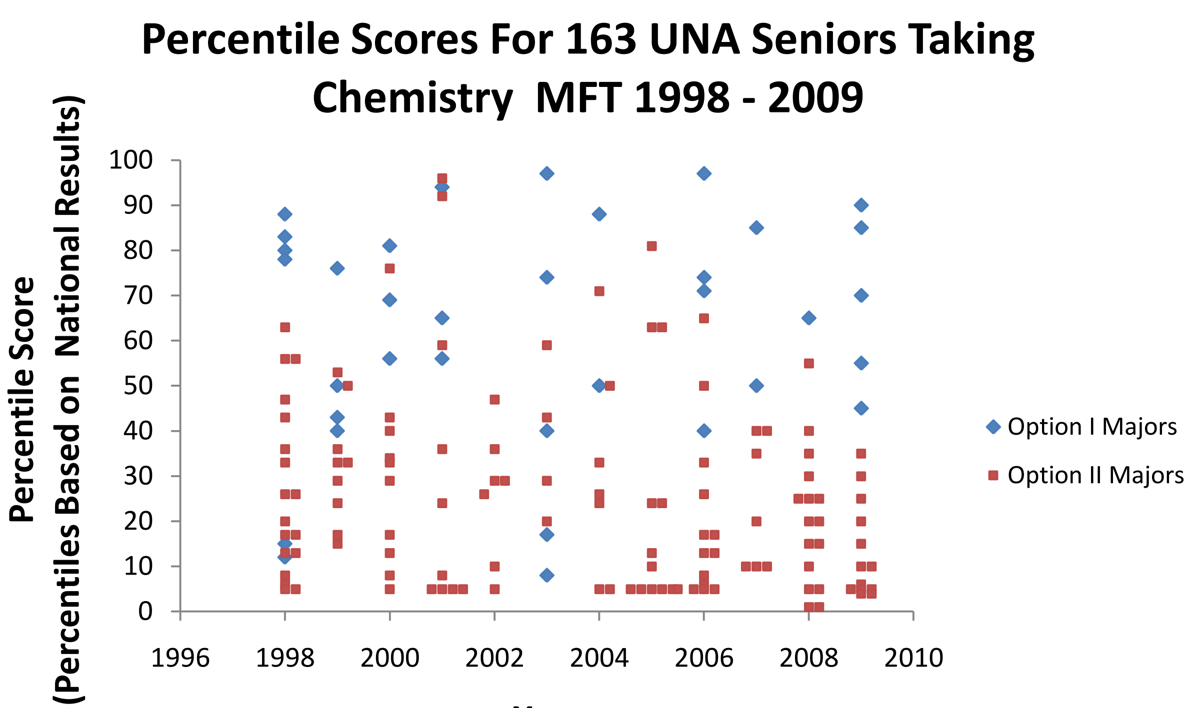


Figure 3.3 Performance of Chemistry majors on the MFT Chemistry Exam.

Since the year 2005, the Industrial Hygiene Program has used software available for the preparation of the professional certification exam in industrial hygiene (Datachem Software® CIHprep V8.3). The software generates a comprehensive practice exam from a large bank of questions encompassing the multiple areas of knowledge and practice required by the Industrial Hygiene profession. Certification is only allowed to practitioners with at least five years of professional practice and to be useful, the practice exam must be in depth. Figure 3.4 shows the performance of IH majors in the CIH practice test. We believe these scores are good, considering that approval scores on the actual certification exam are regularly in the range of 65%.

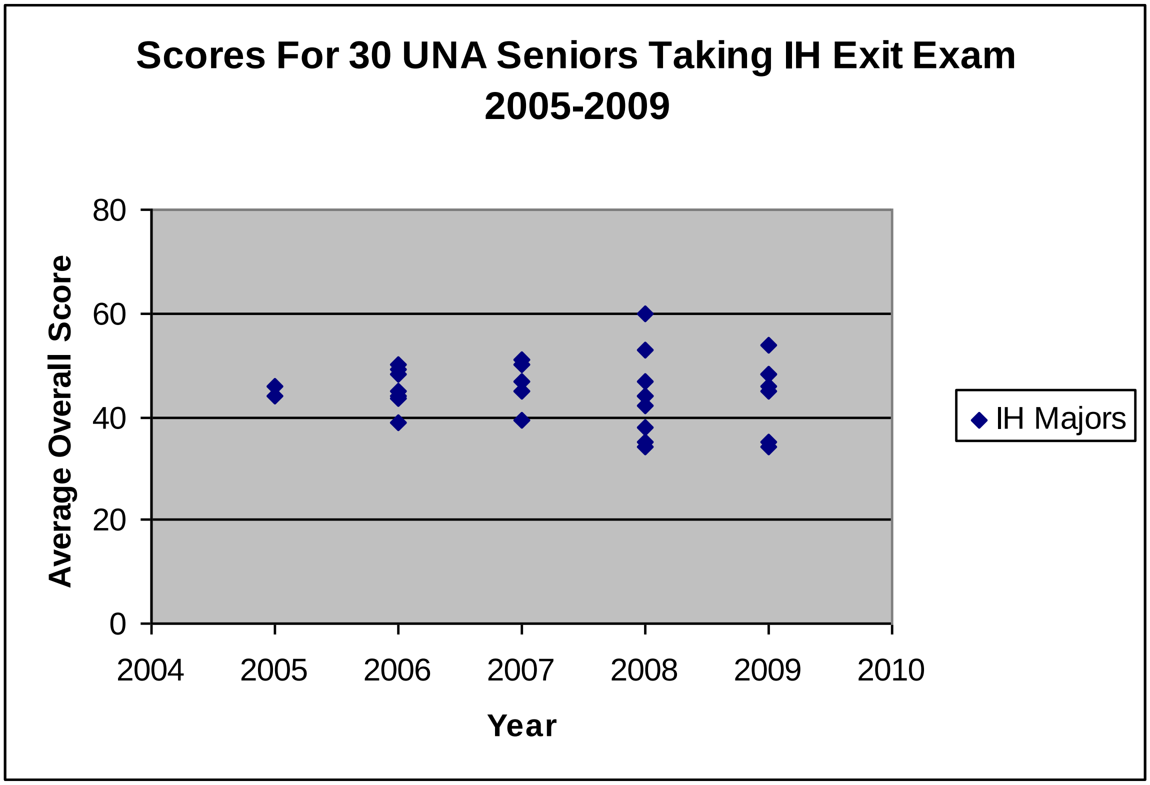


Figure 3.4 Scores for UNA seniors taking the Datachem Software® CIHprep V8.3 Test.

If this practice exam is close in content and degree of difficulty to the actual CIH exam, a band between 40 and 60% is acceptable, considering that graduating seniors with five or more years of professional practice should easily score above 65%. A benchmark for continuous improvement could be established at reducing the number students scoring below 40%.

A survey of our Chemistry graduates, academic years 1999 – 2008, was made during May 2009. This survey and summaries of the responses are given in Appendix A. The survey results show that our graduates have a very positive impression of the Department and our major programs. Survey results will be described in greater detail in Section 10 - Program Evaluation.

The survey indicates that upon graduation a majority of our students either find professional employment, continue their education in graduate programs, or are accepted into professional schools. Approximately 50% of our graduates get post-baccalaureate degrees.

Placement records of Industrial Hygiene students show that from 38 students who graduated between 2003 and 2008, 24-26 (2 unconfirmed) or 68% are employed in environmental health and safety (EHS), 3 or 8% are employed in chemistry, 2 are currently seeking employment in EHS and the rest have chosen a different field of activity or have not provided placement information.

Item 9 in the Chemistry survey asked students to rate their overall experience in Chemistry or Industrial Hygiene at UNA. On a five-point scale, in which five is excellent, the lowest average score was a 4.56 on the acceptance by employer of the UNA degree. If there is a problem here, there is probably not a quick way for the Department to address this issue.

Chemistry/Industrial Hygiene Alumni Survey 2009							
Please rate your overall experience in chemistry and/or industrial hygiene at UNA.							
Answer Options	**Excellent**	**Above Average**	**Average**	**Below Average**	**Poor**	**Rating Average**	**Response Count**
Professor's interest in your success at UNA.	32	11	1	0	0	4.70	44
Professor's interest in your future.	34	8	1	1	0	4.70	44
Technical ability of your professors.	33	10	1	0	0	4.73	44
Level of subject matter presented.	32	12	0	0	0	4.73	44
Acceptance by your employer of your UNA degree.	29	9	5	0	0	4.56	43
answered question							**44**
skipped question							**0**

Table 3.1 Summary of responses on Item 9 of alumni survey

In survey Item 10, our alumni were asked to rate their education with respect to a list of skills. A summary of the responses appears on the next page. Skill in using chemical or industrial hygiene instrumentation stands out as a high point for the Department, while student's preparation in oral communication is noticeably lower than any of the other categories. Historically, the Department has emphasized hands-on experience with laboratory and field instrumentation. We will want to examine our curriculum concerning oral communication skills.

Chemistry/Industrial Hygiene Alumni Survey 2009							
Please rate how effectively you believe the Department of Chemistry and Industrial Hygiene prepared you in the areas listed below.							
Answer Options	**Excellent**	**Above Average**	**Average**	**Below Average**	**Poor**	**Rating Average**	**Response Count**
Written Communication Skills	24	14	5	0	0	4.44	43
Oral Communication Skills	16	19	8	0	0	4.19	43
Data Analysis Skills	31	10	2	0	0	4.67	43
Problem Solving Skills	29	11	3	0	0	4.60	43
Laboratory Skills	29	11	3	0	0	4.60	43
Computer Skills	26	14	3	0	0	4.53	43
Chemical and/or IH instrumentation skills	33	10	0	0	0	4.77	43
Ability to understand and evaluate arguments and evidence	26	12	5	0	0	4.49	43
answered question							**43**
skipped question							**1**

Table 3.2 Summary of responses to Item 13 of alumni survey

Survey item number 13 asked students to state what they considered to be the greatest strengths of their major program. Thirty-four students wrote responses to this question. Frequently mentioned in these responses was the concern that the professors showed for their students (specifically mentioned 7 times), the expertise of the professors (mentioned 7 times), the enthusiasm of the professors (mentioned 5 times), small class size (mentioned 6 times) and the hands-on experience provided (mentioned 5 times.)

Survey Item 14 asked students to state what they considered to be the greatest weaknesses of their major program. Twenty-two students wrote responses to this question. Weaknesses mentioned more than once are: the facilities (4 responses), the biochemistry course (4 responses), the lack of research opportunities or requirement (3 responses), and the lack of a biochemistry requirement (2 responses). Note: Biochemistry is not required for the Option II major and it was not required for the Option I major until 2002.

4. <u>Assess the Department as it Relates to Faculty</u>

The Department has been going through a transition period with our faculty. In the spring of 2006, there were six full-time faculty in the Department: Dr. Figueroa, Dr. Gaunder, Dr. Moeller (Chair), Dr. Murray, Dr. Olive and Dr. Weisenseel. In the fall semester of 2006, Dr. Hofacker joined the Department as our seventh faculty member. Dr. Weisenseel resigned in the spring of 2007 to take a job in industry and Dr. Shearer was hired to replace him, starting in the fall semester 2007.

Dr. Murray retired after the spring semester 2008, but continued teaching for the Department through the spring 2009 semester, donating his salary to scholarships. Dr. Diaz was hired in 2008 to replace Dr. Murray. Dr. Gaunder also retired after the spring semester 2008 and his replacement, Mr. Gren, will be joining the faculty in a tenure-track position in the fall semester of 2009. In the spring of 2009, Dr. Shearer resigned to take a faculty position at another academic institution. The Department is currently engaged in an accelerated search to hire a person for one year to replace Dr. Shearer. In September 2009, we plan to advertise the vacancy left by Dr. Shearer as a tenure-track position starting in the fall semester of 2010.

Professors nearing the end of their teaching careers probably have a tendency to be less productive and innovative. New faculty, on the other hand, need to devote much of their efforts producing teaching materials for the classroom. In spite of the turnover in faculty during these years, and the amount of time spent performing faculty searches, the Department has a number of activities and accomplishments. These will be summarized in the next section.

In addition to the full-time faculty, the Department hires several chemists and an industrial hygienist every semester to teach part-time. The pay rate for part-time instructors is meager and our adjunct faculty are working because they enjoy teaching and providing service to their profession and their community. We employ adjunct faculty in two ways. Some adjuncts teach their specialty in upper-level courses (Industrial Hygiene Management, Hazardous Waste and Emergency Response, Environmental Regulations.) Others teach our lower-level laboratories (Introductory Chemistry, General Chemistry.) The high quality of instruction our adjuncts provide is reflected in the high marks they get in student evaluations. We are selective. Occasionally, we have had an adjunct who has not performed to our expectations and has not been rehired. It will be noted here that the American Chemical Society (ACS) Committee on Professional Training (CPT), has, in the past, had an unfavorable view of our use of adjuncts to teach the lower-level laboratories. It is the firm belief of the Chair of the Department that our adjuncts provide a quality of instruction that far exceeds the quality provided by the average graduate teaching assistant at Research I universities. The CPT does make a legitimate point, however, that having a large number of part-time faculty working mostly for self-satisfaction can make the program fragile. A person not dependent upon a salary may decide not to continue teaching. This could create a dilemma for having all scheduled courses taught without having anyone having to teach more than the fifteen-contact-hour limit set by the ACS. With this in mind, the Department advertises adjunct positions every semester and attempts to maintain an excess number of people in our adjunct pool. During the 2007 – 2008 academic year, the year prior to having Dr. Murray donating his time, the Department taught 38 lectures courses. Two of these (5.3%) were taught by adjunct faculty. Also, during the 2007 – 2008 academic year, the Department taught 57 sections of laboratory. Nineteen of these (33.3%) were taught by adjunct faculty.

The Department has one additional type of faculty, the instructor for Project OPEN. This is a half-time faculty position teaching Introductory Chemistry to students in a federally-funded program for disadvantaged students desiring to go into the nursing profession. Mr. Johnny Smith has been the chemistry instructor for this program since its inception.

- ***Teaching Productivity and Activities Designed To Enhance Teaching and the Curriculum***

The three classrooms used for teaching chemistry and industrial hygiene all are equipped with computer projection systems and these are used for every course. A wireless audience response system, TurningPoint, is installed in all three classrooms and has been used for CH 102, CH 111, CH 112, CH 341 and CH 381. Furthermore, FSB 301 has twenty-four student computers that are used during lectures and laboratories. The drives on these computers are loaded with applications specific for the Chemistry or Industrial Hygiene courses including: ChemOffice Suite by CambridgeSoft, Spartan Molecular Modeling by Wavefunction, Inc. and CIHprep by DataChem Software. On-line Web-Based Learning (OWL) is used to provide assignments for students in CH 101, CH 102, CH 111 and CH 112. Most instructors use the on-line instructional tools in BlackBoard.

The Department holds half-day Saturday retreats at the beginning of the fall and spring semesters. These retreats allow for extended discussions of curriculum, matters concerning ACS certification and ABET accreditation, goal planning and assessment, and other departmental business. In addition the Department has occasionally sponsored a workshop, the latest being a workshop on program assessment conducted by Dr. Dennis George, an authority on the topic.

- ***Research Productivity***

As mentioned earlier, there has been a turnover in faculty. This has undoubtedly diminished the research productivity by the Department. During the five-year period of time for this report, from fall 2002 through spring 2008, the Department has produced the following publications and presentations:

Publications in peer-reviewed journals (2):

> "Salt Index-Misleading Tables," by T. P. Murray and J. G. Clapp., **Communications in Soil Science & Plant Analysis**, **35**, pp 2867-2873, 2004.
>
> "Vapor Pressure Osmometry for Prediction of Turf Burn from Foliar Fertilization," by T. P. Murray and J. G. Clapp., **Communications in Soil Science & Plant Analysis**, **38**, pp 337346, 2007.

Presentations at professional meetings (6):

> "Galvanic Plating of Zinc onto Copper." Michael B. Moeller and Clinton Ray South, **81st Annual Meeting of the Alabama Academy of Science**, Montevallo, Alabama, March 2004.
>
> "Testing for a Discordant Point in Data Fit to a Straight Line Model." Michael B. Moeller, Ryan Johnson and Nathan Thacker, **82nd Annual Meeting of the Alabama Academy of Science**, Birmingham, Alabama, March 2005.
>
> "Investigation of Algorithms for Rejecting Discordant Data." Michael B. Moeller and Jason Downey, **82nd Annual Meeting of the Alabama Academy of Science**, Birmingham, Alabama, March 2005.

"Equilibrium Constant Calculator for Chemical Reactions at High Temperatures." Michael B. Moeller and E. B. Garner, **83rd Annual Meeting of the Alabama Academy of Science**, Troy, Alabama, March 2006.

"Investigation of Algorithms for Straight Line Least Squares with Errors in Both X and Y Values." Michael B. Moeller and E. B. Garner, **84th Annual Meeting of the Alabama Academy of Science**, Tuskegee, Alabama, March 2007.

"Planning Experiments Using Six Thinking Hats." Michael B. Moeller, **85th Annual Meeting of the Alabama Academy of Science**, Sanford, Alabama, March 2008.

Additional scholarly activities:

Dr. Crescente E. Figueroa is a member of the American National Standard Institute (ANSI) Z9.8 Ventilation Sub-Committee. This group has published "Fundamentals Governing the Management, Operation, Testing, and Maintenance of HVAC System for Maintaining Acceptable Indoor Air Quality in Non-Industrial Employee Occupancies through Dilution Ventilation." AIHA Guideline 2004

➢ ***Service (including service to public schools)***

Faculty members provide service through work on a number of university committees and also by serving in leadership positions in professional organizations. During the five-year period of time for this report from fall 2002 through spring 2008, the Department's members served in the following capacities:

Dr. Figueroa

- Member, ANZI Z9 Ventilation for Health Protection Committee
- Member, ANSI Z9.4; Z9.7; Z9.8; and Z9.10 Ventilation Subcommittees
- Member, AIHA Engineering Committee
- Member, AIHA Academic Special Interest Group
- Member of the Organizing Committee of the 8th International Conference on Ventilation
- Chair, Phi Kappa Phi Student Scholars Forum Selection Committee
- Member of the Emergency Preparedness and Safety Committee (2004 – 2007, served as chairperson 2006-2007)
- Member of the Faculty and Students Affairs Committee (2007 - present)
- Member of the Human Subjects Committee (2007 – present)
- Member of the Multicultural Affairs Committee (2004-2007, served as secretary 2006 - 2007)

Dr. Gaunder

- Member, University Curriculum Committee
- Chair, Health Professions Advisory Committee
- Treasurer, Phi Kappa Phi Chapter 132
- Alternate Councilor, Wilson Dam Section ACS

Dr. Hofacker

- Chair, Wilson Dam Section ACS
- Local Coordinator, ACS Chemists Celebrate Earth Day

Dr. Moeller

- Chair, Subcommittee on Area III, General Education Advisory Committee
- Member, *Ad Hoc* Committee of Preliminary Planning for the Science and Health Sciences Building
- Member, Academic Department Chairs' Workshops Committee
- Chair, University General Studies Degree Committee
- Member, Shared Governance Committee
- Member, *Ad Hoc* Committee on Branding
- Chair, Academic and Student Affairs Committee
- Faculty Representative to Jack Kent Cooke Foundation
- Chair, Wilson Dam Section ACS
- Alternate Councilor, Wilson Dam Section ACS
- Chair, Alabama Academy of Science Mason Scholarship Committee

Dr. Murray

- Member, University Infrastructure Development Committee
- Treasurer, Wilson Dam Section ACS

Dr. Olive

- Member, University Parking Committee
- Member, University Human Subjects Committee
- Chair, Wilson Dam Section ACS
- Secretary, Wilson Dam Section ACS
- Chair, Wilson Dam Section ACS Student Educational Activities Committee
- Member, Safety and Emergency Preparedness Committee

Dr. Shearer

- Chair-Elect, Wilson Dam Section ACS

Dr. Weisenseel

- Chair, Wilson Dam Section ACS
- Alternate Councilor, Wilson Dam Section ACS

Another very significant community outreach performed by the Department is the Annual High School Chemistry Contest conducted under the auspices of the Wilson Dam Section ACS. A contest exam is prepared and administered to chemistry students in high schools in the Wilson Dam Section's service area and the top scorer from each high school is invited to the Section's annual awards dinner. Last year, 615 students from twenty high schools participated in the contest.

- ***Faculty Development Plans***

To help remain current in their profession, the Department's faculty try to attend at least one regional or national meeting annually. For example, during this past year:

- Drs. Diaz, Hofacker, Moeller and Shearer attended the Southeast Regional Meeting of the American Chemical Society (SERMACS) held in Nashville, Tennessee.
- Dr. Moeller also attended the National Meeting of the American Chemical Society in Philadelphia, Pennsylvania.
- Dr. Olive attended the Professional Conference on Industrial Hygiene in Tampa, Florida. At this meeting, Dr. Olive took a continuing education course entitled "Risk Assessment for the Industrial Hygienist." Dr. Olive received an Arts and Sciences Faculty Development Grant to pay for this activity.
- Dr. Figueora attended the American Industrial Hygiene Conference and Exposition (AIHCE) in Toronto, Canada.

Unfortunately, SERMACS 2009 is in Puerto Rico which will probably make the trip prohibitively expensive. The Alabama Academy of Science meeting in Livingston, Alabama is a possible substitute. Dr. Moeller will be attending the National ACS Meeting in Washington, D.C. and Dr. Figueroa expects to attend AIHCE in Denver, Colorado.

5. <u>Assess the Department as it Relates to Facilities and Resources</u>

- ***Library***

The University libraries' collection of books, periodicals and documents is sufficient for our Chemistry and Industrial Hygiene programs. Our library resources have passed the inspection of both the ACS Committee on Professional Training and the Applied Science Commission of ABET. The Department's annual budget for purchasing monographs is $7,263 and this is adequate for maintaining a modern collection of monographs. First-rate access to a broad selection of scientific journals was gained in 2006 when the University subscribed to the ACS's online chemical information retrieval system, SciFinder Scholar.

- ***Laboratories***

Our alumni survey showed a favorable impression for the laboratory experience we offer and a negative impression for our laboratory facilities. The Department's philosophy has been to provide our students with as much hands-on experience as possible. We regard this to be strong points for both our Chemistry and our Industrial Hygiene programs. The building, however, is nearly fifty years old. In many laboratories, the benches, shelves and utilities are in a dilapidated state. The laboratory used for organic chemistry is too small and cluttered. The laboratory used for instrumental analysis is poorly designed for the instrumentation. The ventilation in many laboratories is inadequate. "Nothing is more clear than the absolute need to build a new science building at UNA. The project is designated as highest priority among the business and civic leaders of the region." (From: *The Case for a Science Building at the University of North Alabama*, by William G. Cale, April 2009.) A new building with excellent laboratory facilities has been designed. The problem is obtaining the funding. The new building is estimated to cost in the neighborhood of $40 million. Putting new case work in the old laboratories could serve as a stop-gap measure. In April 2009, a request for $95,272.00 was submitted to purchase new benches for FSB 302. These benches, if acquired, could later be moved to the new science building when it is constructed.

- ***Equipment***

In 1995 the total amount in the equipment line ($28,500) was removed from the Department's beginning-of-the-fiscal-year budget. In lieu of having an amount budgeted annually for equipment, a process evolved in which budget requests for specific equipment needs would be sent to the administration through the Dean of the College of Arts and Sciences. By being able to give compelling reasons for needed equipment, the Department was able to replace pieces when they failed. Recently, additional funds for equipment have been made available through a federal grant from the Health Resources and Services Administration/Health Care and Other Facilities Program. The Department's equipment inventory is quite satisfactory for our undergraduate programs although some of our instruments are relatively old and do not use the latest technology.

The computers supplied for our classrooms, laboratories and some faculty offices have been recently updated. The software and the technical support provided by the university are good.

- ***Space***

The offices, classrooms and laboratories for the Department of Chemistry and Industrial Hygiene are all located in Floyd Science Building. The one exception to this is the office for the instructor for Project OPEN, which is in a suite of offices in Stevens Hall. Floyd Science Building (FSB) is located near the center of the campus which is a convenience to students. In addition to the issues mentioned previously in the assessment of our laboratories, the building has severe climate control problems and a roof that frequently leaks. There is not a loading dock for the building, which is an inconvenience, and the room used for storage of solvents and chemical wastes is less than ideal.

Faculty offices are private, have good size and are frequently located close to faculty members' primary laboratory or classroom. The Department recently had the student study room and library in FSB 203 converted into two faculty offices and a small study area. This was done to accommodate the need for additional faculty office space by the Department of Biology. There is not room for any further growth in the faculty of any of the departments housed in FSB.

As previously stated, the Department uses three classrooms in Floyd Science Building, all have computer projection systems. The large classroom, FSB 102, has seats for seventy-seven students. This room was renovated in 2007 and although it is very cramped when filled to capacity, the situation is a great improvement over the situation in that classroom before the renovation. Our second classroom, FSB 201, can seat up to forty students in old-style individual student desks. Our third classroom, FSB 301, also serves as our computer lab. The room has twenty-four computers on four rows of tables which occupy approximately the front three-quarters of the room. Additional individual student desks behind and against one side wall provide seats for an additional twelve students. The computers are a distraction when they are not being used in a lecture. At other times, the computers can be a very good educational classroom resource. There are days, particularly in the fall and the spring, when the air conditioning is not turned on in the building and the outside temperature is warm, that the heat generated by the computers makes this room very uncomfortable.

➢ ***Support Personnel***

The Department has one full-time professional secretary who is very knowledgeable regarding both the University systems for enrollment, scheduling, advisement, procurement, etc., and the Department's particular requirements for discipline-related activities and student recruiting.

6. List Notable Achievements by the Department

➢ ***Departmental Achievements***

Included in the Department's major achievements during the period covered by this report are:

- In August 2003, the University was notified that the Applied Science Accreditation Commission of ABET, Inc. had voted to accredit UNA's Industrial Hygiene program through September 2009. [The Department had a re-accreditation visit in October of 2008 and from the exit report we are very optimistic about our accreditation being renewed.]
- In June 2006, the University was notified that the American Chemical Society Committee on Professional Training had concluded that our Option I Professional Chemistry Major continued to meet the guidelines established for ACS-approved schools. This was after the University responded to concerns the CPT expressed about some aspects of our program.

➢ ***Student Achievements***

- Chemistry majors have received awards in paper/poster presentation competitions at the annual spring meeting of the Alabama Academy of Science. A third place was awarded to a UNA student in 2005 and second place awards were won in 2007 and 2008.
- Two UNA IH students were the recipients of awards in a technical competition organized by the Mid-Tennessee Section of the American Industrial Hygiene Association (MTS-AIHA) during the fall semester of 2007 and 2008.
- During the five-year period for this review, from fall 2002 to spring 2008, six of our former students received their Ph.D.'s in chemistry and three of our chemistry majors were awarded M.D. degrees.

➢ ***Grants and Other Funds Generated by the Department***

- In 2001 Dr. Crescente was awarded a three-year NIOSH Long-term Training Project Grant (TPG) for approximately $30,000 per year. In 2004, the grant was continued at approximately the same annual level of funding through spring of 2009. Dr. Figueroa has applied for another renewal.

- In 2005, Dr. Olive was awarded a $150,000 grant from the Department of Defense/U.S. Army Research Laboratory as part of the Defense University Research Instrumentation Program (DURIP) for his proposal "Quantification of Atmospheric Effects on Bistatic, Monostatic, and Passive Fourier Transform Infrared Remote Sensors."

➢ ***Other Awards and Distinctions***

In addition to the Departmental achievements, other awards and distinctions include the following:

- Dr. Murray received the Wilson Dam Section Outstanding Member Award in 2007.
- Dr. Olive received the Wilson Dam Section Outstanding Member Award in 2008.
- In 2008, Dr. Moeller was elected to the position of Fellow of the Alabama Academy of Science.

7. How the Department has Responded to Previous Program Review Recommendations

In December of 2003, the Department submitted a five-year re-evaluation report on our Option I Professional Chemistry Major to the ACS Committee on Professional Training. The response to this report from the CPT cited several areas where the CPT believed our program did not meet the guidelines for an ACS-approved program. Given below are the areas of concern identified by the CPT and UNA's answer to these concerns:

- Concern: The frequency and sequence that certain courses (CH 382, CH 434, CH 437) are being offered. Explanation: We were offering CH 382 with CH 382L every other spring and offering CH 434 and CH 437 and the corresponding laboratories in alternating fall semesters. The CPT wanted 300-level CH 382 taken by our students before the 400-level courses.

- Concern: Increased reliance on adjunct faculty.

  The action taken to address both these concerns was to create a new faculty line for the Department of Chemistry and Industrial Hygiene. A new faculty member was hired. This permitted scheduling CH 382, CH 382L, CH 434 CH 434L, CH 437 and CH 437L every year. This additional faculty also addressed the issue of heavy reliance on adjunct faculty.

- Concern: There is not sufficient breadth in the techniques taught in Advanced Inorganic Laboratory.

  The action taken to address this concern was to expand the number of inorganic synthesis and characterization experiments using experiments suggested in the Inorganic Chemistry Supplement to the guidelines provided by the CPT. The University provided the Department with additional funds to acquire the equipment needed for several of these experiments.

- Concern: Quantum mechanics is not being covered in physical chemistry. At the time of the reevaluation, our two-semester sequence in physical chemistry mostly taught classical topics in physical chemistry and quantum mechanics was provided in the curriculum by having CH 444, Quantum Mechanics, a requirement for the Option I major. Although this provided a full semester course in quantum mechanics, the CPT wanted quantum mechanics encountered during the junior year so that students had some formal training in quantum mechanics when studying the advanced 400–level courses.

  The action taken to address this concern was to increase the number of lecture hours for CH 382 from three to four hours per week to allow time for a unit of quantum mechanics to be taught in physical chemistry. Also, consideration of surface chemistry was moved from lecture to laboratory in order to provide additional time for quantum chemistry.

- Concern: There are no spectroscopy experiments in the physical chemistry laboratory. The experiments are all classical.

  The action taken to address this concern was to revamp the second semester physical chemistry laboratory, CH 382L, to have a focus on spectroscopic measurements. Again, the University provided the Department with some additional funds to acquire the equipment needed for several of these new experiments. Also, an experiment in molecular computational chemistry was added to the first semester of physical chemistry laboratory.

The ACS recently revised the CPT Guidelines for Program Approval and Student Certification. The Department will be submitting the next reevaluation report to the Committee on Professional Training in June of 2010. We have carefully reviewed the new guidelines and have made the following adjustments in order to strengthen our re-evaluation report under the revised guidelines:

- We have increased the lecture hours for CH 321, Analytical Chemistry, by one hour to make it a 3-credit lecture.
- We have added molecular computation chemistry to CH 381L.
- We have added electrochemical analysis to CH 432L.
- A unit on professional ethics has been added to CH 382L.

The Industrial Hygiene Program was evaluated for ASAC-ABET accreditation during the year-cycle 2002-2003. The following is a summary of deficiencies, weaknesses and concerns documented in the final report and the actions taken to address these shortcomings.

- Deficiency: All students who entered the program subsequent to the 2001-2002 academic year were required to complete all the ABET-accredited program requirements. However, in the fall semester of 2002, there were four students in the pipeline who could have graduated without all the ABET requirements.

  The action taken to address this deficiency was to adopt, for Industrial Hygiene majors, an exception to the seven-year catalog entitlement. As per this exception, Industrial Hygiene students graduating after May 2003 were limited to choose the 1999-2000 catalog or a more recent catalog. This exception was published in the 2004-2005 university catalog (page 45). This deficiency was resolved in the ASAC-ABET Final Statement Report (August 15, 2003).

- Concern: Size of the overall core and supporting faculty and program resources should be consistent with enrollment.
-

  The action taken to address this concern was to affirm that if enrollment figures justified the need for two full-time faculty members, the faculty serving part-time in the IH program can be freed from his teaching assignment in chemistry and assigned to an equivalent number of hours in industrial hygiene. In addition to the full-time faculty, members of the IH Program Advisory Board can support the program as lecturers or adjunct faculty. This concern was resolved in the ASAC-ABET Final Statement Report (August 15, 2003).

- Concern: The existing funding level for the acquisition, maintenance and operation of laboratory equipment and instrumentation is marginal.

  The action taken to address this concern was to establish a new account with annual deposits of four thousand dollars in new monies. It is at the discretion of the chair to transfer monies among supplies, travel, and equipment needs. This concern was resolved in the ASAC-ABET Final Statement Report (August 15, 2003).

The IH program was evaluated for re-accreditation during the year-cycle 2008-2009. The following is a summary of the shortcomings found in the self-assessment study and the actions taken to address these shortcomings:

- Shortcoming: Students could transfer credits for industrial hygiene or safety courses from a school not having ABET accreditation as a substitution for core requirements of our IH curriculum.

  The action taken to address this concern is that students are not allowed to transfer any of the industrial hygiene or safety courses as a substitution for core requirements of the IH curriculum, unless these courses were taken at another ASAC-ABET IH, Safety or OH&S accredited program and are equivalent in content to those required by the UNA curriculum. This exception, which applies to university credit by transfer and credit from transient student status, has been verbally agreed upon by faculty members of the Department. It has not, however, reached a formal policy status, because it was not needed since no students have requested a transfer of IH or safety courses. The corrective action involved the request for formal adoption of this exception and its inclusion in the transfer credit section of the 2010-11 UNA Undergraduate Catalog. This has been approved by the College Curriculum Committee.

- Shortcoming: The Program Director of IH has an assigned full-time teaching load with no release time given for completing the administrative responsibilities of the position.

  The action taken to address this concern is that a statement describing the responsibilities of the position of Program Director of IH was created to justify the request for release time. The designation of Program Director of IH became official in December 2006. A release time equivalent to three credit hours was granted to this position.

- Shortcoming: There was difficulty making estimates of the actual expenditures incurred by the Industrial Hygiene program.

  The action taken to address this concern was to separate budgets of the Chemistry and Industrial Hygiene programs into two different accounts, starting the fiscal year 2008-2009.

- Shortcoming: Students were taking courses out of sequence.

  The action taken to address this concern was to make registration in courses without pre-requisites met generally not allowed. Concurrent registration of a course and its respective pre-requisite(s) will be permitted only for those students who can demonstrate that under a standard sequence of enrollment, their graduation date will be extended by one or more semesters. Approval by the advisor and department chair is required for concurrent registration. The date of implementation of this variance was March 2008. The pre-requisites for IH 411, Industrial Safety (CH 312, CH 312L, and IH 301) were revised with a conclusion that all were unnecessary. A curriculum change lowering the pre-requisites of organic chemistry to CH 311 and CH 311L and changing the number of the Industrial Safety Course to IH 311 was adopted. Advisement of IH students will continue being mandatory regardless of the policies adopted by the university.

- Shortcoming: Some courses of the IH curriculum addressed areas concerning knowledge and skills without making a clear distinction of student accomplishment in any of these two areas.

  The action taken to address this concern was to separate the laboratory components of IH 422, Control of Airborne Hazards, and IH 444, Sampling Methods in Industrial Hygiene (IH 422, IH 422L, IH 444, and IH 444L). This measure was implemented in academic year 2005-2006. Field trips, hands-on activities, use of models, and experiments included in IH 310, Industrial Ergonomics, were moved to a laboratory course (IH 310L) that complements the lecture component (IH 310). This measure was implemented in academic year 2005-2006.

- Shortcoming: The evaluation of objectives and outcomes revealed that students did not fulfill expectations of knowledge and skills on the subject of physical agents, particularly radiological agents.

  The action taken to address this concern was to increase from 2 to 3 the number of credit hours for the course IH 310, Industrial Ergonomics, and to expand on topics of recognition and evaluation of physical agents including ionizing radiation. The new expanded course is called IH 310, Industrial Ergonomics and Physical Agents. This measure was implemented in academic year 2008-2009.

The Industrial Hygiene program was evaluated by a team of program evaluators, for re-accreditation during the year-cycle 2008-2009. The following is a summary of the shortcomings given in the preliminary exit report from the ASAC-ABET evaluation. (Visit Dates: October 5-7, 2008.)

- Weakness: "Criterion 5 Curriculum: Criterion 5 states in part, "Students in baccalaureate degree programs must also be prepared for applied science practice through a curriculum culminating in comprehensive projects or experiences based on the cumulative knowledge and skills acquired in earlier course work." No comprehensive, culminating experience(s) could be identified for all students."

  The action taken to address this weakness was to add to the curriculum a one-credit hour capstone course in Industrial Hygiene to be completed in the last semester of enrollment. This course will be a requirement for all graduating seniors. This course will also require the completion of a comprehensive exit exam (CIH preparation software). This exam is currently completed by all students as an independent graduation requirement.

- Concern: Criterion 1 Students: Criterion 1 states in part, "The program must also have and enforce procedures to assure that all students meet all program requirements." The transcripts submitted with the Self-Study have numerous variations or apparent discrepancies with the current requirements. While the program was eventually able to explain each variation, the process was *ad hoc* and should be improved in the future.

  The action taken to address this concern was to establish a Departmental policy to review the transcripts of all graduating seniors immediately following graduation. Notations will be entered in each explaining the variations found with respect to the most current program requirements. These files will be maintained in the secretarial office of the Department of Chemistry and Industrial Hygiene. A guide with a list of curriculum changes and all variations allowed by the University will be created and provided as supplemental material during the next evaluation cycle.

➢ **Summarize how Previous Review Results have been Used to Inform any of the Following that apply: The Refinement of Mission and Goals/Objectives; Program Planning, Development and Improvement; and Budgeting Decisions.**

As described above, in order to able to give better estimates for the expense of our programs, the budget for the Department of Chemistry and Industrial Hygiene has been divided into two separate budgets. The Department Chair can perform budget transfers between the two budgets when necessary.

8. State the Vision and Plans for the Future of the Department

➢ ***Where the Department Would Like to be in Five Years, Assuming Level Funding.***

Being both realistic and optimistic, when written five years from now, our next assessment report will find:

- The IH program continues to be ABET-accredited and our Professional Chemistry Major continues to be approved by the ACS.
- We have a dynamic faculty, most tenured or close to receiving tenure.

- There is increased enrollment in upper-level chemistry courses and an increase in the number of Option I Professional Chemistry Majors and Industrial Hygiene Majors graduating annually.
- There is an increase in research productivity and an increase in extramural funding.

➢ ***Where the Department Would Like to be in Five Years, Assuming an Increase in Funding is Available.***

In addition to all of the above, in the best scenario our next assessment report will also find:

- We have added a faculty line and have reduced our need for part-time faculty.
- The Department has moved into a new science building.
- A new position, Director of the Chemistry Program, has been created with six hours of release time annually. This person will be responsible for ACS certification, keeping up with assessment data for both chemistry majors and the general studies program, and work on recruitment and retention.

Program Assessment

The University of North Alabama is committed to ongoing, integrated, and institution-wide research-based planning and evaluation processes. To this end, each department, as a whole, should be evaluated to ensure that departmental goals, strategies, and projected outcomes are congruent to and support the institution's mission and strategic plan.

Specifically, the department should show that it 1) incorporates a systematic review of institutional mission, goals, and outcomes; 2) this review results in continuing improvement in departmental quality; and 3) the departmental goals support the institution's mission and strategic plan.

The Department offers two distinct major programs: a Chemistry Major with two options, Option I Professional Chemistry and Option II General Chemistry; and an Industrial Hygiene Major. The assessment of the Chemistry Major is presented in sections 9CH – 11CH on pages 24 – 40. The assessment of the Industrial Hygiene Program follows in sections 9IH – 11IH on pages 41– 58.

9CH. <u>Chemistry Program Overview</u>

- ***Brief Overview of the Chemistry Program***

The Chemistry Program endeavors to prepare students at the baccalaureate level for entry level positions in the chemical professions in the private or public sector, for graduate chemistry programs, for professional school in the medical/health sciences; or to provide the subject field for the preparation of secondary teachers of Chemistry offered through the College of Education.

- ***Mission Statement***

The stated mission of the University of North Alabama is to engage in teaching, research and service in order to provide educational opportunities for students, an environment for discovery and creative accomplishment, and a variety of outreach activities meeting the professional, civic, social, cultural, and economic development needs of our region in the context of a global community. In support of this, the mission adopted by the Department of Chemistry and Industrial Hygiene is to instruct students in the academic disciplines of Chemistry or Industrial Hygiene providing an understanding of the concepts and principles of these disciplines and imparting the ability to conduct scientific investigations, to generate new knowledge in these disciplines through research and to use the resources of the Department to serve the University and the surrounding region.

- ***Goals and Objectives of the Program Relative to Teaching, Research and Public Service, and Assessment of Program Performance in Relation to Them***

The Department has enumerated eight goals to undergird our mission:

1. To prepare Chemistry majors knowledgeable in Chemistry and prepared to continue in graduate school or in the Chemistry professions;
2. To prepare Industrial Hygiene majors for careers in Industrial Hygiene or for graduate programs in Occupational Health;
3. To offer a component of general studies course work designed to provide a diverse educational background and a suitable foundation for specialized study;
4. To promote research and other scholarly activities in Chemistry and Industrial Hygiene;
5. To provide a safe workplace for faculty, students and staff;
6. To assist in the recruitment and retention of a quality student population in the Chemistry and Industrial Hygiene programs;
7. To promote involvement and leadership in University and community service activities; and
8. To promote greater awareness of the programs and services provided by the Department and the Occupational and Environmental Health Laboratory.

Goals 1, 4, 5, 6 and 8 are particularly relevant to the Chemistry program. The assessment of these goals is reported in Sections 4, 6 and 10 of this document.

➢ Student Learning Outcomes of the Program

An undergraduate chemistry curriculum should provide instruction in the five areas that the American Chemical Society's Committee on Professional Training has identified as being fundamental to the discipline. These fundamental areas are analytical chemistry, biochemistry, inorganic chemistry, organic chemistry and physical chemistry. The difference between Option I Professional Chemistry and Option II General Chemistry is mostly the depth to which these fundamental areas are explored. Accordingly, many of the same assessment instruments can be used to evaluate the two chemistry options with the difference being the level of student performance expected for each major.

In addition to the broad fundamental area, the Department has also specified a small set of measureable learning outcomes for chemistry students, both knowledge-based and skills-based, which can be used to assess the Chemistry Program's degree of achievement. These learning outcomes are assessed indirectly with our alumni survey and directly by measuring student performance in specific exam questions or laboratory tasks. The learning outcomes used for this assessment, and the courses where they are measured are:

Knowledge based – Students will be able to…

- Demonstrate knowledge of bonding theory. (CH 111, CH 312)
- Apply concepts of chemical kinetics. (CH 341, CH 382)
- Quantitatively employ chemical thermodynamics. (CH 341, CH 382)
- Demonstrate the use of stoichiometry. (CH 111, CH 321)
- Apply gas laws. (CH 341, CH 382)
- Students will demonstrate an understanding of the three-dimensional nature of molecular structure. (CH 312)
- Demonstrate knowledge of solution chemistry. (CH 321)
- Demonstrate ability to understand and interpret spectroscopic data. (CH 312, CH 322, CH 432)

Skills based – Students will be able to…

- Gather, process and interpret data. (CH 322L, CH 432L)
- Communicate results and information. (CH 321L, CH 322L, CH 432L)
- Design and perform an experiment. (CH 341L, CH 381L)
- Demonstrate the ability to synthesize and characterize chemical compounds. (CH 312L)
- Develop critical thinking skills. (CH 341, 381)

➢ Governance Structure of the Program

All full-time faculty members constitute the Department's Curriculum Committee. Proposals for program planning and curriculum changes are discussed and voted upon at departmental meetings. Approved curriculum changes are passed to the Arts and Sciences Curriculum Committee which, in turn, can recommend them to the University Curriculum Committee for adoption.

➢ *Admissions Requirements, Procedures, and Policies*

Admission and academic policies for the University are published in the University Catalog. There are no specific entrance requirements for becoming a chemistry major.

➢ *Degree Requirements*

In addition to graduation requirements listed in the catalog for all students, chemistry majors must take an exit exam. Option II General Chemistry also requires a minor or second major for graduation.

➢ *Curriculum*

All courses required for a baccalaureate degree with an Option I Professional Chemistry Major or an Option II General Chemistry Major are tabulated in the check sheet given below and on the next page.

General Studies. See University Bulletin for elective courses in Areas II and IV.

Area I. Written Composition (6 hrs.)

EN 111 (3) _____ or EN 121 (3) _____
EN 112 (3) _____ or EN 122 (3) _____

Area II. Humanities and Fine Arts (12 hrs.)

EN 231 (3) _____ or EN 233 (3) _____
EN 232 (3) _____ or EN 234 (3) _____
COM 201 (3) _____

Three hours from Area II electives (Specify courses in spaces below.)
_______________________ (3) _____

Area III. Natural Sciences and Mathematics (11 hrs.)

Requirements met in major and required supporting courses

Area IV. History, Social and Behavioral Sciences (12 hrs.)

HI 101 (3) _____ or HI 201 (3) _____
HI 102 (3) _____ or HI 202 (3) _____
Six hours from Area IV electives (Specify courses in spaces below.)

_______________________ (3) _____
_______________________ (3) _____

Professional Chemistry Major (no minor required)

CH 111 (3) _____ CH 111L (1) _____
CH 112 (3) _____ CH 112L (1) _____
CH 311 (4) _____ CH 311L (1) _____
CH 312 (4) _____ CH 312L (1) _____
CH 321 (3) _____ CH 321L (2) _____
CH 381 (4) _____ CH 381L (1) _____
CH 382 (4) _____ CH 382L (2) _____
CH 432 (3) _____ CH 432L (2) _____
CH 434 (3) _____ CH 434L (1) _____
CH 437 (3) _____ CH 437L (1) _____
CH 441 (3) _____

Prescribed supporting courses:
CS 110, 120 or 155 (3) _____
MA 125 (4) _____
MA 126 (4) _____
MA 227 (4) _____
MA 338 (3) _____
PH 251 (5) _____
PH 252 (5) _____
Electives (as needed):
__________________________________ ( ) _____
__________________________________ ( ) _____
Note: Must have at least 128 credit hours.

General Chemistry Major

CH 111 (3) _____ CH 111L (1) _____
CH 112 (3) _____ CH 112L (1) _____
CH 311 (4) _____ CH 311L (1) _____
CH 312 (4) _____ CH 312L (1) _____
CH 321 (3) _____ CH 321L (2) _____
CH 322 (3) _____ CH 322L (2) _____
CH 341 (3) _____ CH 341L (1) _____
Prescribed supporting courses:
CS 110, 120 or 155 or CIS 125 (3) _____
MA 125 (4) _____ or MA 121 (3) ______
MA 126 (4) _____ or MA 122 (3) ______
PH 251 (5) _____
PH 252 (5) _____

A minor or second major is required for Option II Chemistry
__________________________________ ( ) _____
__________________________________ ( ) _____
__________________________________ ( ) _____
__________________________________ ( ) _____
__________________________________ ( ) _____
__________________________________ ( ) _____
__________________________________ ( ) _____
Electives (as needed):
__________________________________ ( ) _____
__________________________________ ( ) _____
Note: Must have at least 128 credit hours.

- ***Associated Institutes and Centers***

The Chemistry Program does not currently have any associated institutes or centers.

- ***Involvement of External Constituents***

The Chemistry Program at the University of North Alabama has a close association with the Wilson Dam Section of the American Chemical Society. The Wilson Dam Section sponsors an annual awards dinner in the spring where awards are presented to the outstanding student in General Chemistry (CH 111-112), Organic Chemistry (CH 311-312), Analytical Chemistry (CH 321–432), Inorganic Chemistry (CH 435) and several awards for outstanding graduating seniors.

The Department is considering forming an advisory committee for its chemistry program.

- ***Community College Articulation***

In validating academic credits previously earned, the University adheres to specific policies and procedures regarding transfer of courses from other institutions of higher learning in the State of Alabama. Mandated by the Alabama Legislature in 1994, the Statewide Transfer and Articulation Reporting System (or STARS Program) and the Articulation and General Studies Committee (or AGSC) provides a system of course equivalency between public universities and community colleges in the state. The STARS Program, which includes a web-based database, allows students and University personnel to efficiently identify courses needed to satisfy program requirements. This prevents loss of course credit hours upon transfer and facilitates graduation in a timely manner.

An idiosyncrasy in articulation for the chemistry program occurs with organic chemistry. At UNA, the two-semester sequence in organic chemistry, CH 311-312 and CH 311L-312L, constitute a total of 10 credit hours. The corresponding courses offered at a community college in the Alabama system, CHM 221–222, is 8 credit hours. UNA accepts a passing grade in the community college courses as fulfilling a curriculum requirement for organic chemistry, but requires chemistry majors to take an additional 2 credit hours of upper level chemistry courses.

- ***Program Productivity (including number of majors and degrees conferred)***

  See section 2 and section 3 of this document.

10CH. <u>Chemistry Program Evaluation</u>

The Department of Chemistry and Industrial Hygiene at the University of North Alabama is committed to providing our students with a comprehensive, high-quality education, preparing them to be successful in professional careers or for entry into programs of post-baccalaureate education. To help us fulfill this commitment, the Department has devised an assessment plan for measuring student learning outcomes - the levels of abilities that our students attain as they complete the major programs offered by the Department. This measure is a means of validating the breadth and quality of the education being provided. Stakeholders who would be interested in such validation include current, former and future students, employers of our graduates, and entities that provide resources for the programs. More than simply validating program quality, the assessment plan is intended to provide the Department with information that will lead to continual improvement of the academic program.

- ***Describe Briefly the Means of Assessing Student Learning Outcomes, and Recent Improvements Based on the Results of such Assessment. Means of Assessing Outcomes May Include but are not limited to Standardized Tests, Capstone Course/Program Examinations, Analyses of Theses, Portfolios and Recitals***.

The Department's assessment plan for the Chemistry Program has three components: 1) an alumni survey, 2) standardized chemistry tests and 3) students performance on our learning outcomes. This is the first evaluation cycle of our Chemistry Program under this assessment plan.

Alumni Survey

A survey of our Chemistry graduates for the academic years 1999 – 2008 was made during May 2009. The survey was conducted by e-mail using Survey Monkey® software and was in two parts, a biographical questionnaire and another questionnaire for anonymously evaluating components of our Chemistry Program. Probably no group has better knowledge for assessing the Department and our programs than this set of individuals. The Department sent our survey out to the 90 alumni for whom we had e-mail addresses. Twelve of these e-mails were returned as undeliverable. Forty-four alumni answered the survey. This number of responses was considered sufficient to provide valid information for this study and no further effort was made to acquire additional functioning e-mail addresses. The alumni survey as it relates to department assessment was previously discussed in Section 3 of this document. The survey questions and responses are given in electronic format in Appendix A.

Item 1 of the Program Evaluation Survey asked when the individual graduated from UNA. A straight line regression analysis performed on the number of respondents by graduation year had a slope of 0.25 $year^{-1}$, meaning that we had a slightly greater number of respondents from the more recent years.

Item 2 provided information regarding the ratio of Professional Chemistry to General Chemistry majors giving input. Many of the people responding were double majors in General Chemistry and Industrial Hygiene.

Chemistry/Industrial Hygiene Alumni Survey 2009		
What was your major(s) at UNA?		
Answer Options	**Response Frequency**	**Response Count**
Professional Chemistry - ACS Certified	36.4%	16
General Chemistry	59.1%	26
Industrial Hygiene	52.3%	23
Chemistry - Secondary Education	0.0%	0
answered question		**44**
skipped question		**0**

There were adequate numbers of responses by both Profession and General Chemistry Majors to allow any conclusions drawn to be valid for both options.

In Item 3 of the survey, alumni were asked about post-baccalaureate education and Item 4 asked about post-baccalaureate fellowships, scholarships, awards or honors. Forty-eight percent of our alumni enrolled in post-graduate programs and sixty-two percent of these people answered affirmatively to Item 4.

Item 5 asked about patents or publications since their graduation and Item 6 asked for the journal titles for their publications. This group of our alumni has a total of 4 patents and more than 35 publications in some of the top journals in the chemistry.

Item 7 asked for information about their employment record and Item 8 asked about current salary. The median salary range for this group of alumni was \$60,000 - \$80,000. Three people are making less than \$25,000. These three are most likely graduate students receiving other benefits. Two graduates in the group are making over \$100,000.

Survey Items 9 and 10 asked graduates to rate their overall experience and preparation at UNA. These survey items were reported on pages 9 and 10. In every category but oral communication, most of our graduates rated their experience and preparation to be excellent.

Item 11 asked which sub-disciplines in chemistry have they used professionally and survey Item 12 asked them to rate their preparation in these sub-disciplines.

Chemistry/Industrial Hygiene Alumni Survey 2009						
Does your current or past work position(s) require you to have a working knowledge of the following?						
Answer Options	**Analytical Chemistry**	**Biochemistry**	**Inorganic Chemistry**	**Organic Chemistry**	**Physical Chemistry**	**Response Count**
Yes	32	17	25	34	31	39
No	10	24	14	9	10	27
answered question						**44**
skipped question						**0**
Item 11 on 2009 Alumni Survey						

Chemistry/Industrial Hygiene Alumni Survey 2009								
How well do you feel UNA prepared you in the following disciplines?								
Answer Options	**Very Well Prepared**	**Well Prepared**	**Average Prep.**	**Below Average Prep.**	**Poorly Prepared**	**N/A**	**Rating Aver.**	**Resp. Count**
Analytical Chemistry	25	14	4	0	0	1	4.49	44
Biochemistry	2	5	17	3	3	14	3.00	44
Inorganic Chemistry	20	9	8	1	1	4	4.18	43
Organic Chemistry	27	14	3	0	0	0	4.55	44
Physical Chemistry	24	17	3	0	0	0	4.48	44
answered question								**44**
skipped question								**0**
Item 12 on 2009 Alumni Survey								

There are not significant differences in the perceived quality of the preparation offered by analytical, organic and physical chemistry, with all three areas getting high marks. Inorganic chemistry scored a little lower, which is understandable. Our Option II General Chemistry majors are not required to take a specific course in inorganic chemistry, so much of the instruction in inorganic chemistry that they receive is in General Chemistry, CH 111–112.

There were no negative comments in survey Item 14, however, regarding preparation in inorganic chemistry.

From survey Item 11, we know that a substantial number of alumni do not use biochemistry in their profession. Also, our General Chemistry majors are not required to take biochemistry. For these two reasons, a large number of respondents checked "N/A" (Not Applicable) in the Biochemistry row. For those graduates who did express an opinion, biochemistry rated far below the other sub-disciplines of chemistry. This low rating is consistent with negative comments given in survey Item 14 and previously mentioned in Section 3 on page 10 of this report.

The last three items in the survey allowed for comments. Those comments with repeated content were noted previously.

Standardized Tests

The second component of the Chemistry Program Assessment Plan uses our students' scores on standardized tests. The percentile scores made by Chemistry majors on the Major Field Test were previously presented in Section three in Figure 3.3. This data is summarized in Figure 10.1 below by giving average values per year. Our Assessment Plan calls for an average percentile score of 60 for Professional Chemistry majors on the total exam for satisfactory performance and an average percentile score of 40 for General Chemistry majors. The average percentile score for Professional Chemistry majors was, in fact, 62.5, slightly above the standard set by the Department. The average percentile score for General Chemistry majors was 25.1%, considerably below our level for satisfactory performance. In the coming year, the Department will consider what measures can be taken to raise MFT scores, especially for General Chemistry majors. One possibility is to add a capstone course which would prepare students for their exit exam by reviewing material in the chemistry curriculum. Having the grade for this course depend, in part, on the MFT score would also add incentive to do well in the test.

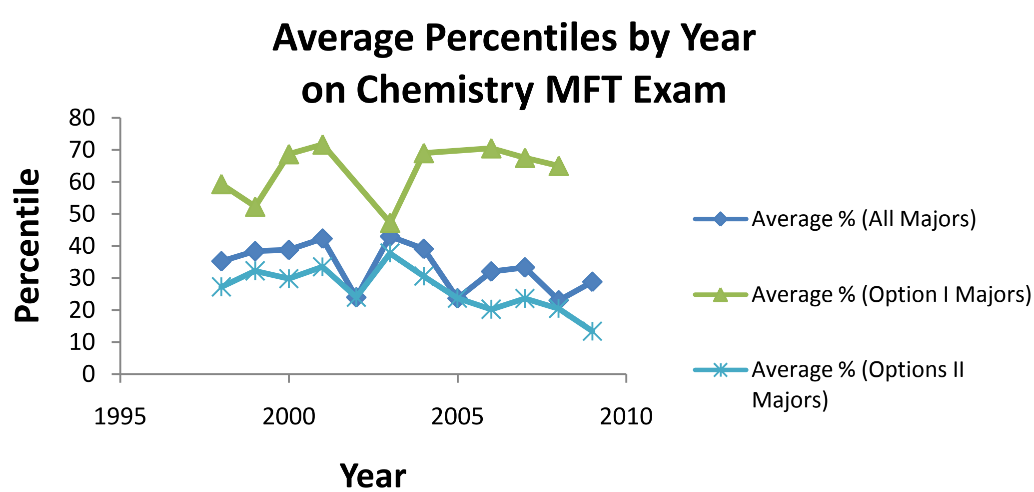


Figure 10.1 Average performance of Chemistry majors on MFT exam by year.

The Educational Testing Service (ETS) also gives subscores and corresponding percentile ranking for the four sub-disciplines of physical chemistry, organic chemistry, inorganic chemistry and analytical chemistry. Figure 10.2 presents the average values for these sub-disciplines by year. There does not appear to be a glaring weakness in any particular sub-discipline.

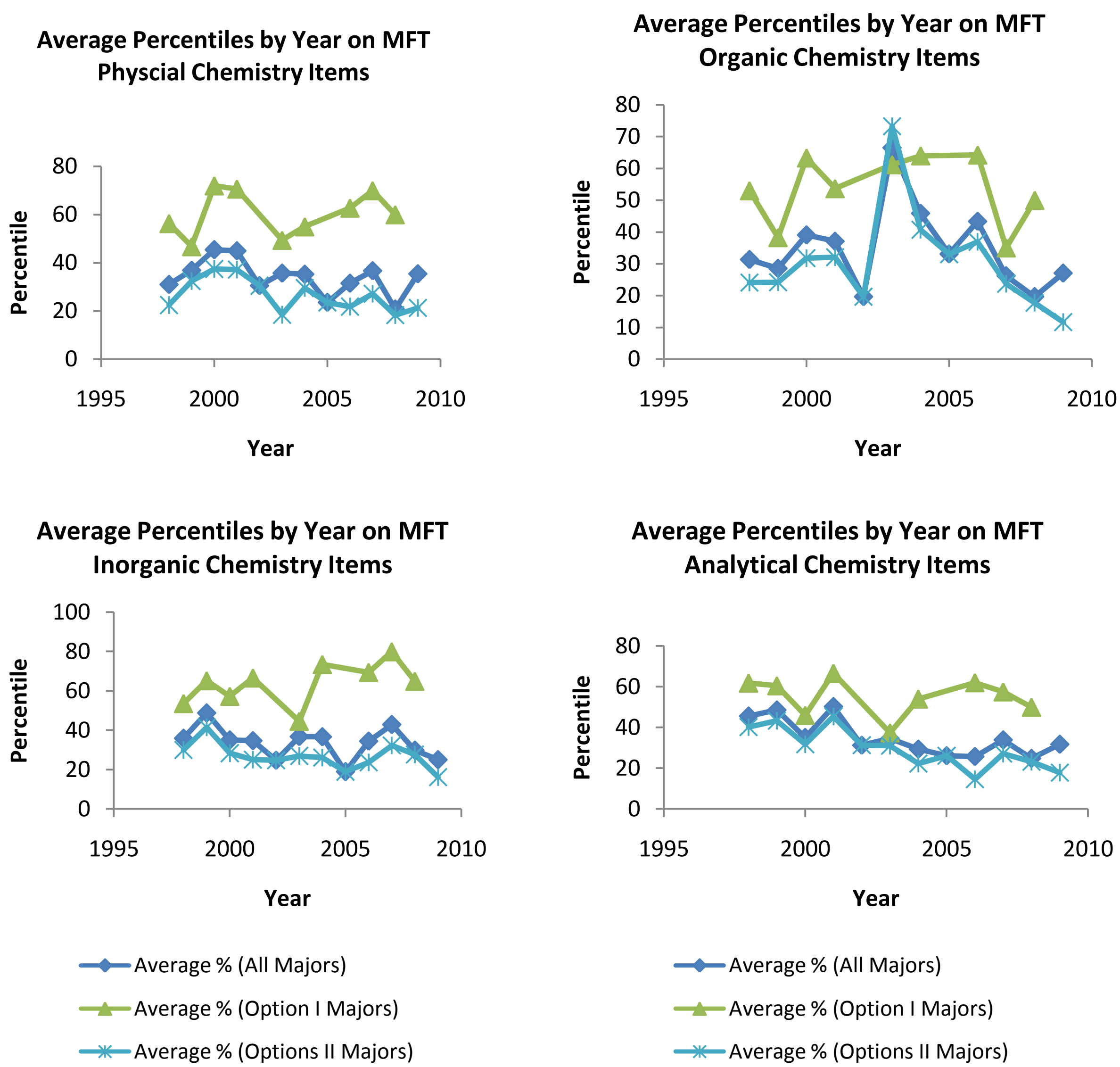


Figure 10.2 Average percentile scores by year for four Chemistry sub-disciplines.

Since 2007, ETS also provides assessment indicators for Biochemistry and Critical Thinking with the Chemistry MFT. The assessment indicators scores given are the mean percent of correct responses and not reported for the individual students. We cannot, therefore, separate data for Option I and Option II, or for students who have taken Biochemistry. For the years 2007 through 2009, the average percentile scores for our students in these assessment indicators was 12% for Biochemistry and 12% for Critical Thinking.

Another type standardized tests useful for assessing the chemistry program is final exams purchased from the American Chemical Society's Division of Chemical Education Examinations Institute. For most of our courses, the faculty has only recently started using these exams and, in some instances, nationally normalized percentile scores are not yet available. A summary of recent data for these final exams is given in Table 10.1 below. These instruments will become increasingly valuable for assessment as more data becomes available.

Table 10.2 Summary of Results from ACS Final Exams

Course	Exam - Form	N	mean correct %	mean percentile
CH 111	1st Semester G. Chem – 2005	553	52.6	42
CH 112	2nd Semester Gen. Chem. - 1998	105	46.1	39
CH 312	Organic Chemistry – 2008	6	49.5	41
CH 321	Analytical Chem. - 2007	35	46.5	N/A
CH 322/ CH 432	Instrumental Analy. - 2001	36	39.7	17
CH 382	Physical Chem. Comp. - 2007	9	52	N/A

With the exception of Instrumental Analysis, the results on ACS standardized exams appear to be rather consistent. The data does provide a set of benchmarks for our program. It would be good to observe an increase in the mean percentile scores in the future. MFT data and the data for the ACS Final Exams are provided in electronic format in Appendix B of this report.

Student Learning Outcomes for Chemistry

While the median or mean scores on standardized tests provide a convenient measure of program quality, the aggregated data can lack the detailed information required to fine tune a program. To provide a more detailed picture, the Department specified a set of measureable learning outcomes for chemistry students, both knowledge-based and skills-based, which can be used to assess the degree of achievement for our educational program. These student learning outcomes are measured through the alumni survey or through graded test questions, homework problems, class projects or laboratory reports. Satisfactory performance was set, *a priori*, by having 75 percent of the alumni surveyed giving positive responses or 75 percent of the students demonstrating mastery of the concept or skill. The results for the individual student learning outcomes are given below:

Measurements of student learning outcomes and conclusions

1. Students will be able to demonstrate knowledge of bonding theory
   a. Result measured in CH 111 – 55% demonstrated appropriate level of knowledge
   b. Result measured in CH 312 – 66% demonstrated appropriate level of knowledge
   c. Conclusion – Students did not demonstrate knowledge of bonding theory.

2. Apply concepts of chemical kinetics
   a. Result measured in CH 341 – 48% demonstrated appropriate level of knowledge
   b. Result measured in CH 382 – 41% demonstrated appropriate level of knowledge
   c. Conclusion - Students did not demonstrate knowledge of chemical kinetics.

3. Quantitatively employ chemical thermodynamics
   a. Result measured in CH 341 – 40% demonstrated appropriate level of knowledge
   b. Result measured in CH 382 – 78% demonstrated appropriate level of knowledge
   c. Conclusion – Option II students did not demonstrate knowledge of chemical thermodynamics while Option I students did demonstrate knowledge of chemical thermodynamics.

4. Demonstrate the use of stoichiometry
   a. Result measured in CH 111 – 48% demonstrated appropriate level of knowledge
   b. Result measured in CH 321 – 50% demonstrated appropriate level of knowledge
   c. Conclusion – Students did not demonstrate knowledge of stoichiometry.

5. Apply gas laws
   a. Result measured in CH 341 – 81% demonstrated appropriate level of knowledge
   b. Result measured in CH 382 – 56% demonstrated appropriate level of knowledge
   c. Conclusion – Option II students did demonstrate ability to apply the gas laws while Option I students did not demonstrate ability to apply the gas laws.

6. Students will demonstrate an understanding of the three-dimensional nature of molecular structure
   a. Result measured in CH 312 – 83% demonstrated appropriate level of understanding
   b. Conclusion – Students demonstrated an understanding of the three-dimensional nature of molecular structure.

7. Demonstrate knowledge of solution chemistry.
   a. Result measured in CH 321 – 34% demonstrated appropriate level of knowledge of solution chemistry.
   b. Conclusion – Students did not demonstrate knowledge of solution chemistry.

8. Demonstrate the ability to understand and interpret spectroscopic data.
   a. Result measured in CH 312 – 62% demonstrated appropriate level of knowledge
   b. Result measured in CH 322/432 – 29% demonstrated appropriate level of knowledge
   c. Conclusion – Students did not demonstrate the ability to understand and interpret spectroscopic data

9. Gather, process and interpret data
   a. Result measured in CH 322L/432L – 86% demonstrated appropriate level of ability to gather, process and interpret data.
   b. Conclusion – Students demonstrated the ability to gather, process and interpret data.

10. Communicate results and information.
   a. Result measured in CH 321 – 84 % demonstrated appropriate level of ability
   b. Result measured in CH 382 – 86% demonstrated appropriate level of ability
   c. Conclusion – Students demonstrated the ability to communicate results and information.

11. Design and perform an experiment
    a. Result measured in CH 341L/381L – 48% demonstrated an acceptable level of ability to design and perform and experiment.
    b. Conclusion – Students did not demonstrate the ability to design and perform an experiment.

12. Demonstrate the ability to synthesize and characterize chemical compounds.
    a. Result measured in CH 311L – 85% of the students satisfactorily demonstrated the ability to synthesize and characterize chemical compounds.
    b. Conclusion – Students did demonstrate the ability to design and perform an experiment.

13. Think critically
    a. Result measured by alumni survey – 88% of respondents answered positively to their training in the ability to understand and evaluate arguments and evidence.
    b. The MFT exam had a particularly low percentile score, 12%, for this assessment indicator.
    c. Result measured in CH 341 and CH 381 – 39% of the students successfully negotiated critical thinking exercises.
    d. Conclusion – The evidence regarding this skill, itself, needs critical evaluation. The graduates of our program have the opinion they learned to evaluate argument and evident while the MFT exam and metrics used in physical chemistry indicate otherwise. Anecdotally, students expressed dislike for the critical thinking exercises in P-Chem. For the reason that much of applied physical chemistry deals with approximations, it is a logical course to test for critical thinking. Students need to think about when a particular approximation is appropriate and when should it not be used. Because of the natural aversion students seem to have for thinking critically, developing proficiency in critical thinking should not be the responsibility of one or just a few courses but needs to be encountered to some degree in every course.

- ***Summarize Improvements Made as a Result of the Continuous Improvement Plan***

Section 7 of this document described changes made to the program in response to the last ACS re-evaluation and also made in anticipation of our next evaluation under new ACS guidelines. There seems to be conflicting conclusions to be drawn from the Alumni Survey and direct measurements by our set of student learning outcomes. As stated previously, this is the first time we have attempted this type of measurement. The Department will need to further consider our student outcomes assessments in order to understand the meaning results. A curriculum proposal for a new biochemistry course has been sent to the Arts and Sciences Curriculum Committee.

- ***Grade Distribution Patterns***

The grade distributions for chemistry courses for calendar year 2003 through calendar year 2008 are displayed in Figure 10CH.2a through 10CH.2d. The data for these plots was supplied by the Office of Institutional Research and the grade distributions by calendar years are given in Appendix D in electronic format. The number-designations of some courses were changed during this period. For consistency, CH 322 is used for Instrumental Analysis, CH 432 is used for Chemical Instrumentation, and CH 434 is used for Advanced Inorganic Chemistry. There is nothing remarkable about the grade distributions with the possible exception that ten out or ten students received A’s in CH 665 during this period.

Figure 10CH.2a Distribution of grades in Chemistry courses 2004 – 2008 for freshman-level courses

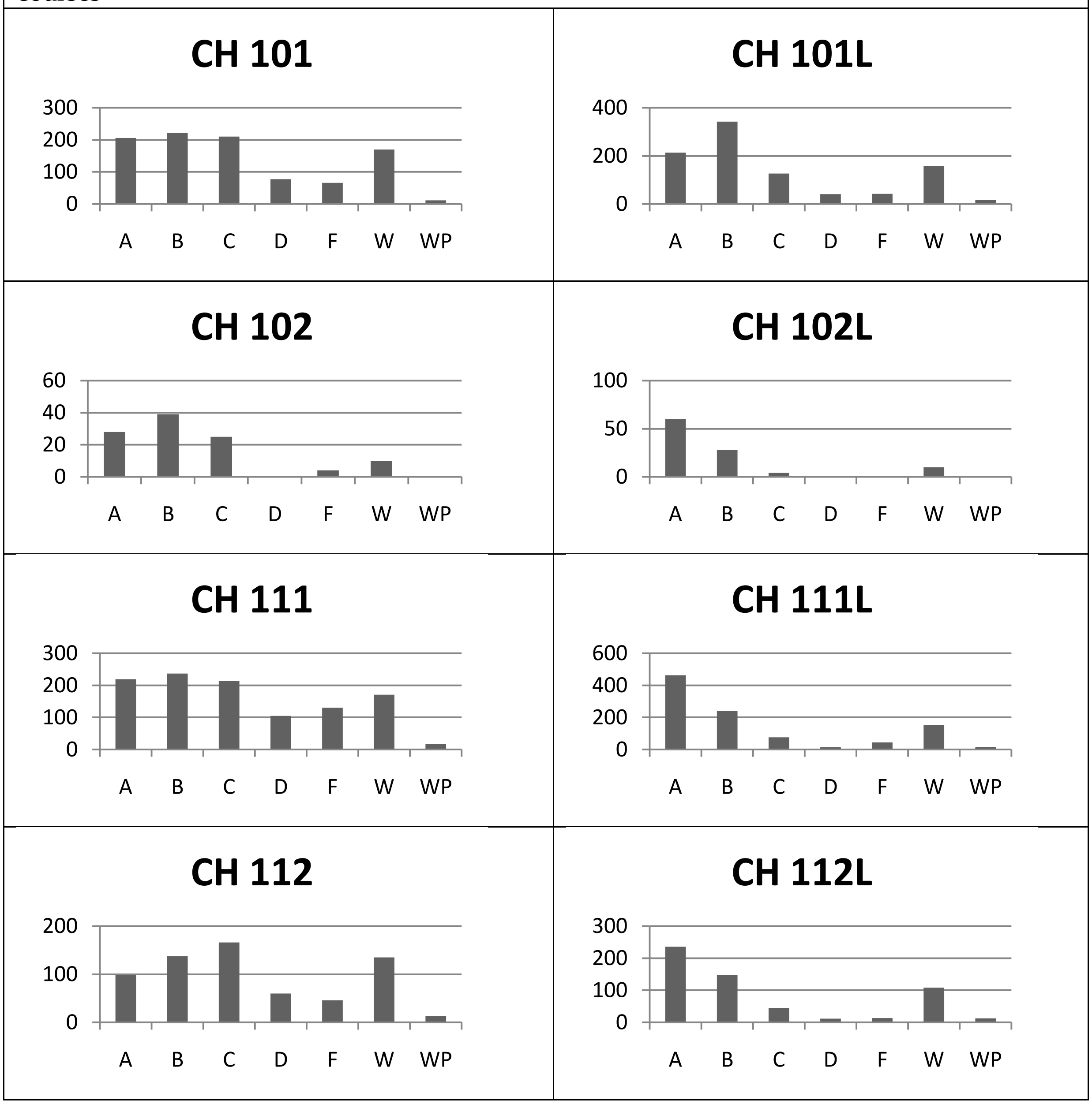


Figure 10CH.2b Distribution of grades in chemistry courses 2004 – 2008 for sophomore- and junior-level courses

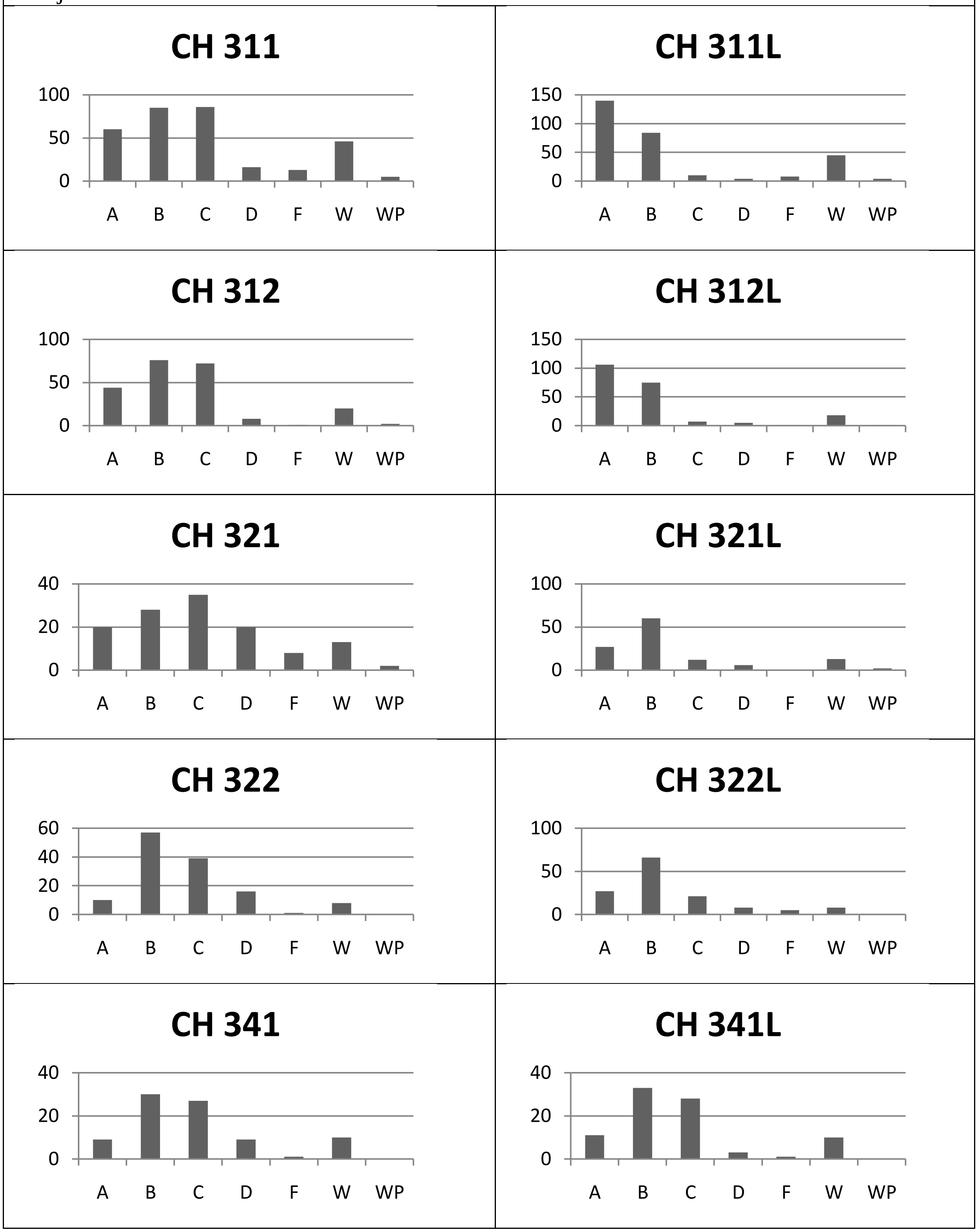


Figure 10CH.2b (continued) Distribution of grades in chemistry courses 2004 – 2008 for sophomore- and junior-level courses

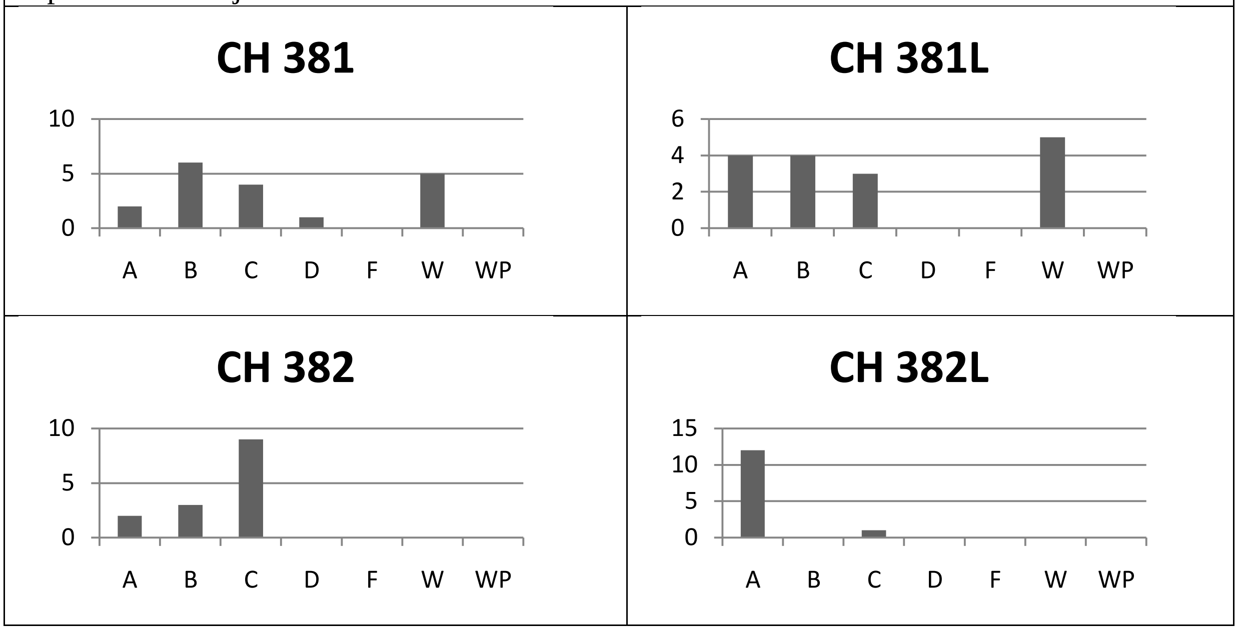


Figure 10CH.2c Distribution of grades in chemistry courses 2004 – 2008 for senior-level courses

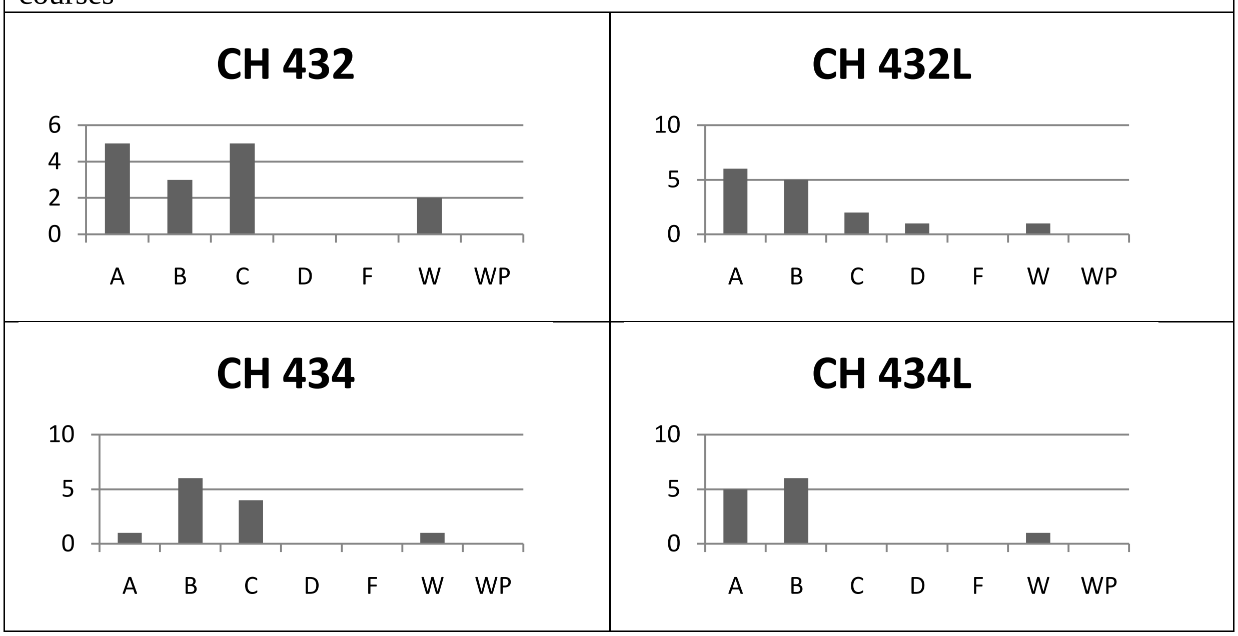
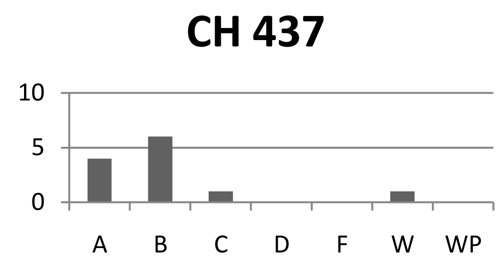
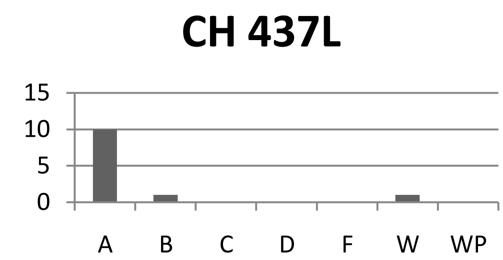
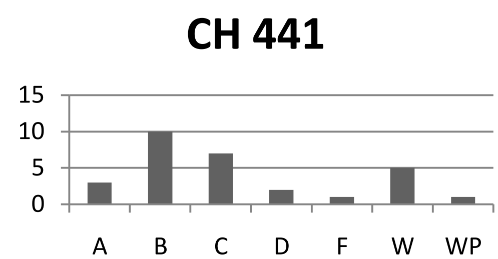
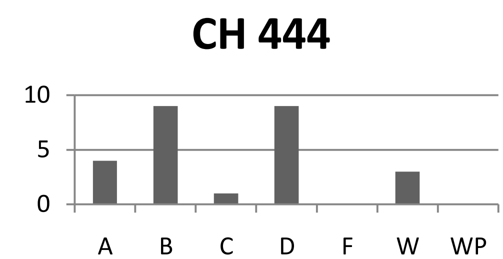


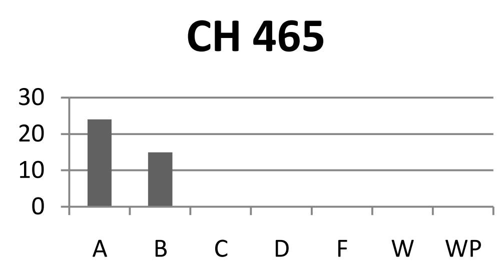
Figure 10CH.2b (continued) Distribution of grades in chemistry courses 2004 – 2008 for senior-level courses











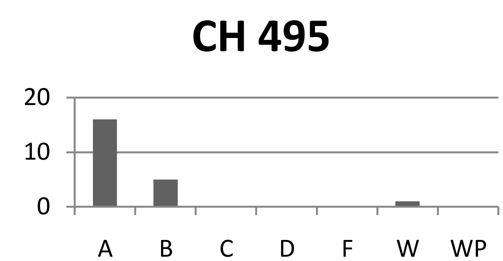
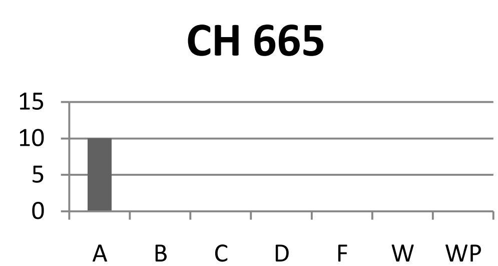
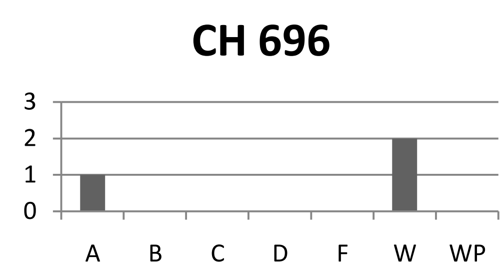


Figure 10CH.2d Distribution of grades in chemistry courses 2004 – 2008 for graduate-level courses





11CH. <u>Program Recommendations for Chemistry</u>

- ***Identify Recommendations for Improvement of the Program***

This is the first cycle for the Department's Assessment Plan for the Chemistry Program. We have found contradictions between the conclusions drawn from the alumni survey and conclusions drawn from the measurements of student learning outcomes. Why are there these inconsistencies? Have we identified an appropriate set of skills and abilities to evaluate? Are we using the correct metrics for these evaluations? Is our level for satisfactory performance appropriately set? Just as academic programs should be evaluated and upgraded, the Assessment Plan must, itself, be regarded as a work-in-progress.

The evaluation has pointed to some strengths and weaknesses of the program and, importantly, has established benchmarks that will enable us to monitor our progress. In addition, the study suggests the need for the following:

- A 300-level course in biochemistry.
- A capstone course to review for the MFT exam.
- A special topics course for subjects like nuclear chemistry to be offer on demand and as resources became available.
- A Chemistry Advisory Committee.

9IH. Industrial Hygiene Program Overview

➢ ***Brief Overview of the Industrial Hygiene Program***

The Industrial Hygiene (IH) Program at the University of North Alabama (UNA) was created in 1978 in response to the passage of the Occupational Safety and Health Act of 1970. Dr. Raymond Isbell, Chair of the Department of Chemistry, anticipated the emerging educational need in occupational health and created a program that, even under current standards, is unique. The first course descriptions appeared in the 1979-1980 UNA catalog. The name of the Department was changed to the Department of Chemistry and Industrial Hygiene in 1987. Because the program was developed by the Chemistry Department, there is an emphasis on Chemistry in the IH curriculum. In fact, under the current configuration, the curriculum requires enough coursework to award students a double major in Industrial Hygiene and General Chemistry. The final report from the previous accreditation review from ASAC-ABET alluded to this unique characteristic of the program. The statement provided in this report was the following: "A unique and innovative strength of the Industrial Hygiene program is that it is part of a dual-track Industrial Hygiene – Chemistry major. The students who complete this rigorous program form a close-knit group and radiate a pride in their program that is unusual for an academic program."

The program was awarded a NIOSH Training Project Grant (TPG) in 2001, initially for a cycle of three years and was renewed for an additional five-year cycle. The program became ASAC-ABET accredited in 2003 and is under current evaluation for re-accreditation.

The academic program of IH at UNA prepares professionals for entry level positions and graduate studies in the fields of Industrial Hygiene and Occupational Safety. This program has earned a reputation for graduating a reliable pool of qualified health and safety professionals who provide valuable services to workers and employers across the United States.

The curriculum contains a central component of industrial hygiene and general chemistry with additional education in allied disciplines of occupational safety and environmental compliance. The curriculum is designed to serve a set of educational objectives and program outcomes identified by the IH faculty and members of the Program Advisory Board. The program outcomes also comply with general and specific criteria established by ASAC of ABET for applied science programs in industrial hygiene.

The University of North Alabama is located in a geographical area of significant industrial activity with a great potential for further expansion and development. Important national and international companies have chosen this region for expanding their operations, attracted by abundant and reasonably priced energy (hydro, fossil, and nuclear), economical incentives, and reasonable costs of living. Newcomers are diversifying and possibly changing the economy of this area, which is becoming less dependent on the production of consumable goods and more oriented to the manufacture of complex, highly-valued, durable products. These new facilities are bringing advanced technology and employment opportunities to an area that was already recognized as a well-established center for engineering research and the home of a number of high-tech companies (Huntsville-Madison area).

Advances and changes in technology undoubtedly demand a more educated and better prepared labor force. We envision the Department of Chemistry and Industrial Hygiene at UNA as a source for qualified professionals (especially in areas of chemistry and occupational health and safety) and a resource for specialized training and service. We recognize that to assure competitiveness we must offer high quality academic programs that are relevant to the current and emerging technological challenges of our time. Quality control and continuous academic improvement require a sustained and extensive administrative effort. The support of NIOSH facilitating faculty release time has been invaluable for the advancement of the IH Program at UNA. In addition, the NIOSH contribution to academic scholarships has been decisive in recruiting and retaining students, particularly those with good scholastic merits who are competitively sought after by academic institutions and program.

- ***Program Mission and Objectives***

The mission and objectives of the IH Program were set forth as broad expectations for career achievements by our students a few years after graduation. The current statement of program objectives is as follows: “The IH Program at the University of North Alabama is dedicated to preparing students who are technically competent to fulfill the professional duties in the practice of IH, who understand the challenges of ethical responsibility of the IH profession, and who are properly educated to undertake graduate studies in occupational health and safety. It is expected that within three years of graduation students will be able to:

1. Demonstrate high level of knowledge, skills, and technical competency in recognizing, evaluating, and controlling workplace hazards and stressors;
2. Provide guidance and significant support to the advancement of health and safety in the workplace;
3. Be creative and resourceful by applying science and recognized scientific principles for the diagnosis and control of occupational health problems;
4. Act responsibly and ethically by adhering to code of ethics of the industrial hygiene profession;
5. Communicate with constituencies effectively by both written and verbal means;
6. Demonstrate a continuous and long-term commitment to learning;
7. Contribute to the health and safety profession by participating actively in professional organizations, technical committees, or local groups; and
8. Complete a graduate degree at a Master’s level for those choosing to pursue graduate studies immediately following undergraduate graduation.”

The educational objectives of the IH Program are consistent with and support the mission, vision, and goals of the University of North Alabama.

The following table provides the connection between the institutional mission, vision and goals and the program mission and objectives.

Table 9IH-1. Institution and Program Goals and Objectives

Institution	IH Program Mission and Objectives
Mission Provide educational opportunities to the students Provide an environment for discovery and creative accomplishment Provide a variety of outreach activities meeting needs of our region	 1; 2; and 8 3 and 6 2 and 7
Vision Offer a rich undergraduate experience Respond to the many educational and outreach needs of our region	 3 and 4 2; 5; and 7
Goals Offer quality programs Enhance and support regional development and outreach	 IH Mission Statement 1; 2; and 7

- ***Program Educational Outcomes***

A set of educational outcomes based on ASAC-ABET guidelines was drafted by the IH faculty and submitted for review and approval by the Program Advisory Board. Each of the 33 outcomes established for the academic program of Industrial Hygiene were defined by a set of measurable performance criteria. The current statement of program educational outcomes is as follows: "The curriculum is designed to provide knowledge and technical skills in the areas of health and safety while promoting a behavior that is guided by strong principles of ethical responsibility. It is expected that upon graduation, students of this program will be able to:

1. Apply the knowledge acquired in basic and applied sciences to solve a variety of problems
2. Design and conduct experiments and interpret results from the analysis of experimental data
3. Use current techniques and modern scientific tools
4. Identify health-affecting agents, factors, and stressors and how they relate to typical industrial processes, unit operations, and tasks
5. Explain mechanisms of human physiological response, toxicity, and health damage associated with the exposure to industrial agents, factors, or stressors
6. Analyze mechanisms of generation and air dispersion of agents in quantitative and qualitative terms
7. Assess dose-response and risk characterization based on toxicological data, mechanisms of exposure and routes of entry
8. Apply statistical methods and principles of epidemiology to hazard recognition
9. Use sources of information for identifying and predicting health, safety, and environmental hazards
10. Understand the scope, application, use, interpretation, and limitations of occupational exposure standards and guidelines

11. Design strategies for obtaining representative data in the processes of evaluation and exposure assessment
12. Apply principles of chemistry for the collection and analysis of airborne contaminants
13. Apply principles of microbiology for the collection, enumeration, and identification of bio-aerosol samples
14. Apply principles of physics to describe mechanical systems and energy sources and the methods used for evaluating energy exposures
15. Interpret and analyze results of sampling activities considering the effect of analytical and environmental variability
16. Communicate results of exposure assessment activities accurately and concisely
17. Apply hazard control analysis to identify and prioritize applicable control options
18. Recommend engineering control options
19. Demonstrate an understanding of the principles of design and performance evaluation of ventilation systems used for exposure control
20. Make decisions of control assurance based on results of performance evaluations
21. Select and recommend proper personal protective equipment
22. Describe fundamental aspects of safety and understand the importance of creating effective safety programs
23. Describe fundamental principles of environmental health
24. Understand that occupational and environmental health issues can impact the environment, trade, and economical growth of different countries
25. Apply principles of management to health and safety
26. Understand the scope of application, use, and limitations of selected standards and guidelines applicable to health, safety, and environmental practice
27. Understand the importance of information updating and knowledge of contemporary issues
28. Design programs and training materials for educating constituencies in occupational health and safety
29. Communicate effectively with various constituencies
30. Demonstrate familiarity with the code of ethics of the profession and the importance of ethical conduct and professional responsibility
31. Work effectively with others and in a multi-disciplinary team
32. Value the need of staying current and the advantage of life-long learning
33. Understand the need for and the value of professional service."

Course and Outcomes Matrix

A matrix indicating which courses address each of the outcomes identified is given on the next page.

Table 9IH-2. Courses and Program Outcomes

UNA Program Outcomes	UNA Industrial Hygiene Courses (IH--)											
	301	310	310L	322	333	411	422	422L	444	444L	490	490
1. Apply knowledge acquired in science		■			■	■			■	■		
2. Design and conduct experiments		■	■	■	■				■			
3. Use current techniques and modern scientific tools			■	■	■		■			■		
4. Identify health-affecting agents, factors and stressors	■	■	■	■	■	■						
5. Explain mechanisms of human physiological response	■	■			■							
6. Analyze mechanisms of generation /dispersion of air contaminants	■						■		■			
7. Assess dose-response and risk characterization	■				■							
8. Apply statistical methods and epidemiological principles					■							
9. Use sources of information for the recognition of health/safety hazards	■	■		■	■	■	■		■	■		
10. Understand the scope, use, interpretation of OELs	■			■			■		■			
11. Design strategies for obtaining representative data	■								■	■		
12. Apply principles of chemistry to air sample collection/analysis										■		
13. Apply principles of microbiology to air sampling and enumeration										■		
14. Apply principles of physics to describe mechanical/energy sources	■	■	■	■		■	■					
15. Interpret and analyze results of sampling activities									■	■		
16. Communicate results of exposure assessment	■								■	■		
17. Apply hazard control analysis to find applicable controls	■	■	■	■			■	■				
18. Recommend engineering control options	■			■			■	■				
19. Demonstrate understanding of design/evaluation of ventilation systems				■			■	■				
20. Make decisions of engineering control assurance				■			■	■				
21. Select and recommend PPE	■					■						■
22. Describe fundamental aspects of safety/create safety programs						■						
23. Describe fundamentals aspects of environmental health					■							
24. Understand that OEH issues can impact the environment, trade	■			■		■						■
25. Apply principles of management to health and safety											■	
26. Understand the scope, use, limitations of EHS standards	■			■		■						
27. Understand the importance of information updating/contemporary		■				■	■		■			
28. Design programs and training materials			■		■	■						
29. Communicate effectively with various constituencies			■	■	■			■		■		
30. Demonstrate familiarity with code of ethics	■			■								
31. Work effectively with others											■	■
32. Value the need of staying current and the advantage of learning												
33. Understand the need for and value of professional service												

- ***Governance Structure of the Program***

The IH academic program is under the Department of Chemistry and Industrial Hygiene. Dr. Crescente E. Figueroa is the current director of the Industrial Hygiene Program. The IH Program Director, who reports directly to the Chair of the Department of Chemistry and Industrial Hygiene, administers the program and makes recommendations concerning the curriculum and budget allocations. In this regard, he is ultimately responsible for coordinating efforts for maintaining accreditation and grant support. The core faculty of the IH Program include two tenured members and two part-time instructors. Tenured members hold doctoral degrees, are certified in industrial hygiene (CIH), and are members of the American Industrial Hygiene Association (AIHA). One of the part-time instructors is certified in IH (CIH) and safety (CSP).

- ***Admission Requirements***

There are no special admission requirements to the IH program other than the general requirement for admission to the University. These general requirements are described in the University Bulletin.

Transfer of Industrial Hygiene Courses

Students are not allowed to transfer any industrial hygiene or safety courses as a substitution for core requirements of the IH curriculum, unless these courses were taken at another ASAC-ABET IH-, Safety- or OH&S-accredited program and were equivalent in content to those required by the UNA curriculum.

Action Plan. This exception, which applies to university credit by transfer and credit from transient student status, has been verbally agreed upon by faculty members of the Department. It has not, however, reached a formal policy status. This has not been needed since no students have requested transfer of IH or safety courses. The Department has asked for formal adoption of this exception and its inclusion in the Chemistry/IH section of the 20010-11 UNA Undergraduate Catalog.

Once this policy is implemented, any request for credit transfer of IH or safety courses received by the Office of Admissions will be transmitted to the Department of Chemistry and Industrial Hygiene. The student requesting the credit transfer will be responsible for submitting the supporting documentation needed for the assessment of equivalency. At a minimum, the supporting documentation should include a copy of the syllabus of the course. The Program Director of Industrial Hygiene in consultation with the IH faculty will make the determination if credit transfer applies.

- ***Degree Requirements***

In addition to approving all course requirements, IH students must have a satisfactory completion of the Collegiate Assessment of Academic Proficiency (CAAP), a Major Field Test (MFAT), and an IH exit examination. ASAC of ABET also requires that students "be prepared for applied science practice through a curriculum culminating in comprehensive projects or experiences based on the cumulative knowledge and skills acquired in earlier course work." The program has added a capstone course of one credit-hour to the IH curriculum to meet this requirement.

Program Curriculum

A list of the courses that are part of the IH curriculum is given in Table 9IH-3. The last column of this table was used to indicate if each course was either a general studies component (GS), a major core requirement (CR), or a prescribed supporting (PS) course. Graduation requirements include the successful completion of the IH curriculum courses with the following number of total credit hours:

General Studies Component:	41 Credit-Hours
Major Core Requirements:	52-60 Credit-Hours
Prescribed Supporting Courses:	40-41 Credit-Hours
Total:	133-142 Credit-Hours

Table 9IH-3. Curriculum

Year; Semester	Course	Category (Credit Hours)			
		Math & Basic Sciences	Professional Program Topics	General Education	Class
Fall, Freshmen	CH 111, Gen Chem I	3			CR
	CH 111L, Gen Chem Lab. I	1			CR
	EN 111, English Composition			3	GS
	HI 101 or 201, History			3	GS
	MA 112, Pre-Calc Algebra	3			PS
	Area IV Elective I			3	GS
Spring, Freshmen	CH 112, Gen Chem II	3			CR
	CH 112L, Gen Chem Lab II	1			CR
	CS 110, 120 or 155, Computer Science	3			PS
	EN 112, English Composition			3	GS
	HI 102 or 202, History			3	GS
	COM 201, Fund Speech			3	GS
Fall, Sophomore	BI 111, Gen Biology	4			PS
	CH 311, Organic Chem I	4			CR
	CH 311L, Org Chem Lab I	1			CR
	EN 231, Lit Western World			3	GS
	MA 121, Calculus for Bus & Life Science I	3			PS
	IH 301, OHS		3		CR
Spring, Sophomore	BI 241, Phys & Anatomy I	4			PS
	CH 312, Organic Chem II	4			CR
	CH 312, Org. Chem II Lab II	1			CR
	MA 122, Calculus for Bus & Life Science II	3			PS
	EN 232, Lit Western World			3	GS
	Area II Elective			3	GS
Summer	IH 322, IH Problems		3		CR
Fall, Junior	BI 242, Phys & Anatomy II	3			PS
	CH 321, Quantitative Analysis	2			CR
	CH 321L, Quant Analysis Lab	2			CR
	IH 411, Industrial Safety		3		CR
	PH 251, Technical Physics I	3			PS

Year; Semester	Course	Category (Credit Hours)			
		Math & Basic Sciences	Professional Program Topics	General Education	Class
Spring, Junior	IH 333, Toxicology		3		CR
	IH 310, Industrial Ergonomics		2		CR
	IH 310L, Ind Ergonomics Lab		1		CR
	MA 147, Statistics	3			PS
	PH 252, Technical Physics II	4			PS
	Area IV elective II			3	GS
Fall, Senior	BI 307, Microbiology	4			PS
	CH 341, Physical Chemistry	4			CR
	CH 341L, Phys Chemistry Lab	1			CR
	IH 422, Control of Airborne Hazards		3	3	CR
	IH 422L, Control of AH Lab		1		CR
	IH 490, Special Topics OHS		3		CR
Spring, Senior	CH 322, Instrumental Analysis	3			CR
	CH 322L, Instrumental Analysis Lab	2			CR
	CH 465, Environmental Regulations		3		CR
	IH 444, Sampling Methods in IH		3		CR
	IH 444L, Sampling Methods Lab		1		CR

All industrial hygiene core requirements are offered at least once every year. The two topics included in IH 490, Special Topics in Occupational Health and Safety, are rotated and offered every other year. The course-topic Management of Health and Safety Programs is offered in the fall semester of even years and the course-topic Hazardous Waste Operations and Emergency Response is offered in the fall semester of odd years.

- ***Associated Institutes and Centers***

The Occupational and Environmental Health Laboratory (OEHL) provides service in Industrial Hygiene to local industry. Selected students of the IH program have the opportunity to participate in activities related to these service projects and gain valuable practical experience in industrial practice.

The Industrial Hygiene Program is a NIOSH Training Project Grant (TPG) Center. The TPG provides economical support and recognition of quality to this program.

- ***Involvement of External Constituents in Establishing Goals, Objectives, Learning Outcomes, and Curriculum***

The Industrial Hygiene Advisory Board was created in the year 2000 and since its inception has provided an invaluable service to the IH program. The IH Advisory Board plays an important role in establishing goals, objectives, learning outcomes and identifying corrective measures that are ultimately integrated in the IH curriculum. Members of the board also contribute giving exit interviews to graduating seniors, lecturing on special topics, and serving as resource for third-party evaluations (NIOSH, ABET).

The current membership of the IH Advisory Board (2009-2010) is as follows:

Brent H. Bailey CSP, CIH, CHMM, Chair
Sr. Safety Engineer
BP Amoco Chemicals
Decatur, AL
Blair D. Burgess, Jr. P.E.
Vice President, Manufacturing Sector Lead
ENSR
Florence, AL
Todd I. Hogue CSP, CIH, Secretary
Site Environmental, Health, Safety
and Regulatory Manager
3M
Decatur, AL
Bonnie Jenkins, CIH
EHS Manager
GE Appliances
Decatur, AL
Karen Ritter
Coffee Health Group
Florence, AL
Roberto Sanchez
OSHA Area Director
Birmingham Area Office
Birmingham, AL

- **Community College and Other Articulation**

No articulation agreements with community colleges are in place. Graduating seniors from the UNA IH program are allowed to enrolled in an accelerated option at the University of Alabama in Birmingham and obtain a MS in IH in one year.

Program Productivity

The number of graduates from the program and the placement record of these graduates in the last five years are given in Table 9IH-4.

Table 9IH-4. Program Graduates UNA IH Program

Student Name	Year Matriculated	Year Graduated	Initial or Current Employment/ Job Title/ Other Placement
Bryan Jones		2008	Marshall Space Flight Center, NASA. Safety and Health
Ben Morgan		2008	
Meagan Hallmark		2008	Bridgestone Firestone North American Tire, LLC, Industrial Hygienist
Ryan Holdbrooks	2006	2008	
David Wilkerson	2003	2008	Tennessee Valley Authority, Browns Ferry Nuclear Plant, Analyst
Regneald Killen	2002	2008	
Whitney Northcutt	2004	2008	Waste Control Specialists LLC, Industrial Hygienist
Chase Hemsley	2004	2008	Tennessee Valley Authority, Browns Ferry Nuclear Plant, Analyst
Shawn E. Belue	1996	2008	
James Todd Springer	2002	2007	Wyle Laboratories, Industrial Hygienist
Mitchell Alan Collier	2002	2007	Tennessee Valley Authority, Browns Ferry Nuclear Plant, Safety and Health
Mary Elizabeth Glade	2004	2007	Landmark Environmental Inc. Project Industrial Hygienist
Michele Rachel Lewis	2001	2007	Moseley Technical Services, Inc. Decatur AL. Safety and Health
Phillip Steele	2002	2007	BE&K, BP Amoco, Decatur AL, Industrial Hygiene
Jonathan Wesley Poling	2003	2006	Waste Control Specialists LLC, Industrial Hygienist
Michael Steven Parker	2000	2006	Univ. of North Alabama, Graduate Assistant-Intramural Sports
Bradley William Murphy	2003	2006	Stanley Associates, Engineering /Scientist RCC Safety, Safety Specialist
Ronald Lee Hendricks	2000	2006	Vanderbilt University. Industrial Hygiene
Mark Edward Faulkner	2002	2006	Southern Environmental Testing, Chemist
Danny Joe Province	2000	2006	General Electric, Environmental, Health, and Safety
Jared Lane Noah	2001	2006	Bridgestone Firestone North American Tire, LLC, Safety Coordinator
Jesse Lee Mitchell	1996	2006	

Student Name	Year Matriculated	Year Graduated	Initial or Current Employment/ Job Title/ Other Placement
Daifallah Al Zahrani	1999	2005	Saudi International Petrochemical Company SIPCHEM, Safety Specialist & Industrial Hygienist
David Michael Britton	2001	2005	University of Alabama at Birmingham, Graduate Student
Christopher Allan James	2001	2005	International Fertilizer Development Center, Muscle Shoals, AL. Chemist
Conrad Alexander Klawuhn	2003	2005	Daikin America, Decatur AL. Safety
Laurie Ann Melson	2003	2005	Honda Manufacturing of Alabama, LLC, Associate Technical Specialist
Jessica DeClermont Michelle	2000	2005	Marriott Hotel and Spa, Florence Alabama
Troy Robert Frye	2000	2005	Simco Construction, Inc., Safety Director
Heather N. Rhodes	2002	2005	National Alabama Rail Car Manufacturing. Industrial Hygienist
Tara Crawford Pilkinton	2001	2005	Tennessee Valley Training Center, Training Specialist
Jamie Marie Turner	2001	2005	NASA/MSFC - AJT & Associates, Industrial Hygienist
Kenneth Lee Nix, Jr.	1994	2004	SHAW Stone and Webster, EH&S Specialist
Joseph Matthew Reed	1999	2004	U.S. Air force
Chasity Delon Dickson	2001	2004	
Michael Shawn Dooley	1994	2003	
Meredith Lee Tilley	1996	2003	United Launch Alliance, Safety and Health Specialist
Leshan Inez Jones	1999	2003	Wise Alloys, Health and Safety Manager

Additionally, in the period between1998-2008, thirteen graduates completed a degree at a Master’s level, and two graduates completed a degree at a doctoral level. During the same period, nine graduates became certified in IH (CIH) and eleven became certified in Safety (CSP).

10IH. <u>Program Evaluation</u>

A comprehensive evaluation of program objectives and educational outcomes was recently completed as required by ASAC of ABET in preparation of a self-study report for the re-accreditation of the academic program. Program constituencies from whom data were collected included graduates, supervisors of graduates, and graduating seniors.

- **Describe Briefly the Means of Assessing Student Learning Outcomes, and Recent Improvements Based on the Results of such Assessment. Means of Assessing Outcomes May Include but are not Limited to Standardized Tests, Capstone Course/Program Examinations, Analyses of Theses, Portfolios and Recitals**.

Surveys were used for the assessment of program objectives. Objective surveys were distributed to all students who had graduated between three and seven years before the fall semester of 2007 and their respective supervisors (if their contact information was available). Returns from objective surveys of students and supervisors were 60% (20 responses) and 10% (5 responses) respectively.

For the evaluation of results, survey questions related to specific objectives were selected. For each selected question, the choice options given for consideration of responders (up to 5 options for some questions) were grouped in two general classes: not-meeting (class 1) versus meeting or exceeding expectations (class 2). The selection provided by the responders was aggregated by class (1 or 2) and expressed as a percentage. A minimum score of 70% was considered acceptable for data aggregated under class 2 for each component under evaluation. Graduate responses were segregated from supervisor responses. No attempts were made to combine inter-group (graduate and supervisors) scores. For objectives that were evaluated by more than one question, each of the question scores was considered separately with no attempts made to integrate the responses in a composite score.

Evaluation of Educational Outcomes

Surveys and students' exit interviews were used for the assessment of program outcomes. Outcome surveys were distributed to all students who had graduated between zero and three years before the fall semester of 2007 and their respective supervisors. Returns from outcome surveys of students and supervisors were 81% (13 responses) and 40% (6 responses) respectively.

In addition to surveys and data from exit interviews (indirect methods), direct methods of evaluation consisting of test questions, assignments, projects, term papers and course activities were used in the assessment of program outcomes. Sources of data of direct methods included all graded coursework generated between one and three years before the fall semester of 2007 and a few samples collected during the spring semester of 2008.

Each of the 33 outcomes established for the academic program of Industrial Hygiene were defined by a set of measurable performance criteria. Measurable performance criteria (instead of outcomes) were assessed by using direct and/or indirect methods of assessment. Scores of direct and indirect methods were averaged separately for each performance criterion. When a combination of direct and indirect methods was used in the evaluation of a performance criterion, a weighting method that gave more value to the direct method of evaluation was adopted in the calculation of a composite score.

Direct methods consisted of samples of related coursework including test questions, assignments, reports, laboratory activities, and projects. Indirect methods included questionnaires submitted to graduates and their supervisors and data from a structured exit interview given to all graduating seniors. The distribution list for the submission of questionnaires included all graduates who had completed their bachelor's degree between zero and three years before the fall semester of 2007. Returns from students and supervisors were 81% (13 responses) and 40% (6 responses) respectively.

Direct and indirect methods used a scale from 0 to 100%. Partial credits on tests questions and assignments were accepted. Average scores for a sample were obtained by adding the actual number of points earned by all students and expressing them as percentage of the total number of points possible.

For the evaluation of survey and exit exam questions (indirect methods), the rubric used was the same as that applied to the evaluation of objectives and explained before.

Scores of direct and indirect methods were averaged separately for each performance criterion. When a combination of direct and indirect methods was used in the evaluation of a performance criterion, more weight was given to the direct method of evaluation. The composite direct/indirect metric (score) was calculated by multiplying the average score of the direct methods by 2/3 and the average score of the indirect methods by 1/3 and then adding these two products. The minimum passing composite score for each performance criterion was set at 70%.

Summary of Evaluation Results

Objectives and outcomes not meeting a minimum acceptable score were considered for corrections. Specific corrective measures were derived from consensual agreement between some members of the Department of Chemistry and Industrial Hygiene faculty and the IH Program Advisory Board. Corrections involving changes in the curriculum also followed an additional process of sequential approval involving the Department of Chemistry and Industrial Hygiene faculty, the College of Arts and Sciences Curriculum Committee, and the University Curriculum Committee.

A summary of responses for questions related to specific objectives that did not achieve a minimum passing score (70%) is given in Table 10IH-1 below.

Table 10IH-1. Objective Components not Meeting Minimum Scores

Objectives	Component	Graduates	Supervisors
1	Recognition, biological agents Recognition, radiological agents Safety, pressure Safety, reactivity	59% 35% 83% 61%	75% 67% 67% 75%
2	Support and guidance to the program	60%	80%
5	Communication	80%	60%
7	Contribution to the profession	95%	60%
8	Master degree completed	60%	N/A

In the review of the evaluation results presented in Table 10IH-1, objectives were considered as achieved if either supervisors or graduates provided a passing score (≥70%) in their responses to each of the objective-related questions. Conversely, the objective was considered as not achieved if graduates and supervisors agreed on a non-passing score (<70%) to any of the objective-related questions. Objective 8 was considered achieved due to special circumstances. A student pursuing a Master's of Public Health in Industrial Hygiene had to rework completely her research work due to the death of her research advisor in a tragic accident. Objective 1 is not attained because of the scores given to graduate abilities in recognizing radiological hazards.

From the 143 performance criteria evaluated, only 5 were considered in non-compliance (did not meet the minimum composite score of 70%). The list of non-compliance performance criteria is given in the table below:

Table 10IH-2. Non-Compliance Performance Criteria

Performance Criteria	Statement	Composite Score
8.2	List advantages and disadvantages of the general types of epidemiological study designs	58%
10.5	OELs: Apply corrections for unusual schedules	36%
14.7	Describe electrical and magnetic fields and their effects on humans	67%
24.1	List international agreements concerning occupational and environmental health	68%
27.2	Attend professional meetings or seminars	67%

Applicable Action Plans

Action plans were devised to correct shortcomings of administrative reporting procedures and shortcomings of objectives and outcomes as revealed by the evaluation process.

Shortcomings of administrative reporting procedures became apparent during the planning and preparation of the ASAC-ABET self-study report. For example, the planning of activities for re-accreditation revealed a need for release time that should be granted to the Program Director of IH. The review of the students' transcripts showed problems of out-of-sequence enrollment. The reporting of the operating budget of IH indicated the advantage of separating the IH account from the Department of Chemistry and Industrial Hygiene account.

A summary of the shortcomings of administrative procedures and the respective plan of action proposed is given in Table 10IH-3.

Table 10IH-3. Corrective Measures for Shortcomings of Administrative Procedures

Shortcoming	Corrective Measures
The Program Director of IH has an assigned full-time teaching load during regular semesters	A statement describing the responsibilities of the position Director of the Industrial Hygiene was created to justify the support of release time.
	Release time for managing re-accreditation maintenance was requested and was granted for the academic years 2007 and 2008.
	A permanent release time equivalent to three credit hours per semester was granted to the position of Program Director of Industrial Hygiene.
Difficulty making estimates of the actual expenditures incurred by the IH program	A separate budget account for Industrial Hygiene starting the fiscal year 2008-2009 was created.
Out-of-sequence enrollment of students in courses of the curriculum	Enrollment is managed under a new system (Banner) that verifies pre-requisites and does not allow registration unless advisor permits it. Registration in courses without pre-requisites is not allowed.
	Variance on concurrent registration is available.
	Consideration is given to lower the pre-requisites of organic chemistry for IH 411, Industrial Safety to CH 311 and CH 311L.
Grading system that does not recognize student achievements of knowledge and skills separately	Laboratory components of IH 422, Control of Airborne Hazards and IH 444, Sampling Methods in Industrial Hygiene were separated from the lecture component (IH 422, IH 422L, IH 444, and IH 444L).
	Field trips, hands-on activities, use of models, and experiments included in IH 310, Industrial Ergonomics were moved to a laboratory course (IH 310L) that complements the lecture component (IH 310).

- ***Summarize Improvements Made as a Result of the Continuous Improvement Plan***

The action plans proposed to address the objectives and performance criteria that did not achieve acceptable scores are given in the Table 10IH-4 on the next page.

Table 10IH-4 Actions Proposed to Address Shortcomings		
Component	Shortcoming	Action Plan
Objective 1, Recognition	Graduates have limited abilities in the recognition of radiological agents	Increase the number of credit hours of the course IH 310, Industrial Ergonomics by one credit hour (from 2 to 3) to expand on topics of recognition and evaluation of physical agents including ionizing radiation. The new expanded course will be called IH 310, Physical Agents and Industrial Ergonomics.
Outcome 8, Performance Criterion 8.2	Students are deficient listing advantages / disadvantages of the general types of epidemiological study designs	Place more emphasis on this topic and its respective learning assessment tools in course IH 333.
Outcome 10, Performance Criterion 10.5	Students are deficient applying corrections of OELs for extended work schedules	Revise and reformulate question in exit interview. Add assignment consisting of a review of the supporting documentation for common models used in the workplace (IH 444).
Outcome 14, Performance Criterion 14.7	Students are deficient describing electrical and magnetic fields and their effects on humans	Continue collecting data to verify trends. Examine if this performance criterion should be a component of outcome 14. Student performance should improve by corrective action 1 given in this Table. If advantage is verified, require PH 251 as pre-requisite of IH 310.
Outcome 24, Performance Criterion 24.1	Students are deficient listing international agreements concerning occupational and environmental health	Include a component in IH 444 in addition to the material presented in IH 301 and IH 322.
Outcome 27, Performance Criterion 27.2	Students are deficient attending professional meetings or seminars	Invite the AIHA local section president or officer to meet with members of the IH Student Association each year to foster understanding of the value of these types of meetings.

➢ ***Grade Distribution Patterns***

The grade distributions for industrial hygiene courses for calendar year 2003 through calendar year 2008 are displayed in Figure 10IH-1. The data for these plots was supplied by the Office of Institutional Research and the grade distributions by calendar years are given in Appendix D in electronic format.

Figure 10IH-1 Grade Distributions for Industrial Hygiene Courses 2004 - 2008

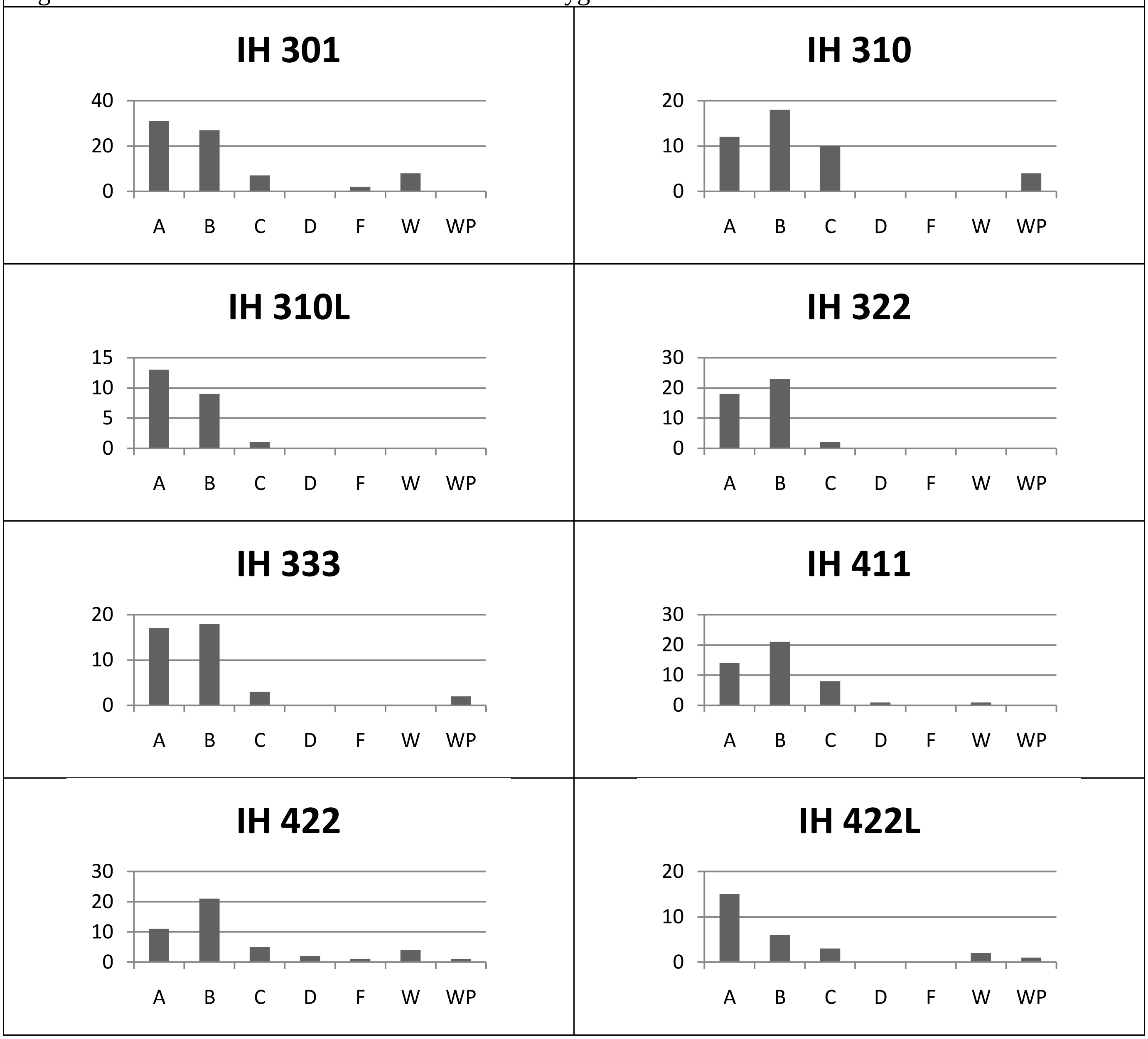
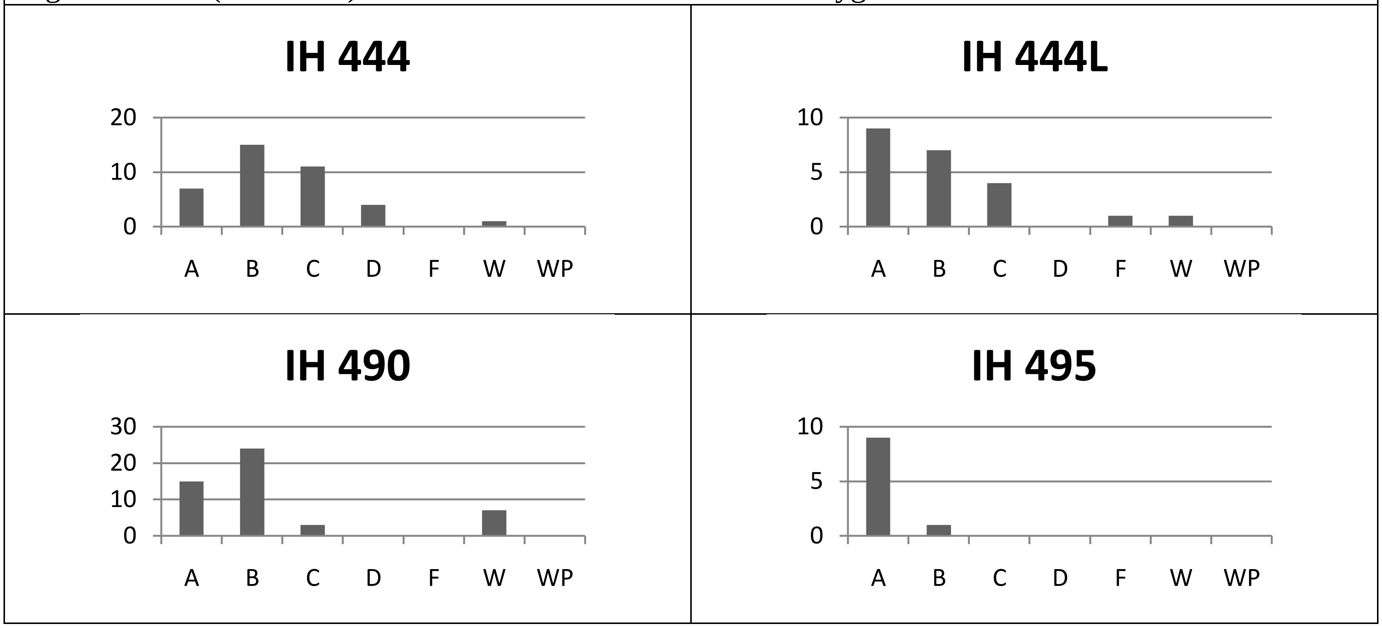


Figure 10IH-1 (continued) Grade Distributions for Industrial Hygiene Courses 2004 - 2008



11IH. <u>Program Recommendations for Industrial Hygiene</u>

- ***Identify Recommendations for Improvement of the Program***

The timeline presented in the table below will be used for the ongoing assessment of objectives and outcomes during the next cycle of accreditation. This timeline will be modified to address recommendations contained in the final report of the current evaluation for re-accreditation.

Table 11IH-1. Timeline of Assessment and Evaluation for Continuous Improvement

Activities	Methods	Academic Years				
		Year 1	Year 2	Year 3	Year 4	Year 5
Review of Objectives and Outcomes		x				
Assessment of Objectives	Indirect					x
Assessment & Evaluation of Outcomes (1-10)	Direct		x			
	Indirect					x
Assessment & Evaluation of Outcomes (11-20)	Direct			x		
	Indirect					x
Assessment & Evaluation of Outcomes (21-33)	Direct				x	
	Indirect					x
Corrective Measures Outcomes				x	x	x
Corrective Measures Objectives						x
Comprehensive Report						x