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ROCKY MOUNTAIN CENTER FOR OCCUPATIONAL AND ENVIRNMENTAL HEALTH - EDUCATION AND RESEARCH CENTER FOR OCCUPATIONAL SAFETY AND HEALTH

ANNUAL REPORT
July 1, 2006-June 30, 2007

NIOSH Training Grant
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SUBMITTED BY:
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Introduction and Executive Summary: RMCOEH

The Rocky Mountain Center for Occupational and Environmental Health (RMCOEH) is an energetic, innovative and growing Occupational Safety and Health (OSH) Education and Research Center (ERC) that has been in existence at the University of Utah since 1977. It is the only ERC in Region VIII (UT, CO, WY, MT, ND, SD), even though these states are annually in the top rankings for occupational fatalities and thus have an urgent need for more OSH professionals. In the past grant period, we have continued to make major progress, including supporting passage of a bill to statutorily establish the RMCOEH as the first statutorily created OSH center in the US [Senate Bill (S.B.) 1SSB234, 2007 Utah General Legislative Session].

The RMCOEH contains academic programs in Ergonomics and Safety (E&S), Hazardous Substances Academic Training (HSAT), Industrial Hygiene (IH), Occupational Injury Prevention Research Training (OIPRT) and Occupational Medicine Residency (OM). We have robust Continuing Education (CE) and Hazardous Substances Training (HST) Programs. The RMCOEH provides specific curricula by Occupational Health Nurses (OHNs) to emphasize the importance of OHN to our trainees. We have trained over 370 graduates to date, and are recognized for high quality trainees and strong, interdisciplinary education programs.

The RMCOEH enjoys unparalleled collaborative relationships with businesses, trade groups, employee groups, governmental units, healthcare organizations, workers compensation insurers, and community groups, and these interactions foster an atmosphere that facilitates state-of-the art training for OSH professionals for the 21st Century. These relationships provide the external 'laboratories' to test critical research theories and develop the innovations to provide safer and healthier workplaces. The RMCOEH has also developed the requisite infrastructure to support the National Occupational Research Agenda (NORA) (I and II), and Research to Practice (r2p) research missions. The RMCOEH's CE and Outreach programs promote and publicize efficacious strategies, helping ensure knowledge is translated into practice. Despite a shrinking national market for CE, the RMCOEH is a bright exception.

A. Major Accomplishments

In the past one year grant period (July 1, 2006-June 30, 2007) a few of our accomplishments included:

- Implement a new capstone course on Occupational Health Solutions to businesses' OSH problems
- Survey all RMCOEH graduates (currently having successfully received 133/363 = 39%)
- Submitted 3 research grant applications, with successful renewal of the Distal Upper Extremity Prospective Cohort Study with indications of potential success on a second submission
- Developed a new distance based CE course
- Expanded our Outreach efforts
- Intensified our Diversity Recruitment efforts
- Successfully supported the passage of 1SSB234 to statutorily establish the RMCOEH

B. Significant Changes

None

C. ERC Website

The RMCOEH has a website that is located at: http://www.rmcoeh.utah.edu/. We have completed a major revision of the website in the past grant year.

Program Title: Center Wide Programs

A. Director: Kurt T. Hegmann, MD, MPH

B. Program Description

The Rocky Mountain Center for Occupational and Environmental Health (RMCOEH) is an Education and Research Center that has been in existence at the University of Utah since 1977. It is the only ERC in Region VIII (UT, CO, WY, MT, ND, SD).

The RMCOEH contains academic programs in Ergonomics and Safety (E&S), Hazardous Substances Academic Training (HSAT), Industrial Hygiene (IH), Occupational Injury Prevention Research Training (OIPRT) and Occupational Medicine Residency (OM). We have Continuing Education (CE) and Hazardous Substances Training (HST) Programs. The RMCOEH provides specific curricula by Occupational Health Nurses (OHNs) to emphasize the importance of OHN to our trainees.

The RMCOEH is primarily housed in the Department of Family & Preventive Medicine (DFPM), University of Utah (U of U) School of Medicine. The RMCOEH's E&S Program and one half of the OIPRT Program (the Occupational Safety Emphasis) are housed in the Department of Mechanical Engineering, College of Engineering. The Center's Economic and Statistical Evaluation Unit is housed in the Dept of Economics (College of Social and Behavioral Science), while including other faculty with biostatistical, epidemiological and business expertise. RMCOEH has collaborative relationships with countless other U of U entities. The RMCOEH also has collaborative ties with the Training Program Grants' programs in Region VIII including those at Montana State and Colorado State, as well as with the next three largest Universities in Utah (Brigham Young University, Utah State University and Weber State University).

The RMCOEH has 4 Program Directors (CE and HST; HSAT and IH; E&S and OIPRT; and OM). Along with the Center Director, Deputy Director and the Statistical and Economic Evaluation Unit Director (Dr. Waitzman), they constitute the Center Executive Committee, which meets monthly and as needed between meetings. The RMCOEH has a large, active and robust Advisory Board that includes representatives from all major stakeholders. The Advisory Board meets at least twice a year. The Director, Deputy Director, or other faculty meet with the RMCOEH Advisory Board Executive Committee periodically as circumstances necessitate.

The RMCOEH Vision, Mission and Goals statements are critical guiding statements that the RMCOEH faculty and staff review and revise at least annually, at our annual retreats. These statements are also reviewed at the RMCOEH Advisory Board meeting following any changes. Emphases are placed on meeting current and projected OEHS challenges and taking advantage of new educational techniques and other opportunities.

VISION: Be recognized internationally as a leading Center in meeting current and future occupational and environmental health and safety challenges

MISSION: To protect workers and the environment through interdisciplinary education, research, and service.

GOALS:

1. Provide quality academic programs.
2. Accomplish NORA research and translate it into practice.
3. Provide superior continuing education, service, and outreach.
4. Accomplish strong interdisciplinary collaboration.

Each Program Director then revises program-specific goals and objectives to achieve the overall Center goals and guide programmatic efforts. Objectives are structured so that progress in achieving them is evaluated on an ongoing basis. The specific Administration goals and objectives are discussed below.

The RMCOEH meets regional needs by: (1) training students for regional needs (195 of the 363 graduates (54%) of our programs reside in Region VIII states), (2) conducting formal needs assessments, (2) targeting academic and CE/HST programs' contents to regional needs, (3) active involvement of the RMCOEH Advisory Board which raises issues for us to address, (4) answering concerns raised by each program's Advisory Committee, and most recently, (5) tying future research endeavors to the hugely successful NORA II Town Hall meeting held in February 2006 (n>150 participants with extensive regional needs developed and posted on our web). The fact that so many graduates remain in this region attests to the strong, previously unfilled, need for OHS professionals and the success of the RMCOEH in meeting this need. Our graduate surveys confirm

C. Program Activities and Accomplishments

Administration Goals and Objectives

Progress towards achieving each of our goals is below.

Goal 1. Provide proactive administrative support to enable faculty to present quality OEHS academic programs.

Objective 1.a. Assure appropriate utilization of the RMCOEH Advisory Board and provide oversight for other programs to ensure adequacy of functioning Advisory Committees.

Progress and Plans: The RMCOEH Advisory Board continues to meet at least twice each year over the past decade. The next meeting is scheduled for October 19, 2007. It is noteworthy that since the last competing renewal, the RMCOEH Advisory Board has re-formed an RMCOEH Advisory Board Executive Committee (Messrs. Marano, Lloyd, Sen. Mayne, and Dr. Hegmann) in response to 1SSB234 and meets quarterly. This Board Executive Committee (to be distinguished from the RMCOEH Center Executive Committee consisting of Program Directors) has been instrumental in the great success that the RMCOEH has enjoyed, as this group has been both highly functional and quite nimble. We will be continuing this successful format. Breakout sessions occurring with our RMCOEH Advisory Board meetings, consisting of individual program's Advisory Committee members, were previously quite effective. However, we have terminated that organizational concept as there are too many things for the Advisory Board to accomplish. Instead, separate Program Advisory Committee meetings are now held.

Objective 1.b. Complete a survey of graduates of RMCOEH academic programs.

Progress and Plans: A survey was e-mailed and mailed to all graduates of RMCOEH academic programs in June 2006, with follow-up reminders to provide up-to-date information for this application's reviewers. Among the most noteworthy findings are that 91% of RMCOEH graduates rated their satisfaction with our training programs at least 7/10 (0-10 scale), with a majority 9/10 or 10/10. Similar results were given to the question regarding whether they would recommend our programs to other potential students.

Objective 1.c. Provide direction and support for development of innovative educational approaches.

Progress and Plans: We are increasing the quantity of digital images in our teaching programs, have involved more distance education formats, and have developed a summative course in OSH problems solving. We have refurbished our classroom/conference room with new tables, chairs, library shelves and a SmartBoard™. We are investigating new degree programs to continue to seek innovative educational formats and solutions.

Objective 1.d. Assist in developing and implementing plans to maintain and expand the number of RMCOEH faculty.

Progress and Plans: Since June 2002, three IH (Drs. Larson, Pahler and Collingwood) and two OM faculty (Drs. Wood and Edwards) have been added, for a net gain of 3 terminally degreed faculty members. Plans are being developed to further augment the RMCOEH faculty, including additions to the E&S and OIPRT programs, followed by restarting the OHN Program.

Objective 1.e. Monitor numbers of minority students with the objective of increasing minority student enrollment in MSPH and MPH programs.

Progress and Plans: We have markedly expanded our activities in this area, and those activities are now discussed under the Diversity Recruitment Plan section.

Goal 2. Provide administrative support needed to enable faculty to design and accomplish research studies that focus on NIOSH priority areas and translate it into practice.

Objective 2a. Encourage research directly related to NORA, NORA II, r2p and WorkLife Initiative priority areas.

Progress and Plans: Recent and current RMCOEH efforts and proposals have focused on the following NORA priority areas: Exposure Assessment, Low Back Disorders, Musculoskeletal Disorders of the Upper Extremity, Traumatic Injuries, Risk Assessment Methods, Social and Economic Consequences of Workplace Illnesses and Injuries, Intervention Effectiveness, Special Populations at Risk, and Organization of Work. The Pilot/Small Projects Program discussed below is planned to target these NIOSH research priority areas.

Objective 2b. Obtain funding to support research training and enhancement of research expertise of junior faculty.

Progress and Plans: Faculty have succeeded in obtaining major research awards. These awards have involved large, cross-disciplinary projects that have resulted in practical training in major research projects. Junior faculty also have received training in research from the University of Utah. We are continuing to

develop our research training and expertise. It is planned that all senior faculty will continue to work with junior faculty to develop their research expertise and extramural proposals.
Objective 2.c. Continue to explore potentials for joint research programs and efforts with other academic institutions.
Progress and Plans: We have succeeded in initiating and conducting two major joint research programs that have involved large teams of researchers from many institutions. We plan to continue to search for such opportunities and one such project has been submitted to NIOSH (July 2006) with signs that it would likely be funded in 2007-08. Others are pending.

Goal 3. Assist faculty in providing superior continuing education, service and outreach that protect and enhance the health and safety of workers, their families, and those exposed to environments impacted by work activities.
Objective 3.a. Provide support to CE and HST efforts to develop Internet-based training programs.
Progress and Plans: The Center's distance based courses continue to prove popular. We have also developed on Occupational and Public Health Journal Club format for continuing education students in 2006. We are now offering a distance-based safety training program beginning in 2006, which is patterned after a successful traditional training program. We continue to seek other distance-based educational opportunities.
Objective 3.b. Improve CE and HST facilities.
Progress and Plans: This goal has been completely met. The RMCOEH moved to newer facilities previously which include the conference room with a SmartBoard™ described above.
Objective 3.c. Provide administration support to outreach and service support activities.
Progress and Plans: This objective is now discussed under the new Outreach section.

Goal 4. Provide administrative support to programs and activities that will maintain and expand the Center's interdisciplinary foci and collaboration in accomplishing education, research, and service.
Objective 4.a. Provide administrative support to strengthen the Center's strong interdisciplinary orientation in all areas.
Progress and Plans: The greatest improvement in this area is the development of the new Occupational Safety and Health Solutions Course (held Spring 2007 for the first time). This exciting, innovative course and other aspects are discussed in more detail under the Interdisciplinary Coordination Plan section.
Objective 4.b. Assist Center faculty in expanding local, regional, and national collaborations with government, industries, and professional organizations.
Progress and Plans: Center faculty continue extensive collaborations with other agencies and organizations, which is discussed under the Outreach Plan section.

Trainee and Faculty Honors, Awards, Scholarships, Appointments, New Faculty Positions, New Courses.
Details are in the program specific progress reports. This is a brief summary. Several trainees have received Paul S. Richards Safe Workplace Scholarships sponsored by the Workers Compensation Fund.

Trainee and Diversity Recruitment and Recruitment
This is discussed in each program. Although states in Region VIII have much lower percentages of minority groups than many other states, Center members recognize that the proportion of minorities is increasing. Further, special effort is needed to overcome the constraints that minorities face. In order to develop a coordinated approach to minority recruitment, the RMCOEH has organized its efforts in this area under the direction of Don Bloswick, Ph.D., E&S program director. Faculty are interacting with numerous University of Utah and community minority groups and schools in an attempt to improve minority recruitment. The efforts have resulted in successes, e.g. those discussed in the OM section of this application. Minority Recruitment remains a priority for the Center and current contacts and efforts set the stage for continued success in this area in the future. We have made contacts with other university's minority and diversity personnel. We have also made contacts with Native American education programs.

D. Program Products

E. Future Plans

This was the last year of this grant period. We have successfully recompeted. Please see 2006 submission of grant application for future plans.

NORA Research

NORA Research

A. Program Director: Royce Moser, Jr., MD, MPH

B. Program Description

Over the past 5 years, the RMCOEH has markedly increased its involvement in many areas of the National Occupational Research Agenda. We have placed significant emphasis on including practical r2p aspects in our research projects. We have developed a Statistical and Economic Evaluation Unit to support RMCOEH faculty and trainee projects, as well as to further OSH research into related fields. We also have worked on communicating those results to the communities for maintaining state of the art OSH programs in Region VIII. RMCOEH involvement in NORA-related research includes both major extramurally funded research proposals, all of which involve trainees, as well as internally funded student projects. A few of these include:

- ✓ A large scale, prospective cohort study on distal upper extremity disorders. This study also involves the University of Wisconsin and Medical College of Wisconsin. The OM, OIPRT and E&S programs are all involved and all trainees in all of those programs participate.
- ✓ The above project was successfully refunded for an additional 3 years in a successful competitive renewal.
- ✓ A large scale, prospective cohort study on low back pain. This study involves the University of Wisconsin, and Texas A&M University. This study similarly includes all trainees and all faculty in the OM, E&S and OIPRT programs. We have been informed that this is the only such major study in the US on low back pain.
- ✓ A third major prospective cohort study, the National Children's Study (NCS) which has been initiated by the University of Utah and others to study health effects in children and involves the measurement of occupational and environmental factors in expectant mothers. This project relies on the IH core and HSAT programs, with some nominal support from the OM core.
- ✓ Numerous industry-funded projects have been undertaken. These involve work with the mining, minerals processing, and chemotherapeutics industries.
- ✓ Additional research applications are currently pending.

We track two main research measures: 1) Extramural funding and 2) Publications. Our measures are showing positive trends.

The highlights of the RMCOEH's NORA Program Products include:

- ✓ A large scale, prospective cohort study on distal upper extremity disorders. This study also involves the University of Wisconsin and Medical College of Wisconsin. The OM, OIPRT and E&S programs are all involved and all trainees in all of those programs participate. We applied for a competing renewal.
- ✓ The above project was successfully refunded for an additional 3 years in a successful competitive renewal.
- ✓ A large scale, prospective cohort study on low back pain. This study involves the University of Wisconsin, and Texas A&M University. This study similarly includes all trainees and all faculty in the OM, E&S and OIPRT programs. We have been informed that this is the only such major study in the US on low back pain. We applied for a competing renewal and have written this project as a NORA project in our competing renewal.
- ✓ A third major prospective cohort study, the National Children's Study (NCS) which has been initiated by the University of Utah and others to study health effects in children and involves the measurement of occupational and environmental factors in expectant mothers. This project relies on the IH core and HSAT programs, with some nominal support from the OM core.
- ✓ Numerous industry-funded projects have been undertaken. These involve work with the mining, minerals processing, and chemotherapeutics industries.
- ✓ Additional research applications are currently pending.

- ✓ Wonderful NORA research-related training experiences for our masters and doctoral trainees.

The main outcomes of the RMCOEH's NORA Research program have been to be the only ERC to have succeeded in landing two major prospective cohort studies on MSDs. Additionally, we have succeeded in becoming a leading center for the National Children's Study that involves major involvement of the IH and HSAT programs to quantify whether and at what levels, chemical and other exposures result in adverse fetal and developmental effects.

Prospective cohort studies are the most powerful observational studies possible. Yet, they take years to develop meaningful data. Thus, all of these major studies will take years to develop major outcomes. However, the LBP project is close to final data analyses for the first 3 years of the study. Thus, we are also close to being able to start the process of major publications.

Impacts from all of these research studies are quite likely to be so major that it is not an exaggeration to be able to predict that the results are likely to have lasting impacts that outlast the careers of all those currently involved.

C. Program Activities and Accomplishments

Assessing Regional Research Needs

The RMCOEH made major efforts for its NORA II Town Hall meeting of February 27, 2006 and by all accounts, it was an unqualified spectacular success. NIOSH personnel commented that it was "by far" the best of these meetings. Over 150 were in attendance, making it by far the largest such meeting in the US. Roundtables were held to solicit as much information as possible. We have carefully evaluated the input, as this is an entirely new source of regional NORA needs. The information is posted on our website.

The Center continues to implement an extensive needs assessment program to research the NORA priority needs of each state within the Center's designated region by needs assessment surveys and questionnaires. Impact evaluations, which also address future needs, are distributed on an every-other-year basis; the most recent survey was sent in 2006. In addition, the Center will continue to use the needs assessment network of the ERC Continuing Education Directors. A regional assessment to occupational physicians was conducted in 2004.

Providing Administrative and Technical Research Support

Royce Moser, Jr., M.D., MPH, Professor and RMCOEH Deputy Director continues to be Director of Research Planning since July 1, 2002. In this role, he leads the faculty in planning and accomplishing research that will concentrate on NORA priority areas. He specifically directs planning that will focus the Center's research on a limited number of priority areas. This permits development of more extensive expertise than might occur with dilution of efforts by attempting to study all priority areas. He works to ensure that projects complement other RMCOEH research and support NORA objectives. He is assisted in these efforts by Ms. Deanne Clegg, Research Coordinator. Ms. Clegg has assumed the duties of maintaining a tracking system that has proven particularly helpful in monitoring grant submissions and results by program and by investigator.

Coordinating Interdisciplinary Research

Dr. Moser previously initiated actions to develop a research plan for the Center, and he has scheduled six month reviews by RMCOEH faculty to assure the plan remains relevant and pertinent. During the current year, efforts continue to include investigators from other components of the Department of Family and Preventive

Medicine (DFPM). This thrust has resulted in interdisciplinary NORA projects and other research projects that have taken advantage of the diverse capabilities, including biostatistical and epidemiologic, of DFPM. One of the outgrowths of these efforts has been the formalization of an Economic and Statistical Evaluation Unit of the RMCOEH that is led by Norm Waitzman, PhD, an internationally known economist who specializes in robust economic analyses of industrial health and safety issues, particularly of the construction industry.

The $2M NIOSH Distal Upper Extremity musculoskeletal disorders and the $1.5M Low Back Pain grants are evidence of such interdisciplinary efforts in that Drs. Hegmann (Occupational Medicine) and Bloswick (Ergonomics and Safety) are lead RMCOEH investigators. The DUE continuation grant is an additional $1.5M. The primary Biostatistician on the grants is from Pediatrics (Dr. Holubkov), reflecting the efforts to expand interactions with disciplines outside the RMCOEH.

Training Graduate Students with NORA Focus

The OIPRT and E&S Programs are developing young PhD trained investigators all of whom target NORA priority areas for research efforts. The masters students in all cores also target NORA priority areas for nearly all the theses and research projects.

Drs. Moser, Bloswick, Hegmann, Holmes, and Larson continue to provide constructive critiques to junior investigators. The senior faculty also serve as mentors for the junior faculty and students. All senior faculty also serve as mentors and provide assistance to junior faculty and students who are accomplishing other research efforts. These efforts will continue during the remainder of the grant period. Faculty regularly assist each other and students in developing papers to be peer-reviewed for consideration for publication in professional journals.

Utilizing NORA Support funds, RMCOEH faculty are again organizing the Fourth Annual NORA Young/New Investigators Symposia in Salt Lake City scheduled for April 19-20, 2007. Financial support is provided to young and new investigators, in particular those who have obtained support, to facilitate their attendance at the meeting. This effort is specifically designed to enable junior faculty and students to gain experience in developing a presentation and then presenting it to peers and colleagues. This venue has been particularly successful in accomplishing these goals.

Administration of Pilot Project Research Training Program

The RMCOEH will reapply for a Pilot Projects program in the coming competing renewal cycle. The Center voluntarily dropped its prior Pilot Projects program when despite much effort, the previous operational rules were unworkable for Region VIII.

D. Program Products

Administration of Continuing Education/Outreach Program to apply NORA Research Findings

Another set of program products from our NORA Research Program involve educational activities (Continuing Education, Outreach and other). Many of our outreach activities also involve findings from this program and examples are listed in the Outreach section.

We utilize our NORA research projects to great effect in educational fora. The RMCOEH delivered an extremely successful 2-day State of the Art Conference on Musculoskeletal Disorders on February 23-24, 2006. This conference was intentionally designed to present up-to-date research findings from our 2

prospective cohort studies, along with the results of other major researchers performing NORA related research. While the final results are not in, from all accounts, this meeting was highly successful in meeting and exceeding expectations of excellence. We plan to hold the Second Annual State of the Art Conference on Musculoskeletal Disorders was held this past March 1-2, 2007.

The Regional NORA New/Young Investigators symposium represents another significant effort to promote occupational safety and health throughout the region. Regional investigators are invited to participate in the symposium to exchange research activities. In addition, the Center exhibits at national and regional association meetings as available funds allow. The CE program will also continue its established marketing efforts to disseminate course information, including listings in association journals as well as collaborating with the University Health Sciences Center departments to ensure widespread notification of upcoming programs. Current marketing strategy combines direct mail with electronic notification through targeted lists.

Lastly, the RMCOEH Newletter, “Gateway to OSH” is an additional platform to promote NORA research findings and is currently in its fourth edition.

E. Future Plans

Ergonomics & Safety

(E&S)

Program Title: Ergonomics & Safety

A. Program Director: Donald S. Bloswick

B. Program Description

Description/Background. The Ergonomics and Safety (E&S) Program was initiated as one of the core academic programs at the University of Utah Rocky Mountain Center for Occupational and Environmental Health (RMCOEH) in 1982. In 1986, Donald S. Bloswick, Ph.D., P.E., CPE was appointed as full-time Program Director. He received tenure in 1993. Dr. Richard Sesek, Ph.D., M.P.H., CSP was hired as a full-time E&S faculty member in December 1999. Dr. Phillip Drinkaus, Ph.D. was hired as a full-time E&S faculty member for AY 05/06, and will continue to teach and collaborate on research in AY 07/08 and beyond. The E&S Program is formally recognized as one of eleven graduate teaching and research emphasis areas in the University of Utah Department of Mechanical Engineering (ME).

The NIOSH-sponsored E&S Program is located within the Department of Mechanical Engineering and focus is on the Master of Science (M.S.-Thesis, M.S.-Non-thesis) and Doctor of Philosophy (Ph.D.) degrees. Students can also pursue the Master of Science in Public Health (M.S.P.H.), and Master of Public Health (M.P.H.) degrees, but are not eligible for NIOSH funding through the E&S Program. Students entering this program must have a Mechanical Engineering undergraduate degree or meet the requirements for graduation from a University Mechanical Engineering program. During the most recent grant period (7/1/02-6/30/07) there were 7 trainee graduates. Additionally, there were also 9 non-NIOSH supported graduates who completed the E&S engineering core courses (ESEC). During the final year of the grant period (7/1/06-6/30/07), there were 5 full-time E&S engineering students (3 Masters, and 2 Ph.D.) and 6 masters-level part-time engineering students in the E&S Program.

The RMCOEH's E&S program meets documented regional needs by: (1) training masters and doctoral level E&S professionals to address the ergonomics and safety issues of Region VIII, (2) targeting our academic and CE programs' contents to meet Region VIII needs, (3) active involvement of the E&S Program Advisory Committee and the RMCOEH Advisory Board which raise Regional issues for us to address, (4) active research collaboration with regional industries, and (5) tying future research endeavors to the very successful NORA II Town Hall meeting held in February 2006 (n>150 participants with extensive regional needs developed and posted on the RMCOEH website). Our graduate surveys confirm our success in training our students to meet challenges and underscore the RMCOEH E&S Program's ability to continue to meet regional needs and to adapt to new developments in the E&S field. In addition to the core responsibilities for providing education and training to E&S trainees, the E&S faculty provide E&S-related instruction to students in IH, HSAT, OIP, OM and Public Health, as well as engineering disciplines other than Mechanical Engineering.

Graduates of the RMCOEH have become leaders in occupational and environmental health. In our most recent graduates' survey (June 2006), 43% of RMCOEH E&S graduates identified themselves as Senior Professionals or Managers in their work setting. Due to the quality of the RMCOEH programs, RMCOEH trainees are highly sought, and it is not unusual for our students to receive multiple job offers prior to graduation. Overall satisfaction with training is highly rated by RMCOEH E&S students with 77% of graduates rating their training at '8' or higher (0 = "Very Dissatisfied' and 10 = "Very satisfied"). When asked how likely they would be to recommend any of the RMCOEH's programs 68% rated it $\geq$ '8' (0= Advise Against, '10' = 'Enthusiastically Recommend').

Goals and Objectives. The RMCOEH E&S program continues its emphasize on NORA, r2p and Work-Life Initiative projects. To date, these efforts have resulted in the successful funding of two prospective cohort studies on musculoskeletal disorders (upper extremities and low back pain) through a consortium with the University of Wisconsin Milwaukee, Texas A&M, and the Medical College of Wisconsin. Other projects involve work with the mining industry, manufacturing, and minerals processing. Additional research applications are currently pending. A summary of progress versus the E&S programs' Goals and Objectives follows.

Goal 1. Provide a quality ergonomics and safety academic program.
All topics (both "highly recommended" and "recommended") from the "NIOSH Guidelines for Graduate Programs in Occupational Safety" (by The Occupational Safety Academic Training Program Panel) continue to be well covered in M.S. and Ph.D. program courses. A new course *Occupational Safety and Health Solutions* was first offered and team-taught by Drs. Sesek (E&S), Collingwood (IH), and Wood (OM) in Spring 2007. This

course includes on-site student projects composed of teams with representation from across the RMCOEH (IH, OM, and E&S) who will visit several local manufacturing facilities and work together on real world problems.

Goal 2. Accomplish NORA-related ergonomics and safety research and translate it into practice (r2p).
In addition to field training and on-site visits that are incorporated into the academic curriculum, students assist in the on-site collection of data for on-going ergonomic epidemiology studies. All current E&S students have participated in the data collection (field work) and/or ergonomic analysis (laboratory work) phases of the Upper Limb Musculoskeletal Disorders: Quantifying Risk study and/or the Low Back Pain: Quantifying Risk Factors study. Ph.D. candidates are strongly encouraged to publish three or more related peer-reviewed journal articles rather than conduct a traditional dissertation (which may or may not result in a publication). All recent graduates, and several active students, of the E&S program have presented their research at the annual Regional National Occupational Research Agenda (NORA) Young/New Investigators Symposium, which includes a peer-reviewed proceedings. All E&S student thesis and dissertations must have a publishable endpoint that addresses the NORA priority areas.

Goal 3. Provide superior E&S-related continuing education, service and outreach.
Dr. Bloswick has developed a program for ATK Thiokol through which over 40 ME graduate students are pursuing their M.S. degrees off-campus. Nearly all of these students take at least one of the E&S core courses and most take two or three. Dr. Bloswick represents ME safety interests at the College of Engineering. As the ME safety representative, and more recently as the College of Engineering (CoE) Safety Officer, Dr. Sesek has improved the safety of the ME department and CoE via frequent laboratory audits. Drs. Bloswick and Sesek serve on numerous graduate committees outside ME and Public Health, including Health Education and Promotion, and Bioengineering. Dr. Bloswick also regularly lectures in both the P.T. and O.T. Programs. Dr. Sesek works with students outside of the E&S Program, using his industry contacts to identify and secure collaborating research partners. In AY 2006/07 Dr. Bloswick presented a 2-day ergonomics course to UAW-Ford (40 attendees),

Goal 4. Accomplish comprehensive interdisciplinary efforts.
All three academic cores (IH, E&S, and OM) have work together on major research projects. The E&S program collaborates extensively with other disciplines in teaching. The new course, *Occupational Safety and Health Solutions,* first taught in Spring 2007, is team taught by Drs. Sesek (ES), Collingwood (IH), and Wood (OM) and is required for students of all three cores. The student chapter of the American Society of Safety Engineers (ASSE) is very active and includes diverse membership across the RMCOEH and the College of Engineering. In addition, the E&S Program has ongoing collaborative research projects with the University of Wisconsin Milwaukee, the University of Wisconsin Madison, and the University of South Florida USF. Collaborative research efforts are projected with Auburn University, the Alaska Marine Education Association (AMSEA), and Colorado State University.

Training in Responsible Conduct of Science. For over 3 years, all RMCOEH trainees, faculty and staff have been required to complete HIPAA and IRB training. All students must complete a web based training program in the protection of human research subjects: “Human Participant Protections Education for Research Teams” (http://cme.cancer.gov/clinicaltrials/learning/humanparticipant-protections.asp). The tutorial satisfies the NIH human subjects training requirement for obtaining Federal Funds and the Institutional Review Board’s (IRB’s) requirements for training initiatives. Courses, such as Epidemiology, Introduction to Biostatistics, and Social Context of Public Health, also incorporate training in responsible research practices into their curriculum. Ethics are also major topics in Ergonomics, Human Factors Engineering, and Design Implications. The topic of research ethics is also covered extensively in ME 7960 *Computer Applications and Research Methods*. In addition to direct training on these topics, ethics content is integrated into course materials with lectures on how to present results in an unambiguous manner without “overstating” conclusions and how to interpret the results of other researchers. RMCOEH trainees also attend a new mandatory noon lecture series that includes among other topics: conflict of interest, responsible authorship, handling of misconduct, data management, data sharing and animal welfare. Attendance logs are kept to track trainee attendance, and faculty attendance is encouraged. Additional topics include how to write research grant proposals and how to manage research laboratories. Additionally, a module on research ethics was created and is presented in every E&S core course.

Faculty Participation. The E&S Program is directed by Donald S. Bloswick, Ph.D., P.E., CPE. Dr. Bloswick is a Professor in the Department of Mechanical Engineering, College of Engineering and is responsible for E&S grant management and student recruitment/selection. Dr. Bloswick teaches ME 6100 (Ergonomics), ME 7100 (Advanced Ergonomics and Occupational Biomechanics), ME 7110 (Systems Safety), and co-teaches ME 6110 (Introduction to Industrial Safety) with Dr. Sesek. Dr. Bloswick also directs research activities and supervises student research. He has adjunct appointments in Family and Preventive Medicine, Physical Therapy, Occupational Therapy, and Bioengineering. Dr. Bloswick is assisted by E&S faculty Dr. Sesek (human factors, safety, ergonomics) and Dr. Drinkaus (ergonomics, research design) with academic training and research, and by Ms. Roanna Keough with program administration. Dr. Sesek teaches ME 6120 (Human Factors Engineering), ME 6130 (Design Implications for Human-Machine Systems), ME 7120 (Functional Musculoskeletal Anatomy for Engineers), ME 7105 (Advanced Ergonomics and Occupational Biomechanics Lab), and co-teaches ME 6110 (Introduction to Industrial Safety) with Dr. Bloswick. In 2006 he received University funding to develop and teach a new interdisciplinary course, Occupational Safety and Health Solutions, that replaced ME 6960-3 (Engineering Controls and Personal Protective Equipment). He also co-directs FPMD 6759 (Occupational Safety and Health Field Trips) with IH and OM faculty and lectures in ME 6100 (Ergonomics). Dr. Sesek advises graduate students, serves on graduate committees, and participates in E&S Ph.D. Qualifier exams. Adjunct appointments at the University of Utah include Family and Preventive Medicine and Bioengineering. Dr. Drinkaus teaches ME 7960 (Computer Applications and Research Methods in Health and Safety). Dr. Drinkaus specializes in ergonomic epidemiology and modeling and has assisted significantly with field data collection and subsequent laboratory analysis. Dr. Drinkaus is an expert in research methods and is heavily involved in the development of experimental data collection systems, the analysis of ergonomic data, and the preparation of subsequent journal submissions.

Other University of Utah faculty include Dr. **Stacy Bamberg, Ph.D**. (Assistant Professor, Mechanical Engineering) who is an expert on gait instrumentation and analysis. Dr. **Sanford Meek** (Assistant Professor, Mechanical Engineering) is an expert in engineering control of prosthetic and orthotic devices. Dr. **AK Balaji** (Assistant Professor, Mechanical Engineering) is an expert on wet and dry machining and manufacturing processes. Dr. Balaji's research interests include environmentally conscious manufacturing and he has collaborated with both E&S and IH faculty in research that has resulted in several conference presentations, proceedings, and in two journal submissions. Dr. **David Hoeppner** (Professor, Mechanical Engineering) is world renowned for his work on aircraft reliability and failure analysis. Dr. **Gary Sandquist** (Professor, Mechanical Engineering) has expertise in nuclear safety, probabilistic risk analysis, and systems safety. He is also an American Society for Quality (ASQ) certified quality auditor and regularly consults in the areas of systems safety and radiation safety. Dr. **Robert P. Tuckett** (Associate Professor, Physiology) is a national expert on peripheral nerve function and quantification of tactile sensitivity. Dr. **Clay Mann** (Assistant Professor, Pediatrics) is an expert on experimental design and analysis. Dr. **Kent Bachus** (Associate Professor, Orthopaedics) is an expert on biomechanics and failure analysis of anatomical structures.

Faculty outside the University of Utah include Dr. Thomas Bernard, Ph.D. (Professor and Chair, Department of Environmental and Occupational Health, University of South Florida, Adjunct Professor, Mechanical Engineering, University of Utah). Dr. Bernard spent Autumn semester 2002 in the E&S Program at the University of Utah as a Visiting Professor, at which time he developed and taught ME 6960-4 (Work Physiology and Occupational Heat Stress). Dr. Bernard returns on an alternate year basis to teach this course (2004, 2006, and beyond). He also serves on graduate committees, and provides guidance in the continued development of the graduate programs in Occupational Injury Prevention. He also co-directed the research and served on the Ph.D. committee of Phillip Drinkaus, a RMCOEH trainee who received his Ph.D. in 2004, and is currently a member of the E&S Faculty.

In addition, other RMCOEH core faculty (Drs. Pahler, Collingwood, Hegmann, Edwards and Wood will continue to be involved as lecturers and graduate committee members for E&S students. For example, Dr. Pahler (IH) co-instructed FPMD 6759 (Occupational Safety and Health Field Trips) with Drs. Sesek and Edwards (OM). Drs. Collingwood (IH) and Wood (OM) co-instruct the new Occupational Safety and Health Solutions class with Dr. Sesek.

Curricula. A detailed illustration of the M.S. and Ph.D. Program course curricula are included as Appendix E&S-1 and E&S-2. The M.S. requires 31 semester course credits and a 9-credit thesis. Of the 31 course credits 23 are in the Department of Mechanical Engineering and 8 are in the Department of Family and Preventive Medicine.

C. Program Activities and Accomplishments

Progress Toward Goals and Objectives. Progress toward goals and objectives is included in Section C above.

Trainee Honors, Awards, and Scholarships. Nathan Godfrey (M.S. student) and Derrick Franklin (M.S. students) received 2007/8 Worker's Compensation Fund Safe Workplace Scholarships.

Trainee Theses and Dissertations.

Jen Tolbert (Sesek, Bloswick Co-Advisor)
Research Project (thesis): "Development of a Method to Simplify the Analysis of Multi-Task Jobs Using the NIOSH RLE" (Design Engineer with the DJH Engineering Center.)

Bryan Howard (Bloswick)
Research Project (dissertation): "Analysis of Low-Back Bone Density as a Function of Vibration Exposure"

Bill Mecham (Bloswick, Sesek, Co-Advisor)
Research Project (dissertation): "UEMSD's in Assembly Work with High Task Rotation"

Sharon Davis (Sesek, Bloswick, Co-Advisor)
Research Project (thesis): "Validation of the UAW-Ford Ergonomics Survey Tool (EST)"

Derrick Franklin (Bloswick, Sesek, Co-Advisor)
Research Project (thesis): "Incremental Analysis of Lifting Speed on Low Back Compressive Forces"

Nathan Godfrey
Research Project (thesis): Undecided (started Autumn 2006)

Robert Poulsen
Research Project (thesis): "Video Analysis of Upper Extremity WMSDs"

New Courses. A new course *Occupational Safety and Health Solutions* was first offered and team taught by Drs. Sesek (E&S), Collingwood (IH), and Wood (OM) in Spring 2007. This course includes on-site student projects composed of teams with representation from across the RMCOEH (IH, OM, and E&S) who will visit several local manufacturing facilities and work together on real world problems.

Trainee recruitment. The University of Utah E&S Program is moving from a predominantly "in-house" effort to one that is more regional and national in scope. For example, two of the new E&S trainees during Autumn 2006 were recruited from Brigham Young University and Mississippi State University. The most recent trainee was recruited from the Illinois Institute of Technology. At present, one of the E&S trainees is African American. In November 2006 Derrick Franklin, an African-American trainee recently recruited from Mississippi State University for the E&S Program, presented a seminar at his alma mater in an effort to identify and recruit additional ethnic-minority trainees, including for the E&S Program. Program flyers have been sent to the Department Chairs of engineering programs at all historically black colleges with programs that could provide students with undergraduate degrees capable of participating in E&S.

D. Program Products

PUBLICATIONS/PRESENTATIONS

E&S faculty were productive with respect to publications and were actively involved in five publications as well as thirteen presentations. Please see Appendix E&S-3 for a complete list of publications and presentations.

SPONSORED SYMPOSIA

All recent graduates, and several active students, of the E&S program have presented their research at the annual Regional National Occupational Research Agenda (NORA) Young/New Investigators Symposium sponsored by RMCOEH, which includes a peer-reviewed proceedings. The NORA Symposium provides a forum for students (undergraduate and graduate) and young/new investigators from the region (Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming) and other interested parties to present and discuss NORA-related research. At the last five conferences, research presentations included 12 IH students, 10 OM residents, 20 E&S students, and 5 OIP students.

E. Future Plans

The E&S program anticipates further success through (1) continuous improvement in existing courses and the development of enhanced course offerings, particularly the new interdisciplinary course “Occupational Health Solutions” required of all E&S, IH, OIP, and OM trainees, (2) continued emphasis on interdisciplinary research, (3) increased emphasis on research-to-practice (r2p) publications for all trainees, (4) continuous improvement in CE and outreach activities, and (5) recruitment of additional E&S faculty through a national search.

Hazardous Substances Academic Training

(HSAT)

Program Title: Hazardous Substance Academic Training

A. Program: Rod Larson

B. Program Description:

Using NIOSH support, the Hazardous Substance Academic Training (HSAT) program was created at the Rocky Mountain Center for Occupational and Environmental Health (RMCOEH) at the University of Utah in February 1993, making it one of the first nine ERCs to receive this award. The primary program goal is to provide an academic course of study and training in the hazardous substances within the academic curriculum of RMCOEH. Focus of this specialty area is to prepare outstanding professionals ready to practice management of and/or research and/or teaching in the subject of handling, exposure control, and disposal of hazardous substances.

Key program components include training of the student to meet the regional needs for individuals with such education (e.g., hazardous substance training, risk assessment training); and certification as having received the 40-hr Hazardous Waste Operator and Emergency Response (HAZWOPER) Training in accordance with requirements in OSHA 1910.120.

Based on NIOSH's HSAT program goals and objectives and after review and discussion, the Rocky Mountain Center's HSAT program was designed to expand on the existing American Board of Engineering Technologies - Applied Science Accreditation Commission (ABET-ASAC) - accredited Industrial Hygiene (IH) program. The HSAT program uses the existing general public health, occupational health and safety, and IH courses and develops additional didactic, research, and hands-on experience to address some unique environmental and occupational health and safety concerns related to hazardous substances. The HSAT program accepts one-two full-time students each year, plus occasional new part-time students.

Graduates of the HSAT program are industrial hygienists possessing additional insights into the unique roles and responsibilities of the professional charged with anticipation, recognition, evaluation and control of occupational and environmental exposures to hazardous substances. The additional training and education these individuals receive positions them to assume responsible professional roles in this uniquely specialized area of health and safety.

During the last year funding period, three students have been supported with HSAT funds. Two HSAT supported students have graduated. Students have submitted two manuscripts, and one made a podium presentation at a national conference on occupational or environmental health, and one at the annual NORA Young Investigators conference (an annual two day conference in Spring of each year at the University of Utah.

The Academic curriculum is designed to offer the best Master's level preparation available. It comprises didactic, field and research experiences. The interdisciplinary nature of occupational health and safety is emphasized. The program is regularly evaluated utilizing inputs from students and graduates, RMCOEH and HSAT Advisory Committee members, and other University of Utah faculty and national leaders. A significant program revision with course modifications preceded the University's conversion from quarters to semesters in fall, 2000. Ongoing modifications have continued as areas for improvements have been identified. These ongoing efforts ensure the currency and relevance of the HSAT Master's program

The day to day operation of the HSAT program is accomplished by three full-time faculty members. Complementary full time faculty are in safety and ergonomics (2), occupational/environmental medicine (3), and numerous epidemiologists, biostatisticians, injury control specialists, environmental health experts, and other public health faculty. Besides full-time faculty employed by the University, numerous clinical faculty from various government, industry, and academic organizations, support the program and supplement the knowledge base. Recently, increasing the research activities of the IH/HSAT faculty has been emphasized.

Provide Quality Academic Programs

The RMCOEH IH Program, which the HSAT Program is linked to, was accredited through the entire prior year and prior 5-year grant period. It is currently accredited by Applied Science Accreditation Commission of ABET (ASAC of ABET) to September 30, 2011. Relative to curriculum changes, the HSAT Program utilizes a continuous quality improvement/total quality management model for enhancing the academic curriculum. Some of the changes or additions in courses during the last year includes the combination of the *Industrial Toxicology* course (FPMD 6752) with the Physiology course, and to expand the course contents to include additional information on a wider variety of potentially hazardous materials; the expansion of the Hazardous Substance course (FPMD 6756) to include the hands-on training to meet requirements to also provide students with certification of having taken the 40-hr HAZWOPER Training when they complete this course; new, capstone course titled *Occupational Health & Safety Solutions* (MEEN 6960) has been added to the requirements for all RMCOEH students, and purpose of that course is to provide both academic and field training on how to identify potential or real concerns, determine methods for remediation, and implement such methods for protection of workers and the environment; and addition of a requirement for HSAT students to take a course on *Quantitative Risk Assessment* (FPMD 6730), which is taught by Dr. Larson, who is a CIH and experienced in conducting quantitative risk assessments for government and industry.

Accomplish NORA-related hazardous substance research and translate it into practice (r2p).
All past HSAT students participated in the data collection (field work) and laboratory analysis. They also conducted statistical analysis of the data they obtained in the study and developed their own conclusions and recommendations when applicable for their study/research project. One of the research projects during this last year involved determination of the bioavailability of zinc oxide in synthetic lung fluids. Another recent research project was to compare the various types of real-time aerosol monitors with filter methods for collecting and analyzing aerosol. Recent graduates of the HSAT Program have presented their research at the annual Regional National Occupational Research Agenda (NORA) Young/New Investigators Symposium, which includes a peer-reviewed proceedings.

Provide Superior Continuing Education, Service, and Outreach

The HSAT program has continued to work extensively with the Continuing Education program over the past year grant period. It continues to work closely with the continuing education program in developing courses containing information pertinent to IH that can be presented via distant learning technology (e.g., computer linking). Based on input from students that have recently completed CE courses on subjects related to HSAT, the HSAT Program's current/traditional CE courses are continually being enhanced with more current information and new courses are being developed. This effort to maintain high quality courses is met with good demand. Examples of some of the CE courses with HSAT emphasis include:

- ✓ Intermediate Industrial Toxicology;
- ✓ HAZWOPER Training;
- ✓ Review Course for Methamphetamine Lab Remediation;
- ✓ Quantitative Risk Assessment;

NIOSH support of HSAT faculty and the CE Program make these courses possible. RMCOEH students also benefit, as we arrange for students to take courses at cost. IH faculty and students participation is significantly aided by NIOSH grant monies. In addition to the course development activities, the HSAT Program has been increasing its outreach over the past few years. For example, the HSAT program has recently increased its outreach activities by collaboration with: Utah State University, Colorado State University, Montana Technical University, Brigham Young University-Utah, Weber State University, and Salt Lake County Community College, Utah Division of Labor, Utah Division of Environmental Quality, US Department of Labor, NIOSH, and the US Environmental Protection Agency. These activities will continue in the future.

Accomplish comprehensive interdisciplinary efforts.
The HSAT program collaborates extensively with other disciplines in both research and teaching courses. All three academic cores (IH, E&S, and OM) have participated with HSAT students on major

research projects, and collaboration has also involved other programs at the University of Utah, such as the Dept. of Metallurgy, and the Dept. of Pharmacology and Toxicology. For example, the Dept. of Metallurgy in the School of Engineering provided the ICP equipment for analysis of samples for the bioavailability studies. All HSAT students were also required to take a new course *Occupational Safety and Health Solutions.* This course replaced the *Occupational Safety and Health Field Trips* course a year ago, and is now required for all RMCOEH students in the HSAT, IH, E&S, and OM cores, and is team taught by Drs. Sesek (E&S), Collingwood (IH), and Wood (OM).

The HSAT program meets regional needs by training masters professionals in the sciences and practices associated with management of hazardous waste programs for waste generators, shippers and disposal companies. The majority of the graduates stay with companies and other organizations in Region VIII that need to address hazardous substance issues. We also work with the CE programs in preparing and presenting courses, such as HAZWOPER Training, Intermediate Industrial Toxicology, and Decontamination Training (methamphetamines) to meet Region VIII needs. A total of 2 trainees were graduated with the HSAT emphasis in IH for this period last year.

Goals and Objectives:

The RMCOEH's HSAT Program has been and is in existence due to the need for hazardous substances professionals and because of historic and current NIOSH grant support. We have and will continue to build upon our existing success by further improvement of course content and expanding the student research into new areas For example, some of the research related to the HSAT program that is planned to be conducted includes:

- solubility of metals and other inorganics in various body fluids (e.g., lung, gastric, intestinal fluids) to determine the capacity of the inorganic to enter the blood distribution system in the human body;
- evaluate the effectiveness of exposure control equipment and methods for materials that may occur in the nanoparticle size;
- evaluate associations between exposures to airborne contaminants from sources such as hazardous waste sites or other emission sources and adverse health effects such as asthma, coronary artery disease or kidney disease.

C. Program Activities and Accomplishments
We have mapped our relevant background and progress against our HSAT Goals and Objectives.

The objectives of the HSAT program can be classified within four specific goals within the RMCOEH. These goals are as follows:
1.) Provide Quality Academic Programs.
2.) Accomplish NORA research and translate it into practice.
3.) Provide superior continuing education, Hazardous Substance Training, service, and outreach.
4.) Accomplish Strong Interdisciplinary collaboration.

Goal 1: Provide Quality Academic Programs

Objective 1.a: Enhance HSAT academic classes.
During the last one year period, the HSAT Program's faculty and staff utilized a continuous quality improvement/total quality management model for enhancing the academic curriculum. The HSAT curriculum is parallel to the processes for the IH Program. At least twice a year, the curriculum was comprehensively reviewed in different venues noted below, and modifications were drafted. The HSAT faculty discussed proposed changes in the Center Executive Committee meetings to ensure there were not unintended consequences on another program. Key among the steps was review by the IH and HSAT Advisory Committee, particularly for external validity and assurance of the program meeting regional needs. All of the following sources were utilized for improvements: (1) Student course evaluations, (2) Faculty experiences, (3) Graduate surveys (every 2 years), (4) IH and HSAT Advisory Committee meetings, (5) RMCOEH Advisory

Board meetings (every 6 months), (6) HSAT Program Director meetings, and (7) the NORA research agenda. Changes to the curriculum were made at least three times over the 5-year period of the grant. Before making these changes, we also carefully evaluate accreditation changes. **Changes made over the past year to the HSAT curriculum in response to this process that are particularly relevant to the HSAT program include: (i) revisions, improvement and a new course director (Dr. Pahler) for the 3-credit *Hazardous Substances* course (FPMD 6756), which is the cornerstone of the HSAT program, (ii) addition of a new *Quantitative Risk Assessment* course (FPMD 6730) that has been added to the requirements for the HSAT program and is taught by Dr. Larson, who is experienced in conducting quantitative risk assessments for government and industry, and (iii) we revised the *Industrial Toxicology and Physiology* (FPMD 6752) to improve the content of the course and include more information related to hazardous waste site chemicals, and added interdisciplinary instruction from Dr. Wood, MD.**

Objective 1.b: Annually evaluate, replace, purchase, and calibrate IH equipment and instrumentation.
NIOSH Funding over the last year continues to be effectively used to assure our equipment is properly maintained and periodically calibrated by manufacturers at recommended frequencies. NIOSH funds were also used to update the various types of analytical and field monitoring equipment used by professionals working with developing and maintaining programs related to hazardous materials. For example, recently purchased equipment related to HSAT type activities includes a GRIMMS Model 1.109 aerosol spectrometer. This instrument was purchased for the purpose of evaluating particle count, mass and particle size. It will be used to evaluate aerosols in work or hazardous waste environments, or downwind of hazardous waste sites.

Objective 1.c: Increase RMCOEH Web site information and resources.
During this last year, we significantly improved our website based information available for both internal and external purposes to include information on our HSAT program. Information was added to this website to indicate the training is intended to prepare professional personnel to properly carry out their responsibilities in the hazardous substance response and site remediation activities authorized by SARA. We also revised and updated our RMCOEH website to include a link to the HSAT web site. This serves as an important reference for both our current students, as well as for our alumni and other OSH professionals.

Objective 1.d: Increase recruiting to maximize student quality and diversity, including women and minorities.
(See also the Diversity Recruitment section discussed later.) We have been increasing our recruitment activities for all students, but are particularly focused on Diversity Recruitments. The IH and HSAT Advisory Committee meetings continue to include this as one of the main agenda items for discussion and problem solving. Our efforts have previously been focused on a combination of contacts and visits to local university programs and our RMCOEH website. Our plans for the coming year include more active recruitment of under-represented minorities through more visits to appropriate professionals at these schools, involvement in high school programs by the University of Utah, and visits to Tribal Colleges (the closest of which is approximately 500 miles).

Objective 1.e: Train and graduate a minimum of two HSAT students each year who are qualified to take the ABIH Board Examination
The HSAT Program graduates two to three trainees per year. They are qualified to sit for the Certified Hazardous Materials Management (CHMM) examination after fulfilling the practice requirement.

Objective 1.f: Increase the rate at which the HSAT Program graduates obtain CIH certification.
Similar to the IH Program, we are encouraging our graduates to obtain CIH certification. This is difficult due to the length of practice requirement prior to examination eligibility. However, the examination may well be the best external measure of competence due to the national, standardized nature of the examination and test pool. Accordingly, we are vigorously encouraging our graduates to plan to obtain CIH certification. Although we have not previously tracked these data, the HSAT Program has set this as a new Objective and will be

evaluating this over the coming grant period. Later, we plan to quantify our performance expectations and improve upon them as needed, including adding this as one of the main methods to assess our curriculum (see Objective 1a above).

Objective 1.g: Maintain ABET accreditation.
The RMCOEH IH Program, including our HSAT Program, was among the first three accredited by ABET in I989. We are currently accredited through 2011. We were told the primary reason that we had been given less than 5 years of accreditation for this most recent cycle was that we needed to show better funding mechanisms, and the addition of the MPH degree with emphasis in IH was late in the accreditation processes. The addition of the MPH degree to the accreditation process was done in response to the increased credit requirements of the Council on Education for Public Health for their degree programs. These issues of concern have now been corrected: the obtaining of additional funding was accomplished with the signing into law of Senate Bill 159 in 2005, an off-set tax credit for industries that contribute a fraction of their workers compensation insurance tax to the RMCOEH, and the additional documentation requested for the MPH degree program was submitted to ABET. We to submitted a request for extension of our accreditation in December, 2006 which was approved this summer. We are currently accredited by Applied Science Accreditation Commission of ABET (ASAC of ABET) to September 30, 2011.

Goal 2: Accomplish NORA research and translate it into practice.

Objective 2.a: Conduct NORA related research.
The RMCOEH HSAT Program has expanded its NORA related research activities markedly in the past year period. In addition to evaluating methods for determining routes and concentrations of exposure, research is being conducted to determine the actual dose received by the exposed individual and the potential routes of movement (e.g., in the attached system) once it enters the body. Additional effort is being placed on quantifying risk and not just performing risk assessment. For example, students and faculty are involved in evaluation of exposures to air contaminants, especially those that may be from hazardous waste sites, and the onset of asthma. Students and faculty have been involved in research to determine the relation between exposures to specific contaminants, such as PCBs and Dioxins, and the potential association with gynecological disorders in women (e.g., endometriosis), or with effects on pregnancies, such as premature deliveries. Involvement in developing the research plan, conducting the research, and analyzing data provides the HSAT student with the necessary knowledge to understand what is necessary for a credible research project. NIOSH training program support allows students to participate in such research. The HSAT Program is also involved in a major epidemiological study, the National Children's Study (NCS). The IH and HSAT Program faculty are leading the efforts nationally in quantification and estimation of exposures for the NCS. Dr. Larson is the Leader for the environmental monitoring program for the University of Utah Vanguard Site of the NCS, and is also a member of the NCS Central Committee Environmental Team. He has input into the decisions on the agents to be monitored, method of monitoring and analysis, and frequency of monitoring. Because of the hypotheses of various exposures potentially leading to certain adverse health effects, Hazardous Substances are one of the primary exposures that are of interest in the NCS. A NCS related area of activity this last year was reviewing U.S. EPA information to identify specific locations in Region 8 of facilities regulated for handling materials designated as hazardous waste. Hazardous waste is any by-product of society that can pose a substantial or potential hazard to human health or the environment when improperly managed. Thus, we are particularly interested in this study to quantify the potential for adverse health effects to offspring from exposures to women during pre-pregnancy as well as during pregnancy. HSAT students are involved in our research to see if there are effects from exposures to specific contaminants, such as PCBs and Dioxins, and the potential association with gynecological or obstetrical disorders in women. There are also multiple public and industry-funded projects that students can elect to participate in, such as validation of methods used for monitoring exposure of women and/or children to potentially hazardous contaminants from waste handling sites.

Objective 2.b: Develop additional interdisciplinary research efforts.
RMCOEH HSAT faculty has increased our interdisciplinary research activities. Recent successful collaborations are reflected in the following examples of studies involving RMCOEH HSAT faculty:

- Occupational and environmental research, including measurements and coordination of the environmental measurement teams for the National Children's Study, with a focus on helping develop methods for monitoring exposures to women that work in jobs outside the home. The University of Utah site for the National Children's Study is composed of faculty and researchers from pediatrics, psychology, obstetrics, nursing, internal medicine, and genetics.
- Environmental and indoor monitoring coordination for the Urban Systems Research Center (USRC) project, where exposure data will be collected on men and women relative to both their residence and their work environments. The USRC project is composed of university faculty from environmental engineering, geology, urban planning, environmental psychology, family medicine, and architecture.

Several other joint or collaborative research projects are also in the discussion or planning phase at this time that will assist in expanding the knowledge of HSAT faculty and students.

Objective 2.c: Implement a research plan to develop HSAT students' research capabilities.
All HSAT students in the MSPH program are required to complete a major project with publishable results or a thesis. The HSAT students in the MPH program are required to conduct a mini-research project (e.g., literature search and/or data analysis of already existing data) and put in a format to be submitted for publication. There are many existing projects available from which students may select. However, students are not restricted to work on an existing RMCOEH HSAT project. They may develop a proposal in an area of their particular interest. HSAT students may also be involved in this applications' NORA research project targeting the mining industry. Additionally, they may elect to participate in an industry or preceptorship site research project. Many students perform industry externships in the summer, which also may afford access to data or data collection for a research project in select circumstances. To further assist the students, the IH and HSAT programs have developed a student manual. This manual has been completed and is distributed to all HSAT and IH students at the beginning of each fall semester. The manual is a useful tool for students and will be updated as needed. Part of the plan to develop student research capabilities involves presentations. To gain this experience, students are encouraged to present their research design in seminars with appropriate critiquing of methods or results with presentations in Departmental seminars. All HSAT students are required to present their findings at the annual Regional NORA Young/New Investigators Symposium, which includes the development of a peer reviewed conference proceedings.

Goal 3: Provide superior continuing education, Hazardous Substance Training, service, and outreach.

Objective 3.a: Increase student participation in local and national professional organizations and conferences.
Students are encouraged to become members of at least one professional organization. Fees for student membership in the Air and Waste Management Association (AWMA), Utah Section are paid by the HSAT program using non-NIOSH funds. Cost for travel for students who have presentations accepted at meetings, such as at the AWMA annual meeting, is provided. Many alumni continue to maintain professional organization affiliations and many are involved in administrative and technical committees in these organizations.

Objective 3.b: Increase the HSAT program's internet available resources to assist students.

A description of the HSAT program and program curriculum requirements is located on the Rocky Mountain Web Site (www.rmcoeh.utah.edu). Through this web site, the user can also link to course syllabi and other pertinent information. We are developing additional on-line resources to assist both academic students and external OSH professionals.

Objective 3.c: Continue to present high quality and timely Hazardous Substance Training courses.
Based on external input from past courses, the current effort in our Hazardous Substance Training courses is adequate. Examples of continuing education courses that have HSAT emphases presented, in addition to the HST program's courses, include:

- Quantitative Risk Assessment;

- Industrial Toxicology;
- Decontamination Specialist Training; A review course for methamphetamine lab remediation.

NIOSH support of HSAT faculty and students, and the HST Program at the Rocky Mountain Center helps the Center provide a comprehensive occupational health and safety program. HSAT faculty and student participation are significantly aided by NIOSH grant monies.

Objective 3.d: Develop partnerships with regional universities; local, state, tribal and federal governments; and private organizations.
The HSAT program engages in strategic linkages with relevant regional and national organizations. This includes involvement in the Region VIII Training Program Grantees. During the just completed budget period, collaboration occurred with: Utah State University, Colorado State University, Weber State University, Utah Division of Labor, Utah Division of Environmental Quality, US Department of Labor, NIOSH, and the US Environmental Protection Agency. We will be increasing our involvement in these outreach activities in the future. For example, we will be increasing our Outreach efforts to the Tribal Colleges in Region VIII.

Goal 4: Accomplish Strong Interdisciplinary collaboration.

Objective 4.a: Continue to develop interdisciplinary research and teaching activities with other OSH disciplines.
The HSAT Program is engaged in strong interdisciplinary collaborations involving research as well as teaching activities. These collaborative efforts were augmented in the past grant period, and we have active planning to further increase those efforts in the coming grant period.

We have successfully increased our extramurally funded research efforts. There are two main credits for this success. First, we have hired research oriented faculty members who have become engaged in research projects as well as the pursuit of additional funding. Second, we have relied upon an interdisciplinary approach in many proposals. The utility of an interdisciplinary approach is that by its nature, it strengthens research proposals as well as resulting in more robust results. Five years ago, there was little extramurally funded research in HSAT at the RMCOEH. Now, as discussed previously, there is significant extramurally funded research that is HSAT specific (details above):

D. Program Products:
Graduates of the program qualified to step into professional roles to manage programs and activities related to hazardous substances.

E. Future Plans:
To expand the number of students in the program by increasing recruiting activities with an emphasis in diversity recruitment.

Industrial Hygiene

(IH)

Program Title: Industrial Hygiene

A. Program Director: Rod Larson

B. Program Description:

Industrial Hygiene trainees have been (and continue to be) in significant demand because of the value of graduate level trained industrial hygienists as members of team-based occupational health and safety programs. The University of Utah's Industrial Hygiene (IH) program was established in 1978 as part of the original Education and Research Center (ERC) grant of the Rocky Mountain Center for Occupational and Environmental Health (RMCOEH). The IH program has been continuously supported by NIOSH funding since. The vision statement of the IH program is: "To be the World's best graduate level industrial hygiene training program."

Five industrial hygiene students were enrolled during the grant period from July 1, 2006 to June 30, 2007. A total of two IH students graduated. Graduates of the Master's degree program are well prepared to meet current and projected challenges in occupational health and safety. The quality of the training program continues to be nationally recognized. All graduates of the program for this period were very successful in obtaining responsible positions within the region and the nation (100% placement rate in the last five years). These graduates have proven to be competent practitioners, and consistently contribute to the development of the profession.

The RMCOEH IH academic curriculum is designed to offer the best master's level IH preparation available. It comprises classroom, field, and research experiences. Course work is designed to meet the Applied Sciences Accreditation Commission of ABET (ASAC of ABET) requirements. These requirements include significant theory, laboratory, and field experience. Research has been significantly increased by the new faculty, and student research projects routinely address National Occupational Research Agenda (NORA) priority areas, as well as global issues. The program is regularly critiqued by students and graduates, Industrial Hygiene and Hazardous Substance Advisory Committee members, other University of Utah faculty, and national leaders in IH.

The day to day operation of the IH program has been (and continues to be) accomplished by three new full-time faculty members. Complementary full time faculty are in occupational/environmental medicine, safety and ergonomics, and numerous epidemiologists, biostatisticians, injury control specialists, environmental health experts, and other public health faculty. In addition to full-time faculty employed by the university, numerous adjunct Industrial Hygiene faculty from various government, industry, and academic organizations, support the program and supplement the knowledge base.

The following is a summary of progress in accomplishing the overall goals for the Industrial Hygiene program for the 2006 - 2007 grant period.

Provide Quality Academic Programs

The RMCOEH IH Program was accredited by Applied Science Accreditation Commission of ABET (ASAC of ABET) through the prior grant period and is currently accredited to September 30, 2011. Relative to curriculum changes, the IH Program utilizes a continuous quality improvement/total quality management model for enhancing the academic curriculum. Some of the changes or additions in courses during the last year includes the combination of the *Industrial Toxicology* course (FPMD 6752) with the Physiology course, and to expand the course contents to include additional information on a wider variety of potentially hazardous materials. In addition, a new, capstone course titled *Occupational Health & Safety Solutions* (MEEN 6960) has been added to the requirements for all RMCOEH students. The purpose of that course is to provide both academic and field training on how to identify potential or real concerns, determine methods for remediation, and implement such methods for protection of workers and the environment. A course on *Quantitative Risk Assessment* (FPMD 6730) has been added as an elective for IH students (required for HSAT students) and is taught by Dr. Larson, who is a CIH and experienced in conducting quantitative risk assessments for government and industry.

Accomplish NORA Research and Translate it into Practice

The RMCOEH IH Program continued to expand its NORA related research activities in this prior year grant period, and continues to do so. In addition, the IH Program is involved in a major epidemiological study. This

particular study is a major prospective cohort study, the National Children's Study (NCS). The IH Program faculty are national leaders in the area of exposure assessment for the NCS. Dr. Larson is the Leader for the environmental monitoring program for the University of Utah Vanguard Site of the NCS, and is also a member of the NCS Central Committee Environmental Team. He has input into the decisions on which agents to be monitored, method of monitoring and analysis, and frequency of monitoring. Because of the hypotheses of various exposures potentially leading to certain adverse health effects, focus is being place on monitoring for various chemical and biological agents in the Mother's workplace pre and post pregnancy for those Mothers that work outside the home. Thus, we are particularly interested in this study for exposures to working women, as we will be performing detailed IH measurements of occupational exposures to be assessed for potential adverse health effects in women prior to, during, and after pregnancy. Students are also involved in research to evaluate monitoring methods, such as direct read aerosol spectrometers for particulates, and determine the relation between exposures to specific contaminants, and routes of contamination as well as total exposure concentrations of specific agents (e.g., solvents, pesticides, etc.). All IH students are required to complete a research project for graduation. Because of the expansion in areas and types of research being conducted, the IH students now have an array of opportunities to participate in research projects currently underway at the RMCOEH.

Provide Superior Continuing Education, Service, and Outreach

The IH program continued to work extensively with the Continuing Education program during this last year. It has continued to work with the continuing education program in developing new courses (e.g., Review Course for Methamphetamine Lab Remediation) containing information pertinent to IH that can be presented via distant learning technology (e.g., computer linking). In addition, based on input from students that have recently completed CE courses on subjects related to IH, the IH Program's current/traditional CE courses are continually being enhanced with more current information and new courses are being developed. This effort to maintain high quality courses is met with good demand. Examples of some of the CE courses with IH emphasis include:

- ✓ Industrial Toxicology;
- ✓ Comprehensive IH Review (for those wanting to take CIH exam);
- ✓ Review Course for Methamphetamine Lab Remediation;

NIOSH support of IH faculty and the CE Program make these courses possible. RMCOEH students also benefit, as we arrange for students to take courses at cost. IH faculty and students participation is significantly aided by NIOSH grant monies. In addition to the course development activities, the IH Program has been increasing its outreach over the past few years. For example, the IH program has recently increased its outreach activities by collaboration with: Utah State University, Colorado State University, Montana Technical University, Weber State University, Salt Lake County Community College, Utah Division of Labor, Utah Division of Environmental Quality, US Department of Labor, NIOSH, and the US Environmental Protection Agency. These activities will continue in the future.

Accomplish Strong Interdisciplinary Collaboration

The RMCOEH IH Program has continued to increase support for strong interdisciplinary activities over the past 1-year grant period. It continues to actively support strong interdisciplinary interaction in all of the aspects of our program. We are a clear example of the success that will come when one embarks on interdisciplinary efforts. For example, five years ago, there was little extramurally funded research in IH at the RMCOEH. Today, that is completely turned around, in no small part to hiring faculty who believe in interdisciplinary efforts. There are multiple examples, such as the fact that we also have been involved with the State of Washington Nanotechnology Research Center in evaluating new methods for monitoring nanoparticles in work environments.

Our IH Program's academic aspects, while previously very good, have improved due to engaging in increased interdisciplinary efforts. The IH program collaborates extensively with other disciplines in teaching courses. Currently, several courses are team taught with faculty from different OSH disciplines. For example, FPMD 6752, "Introduction to Industrial Toxicology and Physiology" is co-taught by Drs. Larson (IH) and Wood (OM).

Faculty representing the three RMCOEH core programs (Drs. Collingwood (IH/HSAT), Sesek (E&S/OIPRT), and Wood (OM/IH)) were awarded a University teaching grant in 2006 to develop of a new summative course, "Occupational Safety and Health Solutions," MEEN 6960. This course has now been developed and is a capstone course for all RMCOEH graduate students. This course takes real world problems presented by businesses interested in having multidisciplinary teams of students under close faculty supervision work to identify methods to solve those problems. Faculty from the School of Business (Dr. Smith-Crowe) and Dept. of Economics (Dr. Waitzman) also participate in this course to familiarize students with methods for quantification of costs and benefits associated with proposed interventions. These interdisciplinary activities will provide both students and faculty with the opportunity to interact with other researchers, as well as representatives of various types of industry, and learn about new health and safety technologies and how to apply them.

Two IH students graduated during this year grant time period. There have been significant, positive, changes to the IH Program. Key of which is the replacement of prior faculty with three new faculty with various areas of expertise. Courses continue to be developed and existing courses were improved. Hands-on and professional experiences are emphasized, both in placement of students for internships (preceptorships), and in conducting their research. Two students presented at professional meetings, one made a presentation at a national conference, and one made a poster presentation at a national conference. With the new faculty, there has been an increased emphasis in a broader range of research, which has increase interest of undergraduate students in other universities to be interested in this program. As a result, students graduating from the IH program available through the RMCOEH Education and Research Center, are well prepared for the professional practice of industrial hygiene.

Program Goals and Objectives:

Much of the success of the RMCOEH IH Program can be attributed to NIOSH support. Our current plan is to build upon our existing success by further improvement of course contents, expanding student research and increasing our interdisciplinary collaboration on research and teaching.

C. Program Activities and Accomplishments

The objectives of the IH program can be classified within the RMCOEH four specific goals. Those goals are as follows:

1.) Provide Quality Academic Programs.
2.) Accomplish NORA Research and Translate it into Practice.
3.) Provide Superior Continuing Education, Service, and Outreach.
4.) Accomplish Strong Interdisciplinary Collaboration.

Goal 1. Provide Quality Academic Programs

Objective 1.a: Maintain ASAC-ABET accreditation**.**

Result: Accomplished The RMCOEH IH Program, including our HSAT Program, was among the first three accredited by the Applied Science Accreditation Commission of ABET (ASAC of ABET) in I989. We were accredited through 2007. After submitting information on the changes requested, in August, 2007 this accreditation has been extended to September 30, 2011.

Objective 1.b: Enhance IH academic classes.

Result: Accomplished The IH Program utilizes a continuous quality improvement/total quality management model for enhancing the academic curriculum. At least twice a year, the curriculum is comprehensively reviewed in different venues noted below, and modifications are drafted. IH faculty discuss proposed changes in the IH and HSAT Advisory Committee to ensure there are not unintended consequences on another program. Key among the steps is review by the IH and HSAT Advisory Committee, particularly for external validity and assurance of meeting regional needs. All of the following sources are utilized for improvements: (1) Student course evaluations, (2) Faculty experiences, (3) Graduate surveys (every 2 years), (4) IH and HSAT Advisory Committee meetings, (5) RMCOEH Advisory Board meetings (every 6 months), (6) IH Program

Director meetings once per year, and (7) the NORA research agenda. Changes to the curriculum are made at least annually, with the goal to be to proactive. We carefully weigh accreditation changes. Changes made to the curriculum in response to this process include expansion of the Industrial Toxicology course from two credits to three to address a broader range of chemical agents, provide more current information on distribution of chemical toxins in the body, and allow more education in physiology. The Advanced Industrial Hygiene course has also been modified to increase coverage of new technology for monitoring (e.g., equipment and methods for monitoring and analyzing nanoparticles). Additionally, a new course on Quantitative Risk Assessment to teach how to use epidemiological and toxicological information to derive exposure limits for various chemical agents has been added during this last year to the curriculum.

Objective 1.c: Annually evaluate, replace, purchase, and calibrate IH equipment and instrumentation.

Result: Accomplished Successful research grants have added to the instrument and equipment inventories over the past year as well as the past 5-year grant periods and are anticipated to continue. NIOSH funds have also been effectively used to update the various types of standard analytical and field monitoring equipment that IHs need to understand how to use. This equipment includes a laser spectrometer for aerosol monitoring, an octave band analyzers for noise surveys and programmable noise dosimeters, aerosol spectrometers for particulate monitoring and analysis, and programmable precision sampling pumps and calibration instruments.

Objective 1.d: Involve students in the AIHA-Student Section meetings and engage in professional organizational activities.

Result: Accomplished We encourage the IH students to attend at least 3 of the 4 quarterly meetings per year (Student Section of the American Industrial Hygiene Association - Utah Chapter), as well as to become members of at least one professional organization. The IH Program continues to foster this relationship by paying for the student memberships in the AIHA Student Section with non-NIOSH funds. The purpose of this objective is to begin the integration of the students into their future professional organization. Students also volunteer to assist at and attend the Annual Utah Conference on Safety and Industrial Hygiene. Travel costs for students who have presentations accepted at meetings, such as at the AIHC&E, are also provided as additional incentive. We have succeeded in having students awarded best poster of the conference awards at AIHC&E.

Objective 1.e: Increase recruiting to maximize student quality and diversity, including women and minorities.

Result: Accomplished (See also the Diversity Recruitment section later in this narrative.) These activities were initiated in the prior 5-year grant period and continued to be an area of increasing emphasis during the last year, not only for the IH program but for all RMCOEH programs. This topic continues to be a focal point for at least one of the semi-annual IH Advisory Committee meeting each year. The committee has provided insight and suggestions for future improvement. We have contacted the undergraduate science programs at the University of Utah, undergraduate IH Program at Utah State University, and the science programs at Weber State University. Plans include contacting of Westminster College. Suggestions from the IH Advisory Committee, which will be followed up by Dr. Larson, include identifying additional engineering and life science students and providing students with information about career opportunities in OSH. An e-mail based letter will be mailed to undergraduate career counselors across the nation to make them aware of IH as a career path and provide them an internet address of the RMCOEH for further information.

Numerous inquires about the IH program have resulted from our Internet site. The site will be maintained and improved. Besides the web site, the IH program, in cooperation with the CE program, has staffed a booth at the annual AIHCE to recruit and provide information to potential students. This activity will also be continued.

Objective 1.f: Train and graduate a minimum of two IH students each year who are qualified to take the ABIH Board Certified Industrial Hygienist (CIH) Examination

Result: Accomplished The IH Program graduated two students this last year, and has graduated an average of more than three graduates per year over the past 5-year grant period. We are currently working on

accelerating that pace. The graduates from the RMCOEH IH Program are qualified to sit for the CIH examination after fulfilling the practice requirement.

Objective 1.g: Increase the rate at which the IH Program graduates obtain CIH certification.

Result: We believe that this has been accomplished, however as there is no mandate for IHs to obtain Certification in Industrial Hygiene status this remains somewhat unclear and is an area of major focus for the coming grant period. CIH status is widely considered to be a good marker for quality and implied IH professional abilities. This may be one of the best outcome measures of quality for our IH Program. As well, it may be the best outcome indicator for the quality of an IH Program due to the national nature and standardization of the examination. Accordingly, even though we have not previously tracked these data, the IH Program has set this as a new Objective and will be evaluating this over the coming grant period. Later, we plan to quantify our performance expectations and improve upon them as needed.

Goal 2: Accomplish NORA Research and Translate it into Practice.

Objective 2.a: Emphasize NORA related areas.

Result: Accomplished Over the past year, as well as the 5-year grant period, the RMCOEH IH Program has emphasized NORA related research. The program also continues to markedly expand its NORA related research activities. The IH Program is involved in a major epidemiological study. This particular study is a major prospective cohort study, the National Children's Study (NCS). The IH Program faculty are national leaders in the area of exposure assessment for the NCS. Dr. Larson is the Leader for the environmental monitoring program for the University of Utah Vanguard Site of the NCS, and is also a member of the NCS Central Committee Environmental Team. He has input into the decisions on which agents to be monitored, method of monitoring and analysis, and frequency of monitoring. Because of the hypotheses of various exposures potentially leading to certain adverse health effects, focus is being place on monitoring for various chemical and biological agents in the Mother's workplace pre and post pregnancy for those Mothers that work outside the home. Thus, we are particularly interested in this study for exposures to working women, as we will be performing detailed IH measurements of occupational exposures to be assessed for potential adverse health effects in women prior to, during, and after pregnancy. Students are also involved in research to determine the relation between exposures to specific contaminants, and routes of contamination as well as total exposure concentrations of specific agents (e.g., solvents, pesticides, etc.). We also have industry funded studies and students are invited to work on those studies. Other applications are pending.

Objective 2.b: Develop and implement multidisciplinary research efforts.

Result: Accomplished Over the past 1-year grant period, the RMCOEH IH Program has continued to develop and implemented major interdisciplinary efforts. Successful research activities increasingly require an interdisciplinary effort as nearly all of our successful applications above demonstrate. For example, the NCS involves faculty from pediatrics, psychology, obstetrics, nursing, and genetics. Another study is the Urban Systems Research Center (USRC) project, where exposure data will be collected on men and women relative to both their residence and their work environments as applicable. The USRC project is composed of university faculty from environmental engineering, chemical engineering, geology, urban planning, environmental psychology, family medicine, and architecture.

Objective 2.c: Implement a research plan to develop IH students' research capabilities.

Result: Accomplished Over the past 1-year grant period, the IH Program has continued to expand its research plan to develop IH students' research capabilities. All IH students are required to complete a research project for graduation. Students in the MSPH program are required to conduct an in-depth research project and the MPH students are also required to conduct a research project but to a lesser level of intensity (e.g., MSPH research will likely involve laboratories to conduct a study, and MPH research may be based on field observations or statistical analyses of existing data). To further assist the students, IH faculty work closely with the student to help develop the research plan, assist in arranging resources needed to conduct the study (e.g.,

chemical reagents, monitoring and/or analytical equipment, miscellaneous supplies), provide guidance on interpretation of data (e.g., application of statistics), and assist in preparing the study report.

During the last five years, and especially last year, opportunities for IH students to participate in a wide array of research projects currently underway at the RMCOEH have increased significantly. Future plans include a NORA research project targeting the mining industry, which is planned to also heavily rely on student involvement and become another major source of student projects. Many students perform industry externships in the summer, which frequently afford access to data or data collection for a research project in select circumstances. Many of the other student research projects are directly or indirectly supported with NIOSH funds as they are part of the formal MSPH degree requirements and are an integral part of student training. Students consistently present their research design in RMCOEH seminars with appropriate critiquing of methods or results and also present in Departmental seminars, regional meetings, and national conferences. They are required to present their findings at the annual Regional NORA Young/New Investigators Symposium, which includes the development of a peer reviewed conference proceedings.

Goal 3: Provide Superior Continuing Education, Service, and Outreach.

Objective 3.a: Increase the IH program's electronic resources.

Result: Accomplished The IH program has worked closely with the continuing education program over the past year and continues to work closely with the CE Program in developing courses containing information pertinent to IH that can be presented via distant learning technology (e.g., computer linking).

Objective 3.b: Continue to present high quality and timely CE courses in IH.

Result: Accomplished Over the past year grant period, the IH Program has presented a number of high quality CE courses. Based on input from students that have recently completed CE courses on subjects related to IH, the IH Program's current/traditional CE courses are continually being enhanced with more current information. This effort to maintain high quality courses is met with good demand. Examples of some of the CE courses with IH emphasis presented in addition to hazardous substances CE course include:

- ✓ Industrial Toxicology;
- ✓ Comprehensive IH Review (for those wanting to take CIH exam);
- ✓ Review Course for Methamphetamine Lab Remediation.

NIOSH support of IH faculty and the CE Program make these courses possible. RMCOEH students also benefit, as we arrange for students to take courses at cost. IH faculty and students participation is significantly aided by NIOSH grant monies.

Objective 3.c: Develop outreach partnerships with: regional universities; local, state, tribal and federal governments; and private organizations.

Result: Accomplished Over the past year grant period, the IH Program has developed increased outreach activities with these entities. This has involved a large array of different types of governmental and private industries. During the just completed budget period, collaboration has occurred with: Utah State University, Colorado State University, Montana Technical University, Weber State University, Salt Lake County Community College, Utah Division of Labor, Utah Division of Environmental Quality, US Department of Labor, NIOSH, and the US Environmental Protection Agency. These activities will continue, and in some areas expand in the future particularly to emphasize diversity recruitments.

Goal 4: Accomplish Strong Interdisciplinary Collaboration.

Objective 4.a: Continue to develop interdisciplinary research and teaching activities with other OSH disciplines.

Result: Accomplished The RMCOEH IH Program has activity developed interdisciplinary research and teaching activities over the past year grant period. The IH Program actively supports strong interdisciplinary interaction in all of the aspects of our program. We are a clear example of the success that will come when

one embarks on interdisciplinary efforts. For example, five years ago, there was little extramurally funded research in IH at the RMCOEH. Today, that is completely turned around, in no small part to hiring faculty who believed in interdisciplinary efforts. There are multiple examples, such as the fact that we also have been involved with the State of Washington Nanotechnology Research Center in evaluating new methods for monitoring nanoparticles in work environments.

Our IH Program's academic aspects, while previously very good, have improved due to engaging in increased interdisciplinary efforts. The IH program collaborates extensively with other disciplines in teaching courses. Several courses are team taught with faculty from different OSH disciplines. For example, FPMD 6752, "Introduction to Industrial Toxicology and Physiology" is co-taught by Drs. Larson (IH) and Wood (OM). Interdisciplinary Field Trips was co-taught by Drs. Sesek (OIPRT and E&S), Pahler (HSAT) and Edwards (OM). This course offers the opportunity for demonstrations of team approaches in OSH activities at in-plant settings, and frequently involves OHNs and now has been improved through the merging of this course with the OSH Solutions course which follows. Faculty representing the three RMCOEH core programs (Drs. Collingwood (IH/HSAT), Sesek (E&S/OIPRT), and Wood (OM/IH)), were recently awarded a University teaching grant for development of a new summative course, "Occupational Safety and Health Solutions," MEEN 6960. This course will become the capstone course for all our graduate students. This course will take real world problems presented by businesses interested in having multidisciplinary teams of students under close
faculty supervision work to solve those problems. Faculty from the School of Business (Dr. Smith-Crowe) and Dept. of Economics (Dr. Waitzman) have agreed to participate in this course, with a plan for all RMCOEH trainees, including IHs, to become familiar with quantification of costs and benefits from proposed interventions. Some graduate students from the School of Business will likely enroll in the class and provide additional perspectives on interdisciplinary teams and further those interactions that are so essential to success in today's business environment. These interdisciplinary activities will provide both students and faculty with the opportunity to interact with other researchers and learn about new technologies and how to apply them.

D. Program Products:

Graduates of the program qualified to step into professional roles to manage programs and activities related to industrial hygiene.

E. Future Plans:

To expand the number of students in the program by increasing recruiting activities with an emphasis in diversity recruitment.

Occupational Injury Prevention Research Training

(OIPRT)

Program Title: Occupational Injury Prevention Research Training

A. Program Director: Donald S. Bloswick

B. Program Description

Description/Background. The RMCOEH OIPRT Program is a unique occupational injury prevention program in the RMCOEH. This program is a combination of two different, but related and well-integrated emphases within one program. In keeping with CDC Program Announcement 01036 (March 13, 2001), one emphasis is "Occupational Safety Engineering" (OSE) and the other is "Occupational Injury Epidemiology" (OIE). The coordination and integration of these programs occurs at the programmatic, teaching, and research levels. This program was initiated as an allied academic program in the RMCOEH in July 2001 for two years, then unfunded. In response to critiques, we then extensively revised the curriculum, including development of the two interdisciplinary emphases, and in July 2005 the revised OIPRT program was again funded by NIOSH as an interdisciplinary effort between the Department of Mechanical Engineering (ME) and the Public Health Program in the Department of Family and Preventive Medicine (DFPM). In May 2004, one student graduated from the OSE program (Phillip Drinkaus; Faculty Advisor: Dr. Bloswick) and another graduated in December 2004 (Mark Warner; Faculty Advisor: Dr. Bloswick). There is presently one student in the OSE emphasis (Andrew Merryweather, Faculty Advisor: Dr. Bloswick) and two in the OIE emphasis (Matthew Thiese; Faculty Advisor: Dr. Hegmann and Steven Oostema; Faculty Advisor: Dr. Hegmann). The interdisciplinary nature of the OIPRT is producing an excellent training program. These three current OIPRT trainees are truly outstanding, e.g., having already begun to assume major roles in our cohort studies that augur very well for the future.

The RMCOEH's OIPRT program meets regional needs by: (1) training doctoral level OIPRT professionals to address the well documented, elevated fatality and injury problems of Region VIII, (2) targeting our academic and CE programs' contents to meet Region VIII needs, (3) active involvement of the OIPRT Program Advisory Committee and the RMCOEH Advisory Board which help identify Regional issues for us to address, and (4) tying future research endeavors to the very successful NORA II Town Hall meeting held in February 2006 (n>150 participants with extensive regional needs developed and posted on our website). Our graduate surveys confirm our success in training our students to meet challenges and underscore the RMCOEH OIPRT Program's ability to continue to meet regional needs.

Graduates of the RMCOEH have become leaders in occupational and environmental health. Our two OIPRT graduates are well placed, one directing Sandia Labs ergonomic initiatives (for the entire 18,000 person complex) as a Senior Safety Engineer and the other embarking on an academic career including research. We anticipate long-term, similar success with the OIPRT program. There was only one OIPRT survey respondent (of 2 graduates to date). He was "Very Satisfied" with the OIPRT Program and indicated that he would "Enthusiastically Recommend" the program. Overall satisfaction with training is highly rated by RMCOEH students with 80.5% of graduates rating their training at '8' or higher (0 = 'Very Dissatisfied' and 10 = 'Very satisfied').

The RMCOEH OIPRT program continues to evolve in response to faculty guidance, ongoing feedback from graduates and students, and in response to professional and community needs. The OIPRT's OIE emphasis also changed modestly in response to our program's responses to new Council on Education for Public Health (CEPH) mandates. These changes are generally resulting in a stronger, more effective training program. The RMCOEH anticipates further growth of the OIPRT program and increased success in its efforts to train highly skilled OIPRT doctorates. Thus, there is strong rationale and need for the Rocky Mountain Center for Occupational and Environmental Health (RMCOEH) Occupational Injury Prevention Research Training (OIPRT) Program. Courses and training materials developed for OIPRT students also strengthen the overall RMCOEH and introduces OIP topics to students in allied fields.

Goals and Objectives. The RMCOEH OIPRT program has markedly expanded its research programs to emphasize NORA, r2p and Work-Life Initiative projects. To date, these efforts have resulted in the successful funding of two prospective cohort studies on musculoskeletal disorders (upper extremities and low back pain) through a consortium with the University of Wisconsin Milwaukee, Texas A&M, and the Medical College of Wisconsin. A third cohort study is a large retrospective cohort study of Utah police officers and firefighters (methamphetamine and combustion products exposures, respectively) that is commencing after successful

competitive bidding. We will track injuries in that study as well. In addition, OIPRT faculty have a project underway to look at back injuries and traumatic injuries in commercial truck drivers. There are also multiple public and industry-funded projects undertaken by the RMCOEH that residents can elect to participate in. These projects involve work with the mining industry, manufacturing, and minerals processing. Additional research applications are currently pending.

Goal 1. Provide quality OSE and OIE academic programs.
The RMCOEH OIPRT Program provides extensive formal and practical experiences in the development, implementation and execution of research programs. The OSE and OIE curricula cover all of the topics noted in NIOSH Guidelines for Programs in Occupational Injury Prevention. This interdisciplinary OIPRT program plan is attracting high quality applicants, and their productivity is evidence of a quality program.

Goal 2. Accomplish NORA-related OSE and OIE research and translate it into practice (r2p).
The OIPRT program is currently involved in extensive research studies and all trainees present at conferences, usually multiple times in the course of the curriculum. All current OIPRT students participate in the data collection (field work) and/or job analysis (laboratory work) phases of the Upper Limb and/or Low Back Pain cohort studies. One current trainee, Matt Thiese, has already participated in approximately 6 grant applications, having written much of one proposal, with some guidance. One graduate, Phillip Drinkaus, is PI on a contract with UAW-Ford. Ph.D. candidates are encouraged to publish 3 related peer-reviewed publications rather than conduct a traditional dissertation Now that the cohort studies baseline databases are largely complete, we anticipate an acceleration of the rate of publications. The NORA Young/New Investigators Symposium provides a forum for students (undergraduate and graduate) and young/new investigators from Region VIII and other interested parties to present and discuss NORA-related research. At the last five conferences research presentations included 12 IH students, 10 OM residents, 20 E&S students, and 5 OIPRT students. The OIPRT trainees bring a different, but highly relevant aspect to this conference, and all are required to present at this conference at least once.

Goal 3. Provide Superior Service, Outreach, and Support of Continuing Education.
While the OIPRT Program is relatively young, we have significant OIPRT-related CE activities that have been delivered. We anticipate increasing this rate in the near term as the program matures. These course offerings include our very successful State of the Art Conference on Musculoskeletal Disorders. The OIPRT faculty have extensive Outreach activities. One OIPRT-related lecture was recently presented as a keynote address at a conference in Grand Junction, CO that targeted the “Western Slope” of Colorado.

Goal 4. Accomplish comprehensive interdisciplinary efforts.
The OIPRT program excels in interdisciplinary teaching and has a major course coming on line to cement that concept for the trainees. All major studies, and nearly all remaining research activities are interdisciplinary. Professional and informal activities with students and faculty from other core programs have already been occurring in our OIPRT program on a regular basis and are a testament to the interdisciplinary research and education that is one of our program and Center’s trademarks. Students in the OSE emphasis (working toward a Ph.D. in Mechanical Engineering) take 5 courses (14 credits) in the Department of Family and Preventive Medicine and students in the OIE emphasis (working toward a Ph.D. in Public Health) take 3 courses (6 credits) in the Dept. of Mechanical Engineering (See Figure 1). Currently, several courses are team taught with faculty from different OEH disciplines. the 2 MSD cohort studies involve major efforts by all OIPRT, E&S and OM faculty, as well as every student and resident. The two NIOSH-funded studies best exemplify the cooperation between the OSE and OIE emphasis areas and the three ERC cores. These prospective studies require frequent and continued communication and coordination of data between Andrew Merryweather, team leader for the Low Back Job Exposure Assessment Team (OSE student; supervision by Dr. Bloswick), and Matthew Thiese, Research Associate of the Statistical Analyses and Data Management Team, (OIE student; supervision by Dr. Hegmann) and the Health Outcomes Assessment Teams (OM Program)

Training in Responsible Conduct of Science. For over 3 years, all RMCOEH trainees, faculty and staff have been required to complete HIPAA and IRB training. All students must complete a web based training program

in the protection of human research subjects: Human Participant Protections Education for Research Teams (http://cme.cancer.gov/clinicaltrials/learning/humanparticipant-protections.asp). The tutorial satisfies the NIH human subjects training requirement for obtaining Federal Funds and the Institutional Review Board's (IRB's) requirements for training initiatives. Courses, such as Epidemiology, Introduction to Biostatistics, and Social Context of Public Health, also incorporate training in responsible research practices into their curriculum. Ethics are also major topics in Ergonomics, Human Factors Engineering, and Design Implications. The topic of research ethics is also covered extensively in Computer Applications and Research Methods. In addition to direct training on these topics, ethics content is integrated into course materials with lectures on how to present results in an unambiguous manner without "overstating" conclusions and how to interpret the results of other researchers. RMCOEH trainees also attend a new mandatory noon lecture series that includes among other topics: conflict of interest, responsible authorship, handling of misconduct, data management, data sharing and animal welfare. Attendance logs are kept to track trainee attendance, and faculty attendance is encouraged. Additional topics include how to write research grant proposals and how to manage research laboratories

Faculty Participation. Dr. Bloswick directs the overall OIPRT grant, as well as the Occupational Safety Engineering (OSE) emphasis. Dr. Hegmann directs the Occupational Injury Epidemiology (OIE) emphasis. Dr. Bloswick is responsible for all aspects of the OIPRT Program. Drs. Bloswick and Hegmann share responsibility for meeting with students to discuss progress, projects, and concerns. It should be noted that the coordination of these emphases is so close that the students regularly meet with the faculty of the other emphasis. Trainee progress is reviewed on at least a monthly basis, and sometimes weekly depending on the circumstances. Despite some geographic distance across campus, Drs. Bloswick and Hegmann maintain close, sometimes daily contact.

In addition to the extensive teaching and advising responsibilities of Drs. Bloswick and Hegmann, support of the OIPRT Program include many other faculty. **Dr. Richard F. Sesek** (Research Assistant Professor, Mechanical Engineering, adjunct appointment in Family and Preventive Medicine) shares responsibility for student recruitment and selection in the OIPRT Program. He directs FPMD 6759 (Occupational Safety and Health Field Trips) and teaches ME 6130 (Design Implications in Human-Machine Systems), ME 7105 (Advanced Ergonomics and Occupational Biomechanics Lab), ME 6960-3 (Occupational Safety and Health Solutions), and co-teaches ME 6110 (Industrial Safety) with Dr. Bloswick. Dr. Sesek also directs research activities and supervises student research and is a member of the OIPRT Executive Committee. **Dr. Phillip Drinkaus** (Adjunct Research Assistant Professor Mechanical Engineering) teaches ME 7960 (Computer Applications and Research Methods). Dr. Drinkaus specializes in ergonomic epidemiology and modeling and has assisted significantly with field data collection and subsequent laboratory analyses. Dr. **Rodney Larson** (Assistant Professor, Family and Preventive Medicine) directs research activities and supervises student research and is a member of the OIPRT Executive Committee. Dr. **Leon Pahler** (Assistant Professor, Family and Preventive Medicine) co-instructed FPMD 6759 (Occupational Safety and Health Field Trips) with Dr. Sesek and Dr. Edwards (OM),. Dr. **Scott Collingwood** (Assistant Professor, Family and Preventive Medicine) co-instructs the new course, ME 6960-3 (Occupational Safety and Health Solutions), with Dr. Sesek and Dr. Wood (OM). Dr. **Clay Mann** (Associate Professor, Pediatrics) is a staff member at the Intermountain Injury Control Research Center and directs independent study courses for OIPRT students, directs student practicums and research efforts within the IICRC, and lectures in FPMD 6607 (Injury Surveillance) and ME 7960 (Computer Applications and Research Methods). Dr. **Anthony Suruda** (Adjunct Associate Professor, Family and Preventive Medicine) teaches FPMD 6607 (Injury Surveillance) and assists with overall curriculum development and program review, serves on student committees, and advises student research projects. Dr. **Kent Bachus** (Research Associate Professor Orthopedic Surgery and Bioengineering, Adjunct Associate Professor, Mechanical Engineering) is Director of the University of Utah's Orthopedics Research Lab. He and Dr. Bloswick have developed a joint research program to investigate the response of intervertebral discs to repetitive torsion and compressive loading. He also co-directed the research of Mark Warner, an OIPRT trainee who graduated in 2005. Dr. **Robert Tuckett** (Research Associate Professor, Physiology, Adjunct Associate Professor, Mechanical Engineering) assists in OIPRT Program field research efforts involving ergonomic injury surveillance, particularly those involving surveillance for Upper Extremity MSDs, and laboratory research into improved methods of diagnosing and preventing hand/wrist injuries. Dr. **Tom Bernard**

(Professor and Chair, Department of Environmental and Occupational Health, University of South Florida, Adjunct Professor, Mechanical Engineering, University of Utah) spent Autumn semester 2002 in the OIPRT Program at the University of Utah as a Visiting Professor, at which time he developed and taught ME 6960-4 (Work Physiology and Occupational Heat Stress). Dr. Bernard returns on an alternate year basis to teach this course (2004, 2006, and beyond). He also serves on graduate committees, and provides guidance in the continued development of the graduate programs in Occupational Injury Prevention. He also co-directed the research and served on the Ph.D. committee of Phillip Drinkaus, an OIPRT trainee who graduated in 2004.

Curricula. Graduation from the OSE emphasis requires 51 credits and graduation in the OIE emphasis requires 59 credits. There is significant course overlap between the two emphases and distinct courses for each emphasis. Students in the OSE emphasis (working toward a Ph.D. in Mechanical Engineering) take 5 courses (14 credits) in the Department of Family and Preventive Medicine and students in the OIE emphasis (working toward a Ph.D. in Public Health) take 5 courses (12 credits) in the Dept. of Mechanical Engineering. A summary of the program requirements for the OSE Ph.D. in Mechanical Engineering and for the OIE Ph.D. in Public Health is included in Appendix OIP-1 and OIP-2.

C. Program Activities and Accomplishments

Progress Toward Goals and Objectives. Progress toward goals and objectives is included in Section C above.

Trainee Theses and Dissertations.

Andrew Merryweather ((Advisor Bloswick) ME OSE Ph.D. expected graduation May 2008)
Mr. Merryweather has completed his practicum and has six remaining courses. He will complete his qualifying/comprehensive examination in Autumn 2007 and graduate May 2008.
Research Project (Dissertation): “An Investigation into slips/falls and ankle/knee stresses while walking on uneven surfaces.

Matthew S. Thiese ((Advisor Hegmann) PH OIE Ph.D. expected graduation May 2008)
Mr. Thiese has completed his practicum and has five remaining courses. He passed his qualifying/comprehensive examination in May 2005, and is in the process of preparing for his dissertation defense in December 2007.
Research Project (Dissertation): “Assessing the relationship between physical activity and low back pain in a prospective cohort study”

Steven J. Oostema ((Advisor Hegmann) PH OIE Ph.D. expected graduation May 2010)
Research Project (Dissertation): Undecided.

New Courses. A new course, *Occupational Safety and Health Solutions,* was first offered and team taught by Drs. Sesek (E&S), Collingwood (IH), and Wood (OM) in Spring 2007. This course includes on-site student projects composed of teams with representation from across the RMCOEH (IH, OM, and E&S) who will visit several local manufacturing facilities and work together on real world problems.

Trainee recruitment. Incoming students for the Ph.D. program in Mechanical Engineering are required to have competency in the basic engineering sciences. This competency may be demonstrated through: (1) graduation from an engineering curriculum, (2) completion of the Fundamentals of Engineering exam, (3) record of appropriate course work, or (4) successful completion of appropriate course work while in residence. Trainees are selected on the basis of academic record, GRE scores, industrial experience, and letters of recommendation. Incoming students in the OIPRT Program will also be required to have past academic course work in biostatistics, ergonomics, and industrial safety. Ph.D. students must pass a qualifying exam in three areas selected from the three Divisions in the Mechanical Engineering Department (1) Design, Manufacturing, Controls, and Ergonomics, (2) Thermal, Fluid and Energy Systems, and (3) Mechanics. Incoming students for the Ph.D. program in Public Health are required to have demonstrated capabilities in science including mathematics. This competency is typically demonstrated through: (1) graduation from an appropriate scientific

background, (2) high Quantitative scores on the GRE exam, (3) record of appropriate course work, or (4) successful completion of appropriate course work. Trainees are selected on the basis of academic record, GRE scores, experience, and letters of recommendation. Ph.D. students must pass a qualifying examination. For both emphases, preliminary decisions are made on the applicants' probability of successful selection with offers to interview extended based on that preliminary review. All available OIPRT faculty interview all applicants, as well as at least one other RMCOEH faculty member (most often IH, other Public Health or HSAT). All interviewers complete interview forms and applicants are discussed with all interviewers. Selections are made based on a global assessment of all qualifications. The recruitment of trainees under-represented in Occupational Injury Prevention is being given increased emphasis. In November 2006, Derrick Franklin, an African-American trainee recently recruited from Mississippi State University for the E&S Program, presented a seminar at his alma mater in an effort to identify and recruit additional ethnic-minority trainees, for both the E&S and OIP Programs.

D. Program Products

PUBLICATIONS/PRESENTATIONS

OIPRT faculty were productive with respect to publications and were actively involved in five publications as well as five presentations. Please see Appendix OIP-3 for a complete list of publications and presentations.

SPONSORED SYMPOSIA

While the OIPRT Program is relatively young, we have significant OIPRT activities. These course offerings include our very successful State of the Art Conference on Musculoskeletal Disorders. This conference targeted one aspect of OIP that was repetitively identified in many of our industry sector-specific roundtables at the SLC NORA II Townhall meeting as a major need. While that course also targeted Health Care Providers and Ergonomists, it contained major course content on injury epidemiology and safety. That course will be repeated this winter. Each of the first four annual Regional (NORA) Young/New Investigators Symposiums have included significant content relating to epidemiology and injury prevention. The NORA II Townhall meeting agenda is being reviewed in more detail to identify additional needs likely to be successful in a CE venue.

E. Future Plans

Over the next 5 year period, we plan to: (1) increase the number of OIPRT trainees, (2) further grow our extramural research programs that emphasize NORA (as well as NORA II, r2p, the Work Life Initiative and build on our regional NORA II Town Hall meeting held in Salt Lake City; (3) recruit additional faculty member(s) after nationwide searches, (4) develop OIPRT-related distance-based education programs, (5) increase the integration of the Statistical and Economic Evaluation Unit with our trainees, (6) critically evaluate our curriculum for potential improvements, and (7) utilize this grant's proposed NORA projects for additional OIPRT trainee research projects. We recognize that this is an ambitious agenda, however, we have made much headway in only 3 years.

Figure 1. Illustration of Integration of OSE & OIE

pational Safety Engineering (OSE)		**BOTH**	**Occupational Injury Epidemiology**	
	ME 6960-3	Occupational Safety and Health Solutions		
Quality Assurance	ME 6960-6	Interdisciplinary Seminar in Occupational Injury Prevention (0 credits)	FPMD 6340	Infectious Disease Epide
Design Implications for Human Machine Systems	ME 7960	Computer Applications & Research Methods in Occupational Injury Prevention	FPMD 7100	Biostatistics II
Work Physiology and Occupational Heat Stress (2 credits)	FPMD 6101	Introduction to SAS Programming	FPMD 7140	Survival Methods and Lo Regression
Advanced Ergonomics and Occupational Biomechanics	FPMD 6607	Injury Surveillance (2 credits)	FPMD 7310	Advanced Research Des
System Safety	FPMD 6703	Occupational Injuries and Diseases	FPMD 7530	Design Implementation a of Public Health Progran
Experimental Design and Analysis	FPMD 7300	Epidemiology II	FPMD 7640	Advanced Social Contex
	FPMD 7720	Occupational Epidemiology		
6 courses 17 credits		8 courses 20 credits		6 courses 18 credits

Not including ME requirements, Interdisciplinary Seminar, Research Practicum, and Dissertation credit

Occupational Medicine

(OM)

Program Title: Occupational Medicine

A. Program Director: Edward B. Holmes

B. Program Description

The Occupational Medicine Residency (OMR) program at the Rocky Mountain Center for Occupational and Environmental Health (RMCOEH) continues to grow in clinical activity, research, and education.

Clinics. RMCOEH OM faculty are deeply involved in developing evidence-based guidelines for the practice of Occupational Medicine through participation in revisions for the third edition of American College of Occupational and Environmental Medicine's (ACOEM) *Occupational Medicine Practice Guidelines*. Faculty

enhance the clinical experience for trainees by incorporating these evidence-based practices into the clinic for residents who rotate at the University of Utah's OccMed clinic.

Research. RMCOEH research programs emphasize NORA, r2p and WorkLife Initiative projects. These research efforts include two prospective cohort studies on musculoskeletal disorders (upper extremities and low back pain) through a consortium with the University of Wisconsin, Texas A&M, and the Medical College of Wisconsin. A third major prospective cohort study, the National Children's Study (NCS), initiated by the University of Utah and others primarily utilizes expertise of the Industrial Hygiene (IH) and Hazardous Substances Academic Training (HSAT) programs with nominal support from the OM core. In addition, OM faculty have a project underway to study back injuries in commercial truck drivers. There are also multiple public and industry-funded projects undertaken by the RMCOEH in which residents can elect to participate. These projects involve work with hazards of methamphetamine laboratory investigation, air pollution, the mining industry, minerals processing, and chemotherapeutics.

Education. The OM curriculum continues to evolve in an effort to incorporate experiences that will prepare residents to work effectively in clinical and industrial environments. In addition to classes in Ergonomics, Occupational Injury and Disease, Clinical Prevention and core Industrial Hygiene (IH) and Public Health courses, residents are now also required to take a research course and a new interdisciplinary capstone course. The new capstone course has residents work in teams with IH, Ergonomics and Safety (E&S), Occupational Injury Prevention and Research (OIPRT), public health, and business students to solve real-world occupational health and safety problems posed by local businesses. Residents continue to train in a variety of industrial and population-based medical surveillance sites throughout the United States during the practicum year.

All PGY-2 residents are now required to take "Occupational Safety and Health Solutions", MEEN 6960, and "Individual Research in Occupational Medicine," FPMD 6710. The Occupational Safety and Health Solutions capstone course has interdisciplinary teams of students address real problems presented by local businesses. The Individual Research in Occupational Medicine course provides residents with guidance, academic support, and a timeline for completing research projects.

OMR Website: http://uuhsc.utah.edu/rmcoeh/EdProg/OccMed/OMhome.html

The Occupational Medicine Residency (OMR) program at the Rocky Mountain Center for Occupational and Environmental Health (RMCOEH) was founded in 1977 and has been continuously supported by NIOSH since the original application in 1978. **To date, the program has graduated 71 OM physicians.** Program graduates fill a critical need by providing highly skilled OM physicians to NIOSH Region VIII (CO, MT, ND, SD, UT, WY), which is underserved by OM specialists. The program meets regional needs by: (1) training OM physicians for the needs of Region VIII, (2) targeting academic and CE programs' contents to regional needs, (3) obtaining active involvement of the Residency Advisory Committee and the RMCOEH Advisory Board which raise Regional issues, and (4) tying future research endeavors to the NORA agenda.
Goals and Objectives: The OM Program's objectives were updated in the summer of 2006 and are listed below. The program objectives are subsumed under the 4 goals shared by all educational programs at the RMCOEH.

Goal 1. Provide Quality Academic Programs.

Objective 1.a. Maintain ACGME accreditation of the OM residency, including instruction and evaluation of OM residents in Core Competencies.
Objective 1.b. Continually review and improve the quality of OEH instruction
Objective 1.c Provide excellent training opportunities
Objective 1.d. Provide opportunities for OEH training of medical students and residents in other specialties

Objective 1.e Train and graduate a minimum of two OM residents each year who are qualified to take the ABPM Board examination
Objective 1.f. Train qualified individuals who are sponsored by other agencies
Objective 1g. Enhance current educational offerings.

Goal 2. Accomplish NORA research and translate it into practice (r2p)

Objective 2a. Emphasize NORA-related areas.
Objective 2.b. Further augment the resident research experience.

Goal 3. Provide Superior Service, Continuing Education, and Outreach

Objective 3.a. Continue to enhance OM consultative services
Objective 3.b Expand clinical and OEH services on-campus.
Objective 3.c. Increase continuing education and maintain outreach activities. Conduct at least 6 training programs annually.

Goal 4. Accomplish Strong Interdisciplinary Collaboration

Objective 4.a. Augment current interdisciplinary teaching activities
Objective 4.b. Continue to provide IH, HSAT, E&S and OIPRT students with opportunities to join the OM students in the OM clinic.
Objective 4.c. Foster interdisciplinary research efforts

Training in Responsible Conduct of Science: For over 4 years, all RMCOEH trainees, faculty and staff have been required to complete HIPAA and IRB training. All students must complete a web based training program in the protection of human research subjects: Human Participant Protections Education for Research Teams (http://cme.cancer.gov/clinicaltrials/learning/humanparticipant-protections.asp). The tutorial satisfies the National Institutes of Health's human subjects training requirement for obtaining federal funds and the Institutional Review Board's (IRB's) requirements for training initiatives. Courses, such as Epidemiology, Introduction to Biostatistics, and Social Context of Public Health, also incorporate training in responsible research practices into their curriculum. In addition to direct training on these topics, ethics content is integrated into course materials with lectures on how to present results in an unambiguous manner without "overstating" conclusions and how to interpret the results of other researchers. RMCOEH trainees also attend a mandatory noon lecture series that includes among other topics: conflict of interest, responsible authorship, handling of misconduct, data management, data sharing and animal welfare. Attendance logs are kept to track trainee attendance, and faculty attendance is encouraged. Additional topics include how to write research grant proposals and how to manage research laboratories

Faculty Participation: Dr. Edward Holmes directs the overall Occupational Medicine Program that consists of the Occupational Medicine Residency (OMR) program, OM educational services, and clinical and consultation services through the University of Utah's OccMed clinic and the RMCOEH. Dr. Eric Wood directs the OMR program. Dr. Kurt Hegmann is the Center Director of the RMCOEH and Assistant Director of the OMR. Dr. Royce Moser serves as Deputy Director of the RMCOEH and lends his considerable expertise to help manage the OMR. Dr. Edwards serves as Associate Medical Director of the OccMed clinic and is a supervising physician at ARUP Clinical Laboratories Employee Health Clinic (associated with the University of Utah). All faculty teach and direct occupational safety and health courses, participate in research projects at the RMCOEH, perform professional and community outreach, provide clinical OM services and/or consultation, and participate in evidence-based guideline development for Occupational Medicine.

Curriculum: The MPH curriculum requires completion of 45 semester hours of course work. The practicum year consists of 3 major components over the 12 month period. Residents must complete a minimum of 14 weeks of what have been traditionally called comprehensive "industrial rotations." The objective for these industrial rotations is for residents to learn in an OEHS interdisciplinary employment setting, as well as gain practical exposure to administration and management. Residents are also required to complete 12 weeks in

the OccMed Clinic or another community OM clinic, where they have patient continuity experiences to learn how to care for patients who do not follow expected recovery timelines. Approximately 23 weeks are clinical and elective activities. Practicum year rotations are accomplished through formal affiliation agreements that include specific learning objectives for each site.

In addition to the core responsibilities for providing education and training to OM residents, the OM faculty provides instruction to students in IH, HSAT, E&S, OIPRT and Public Health. Faculty train primary care residents, as well as teach other residents [e.g., Physical Medicine and Rehabilitation (PMR)]. Faculty instruct first year medical students and direct an elective OM rotation for fourth year students. The OM faculty sponsors the RMCOEH's Occupational and Public Health Journal Club and co-sponsor OM Grand Rounds at Intermountain Health Care. The OM faculty also regularly participates in continuing education and accomplishes extensive Outreach activities.

C. Program Activities and Accomplishments

Progress Toward Goals and Objectives:
Goal 1. Provide Quality Academic Programs.
Objective 1.a. Maintain ACGME accreditation of the OM residency, including instruction and evaluation of OM residents in Core Competencies.
Progress: In December 2003, the OM residency was accredited with the maximum 5 years by ACGME. There were no citations or adverse comments. The next accreditation site visit will be in 2008. To comply with the ACGME mandate to instruct and evaluate competence in core competencies, faculty audited the OM curriculum augmented course and rotation content based on this audit, and revised the resident evaluation forms.
Objective 1.b. Continually review and improve the quality of OEH instruction
Progress: Faculty meet regularly to discuss curriculum content and devise strategies to improve OEH instruction. This review process has identified content areas that are being enhanced through changes in course content and additions of new courses and rotations, such as the interdisciplinary problems solving course, "Occupational Safety and Health Solutions."
Objective 1.c Provide excellent training opportunities
Progress: The program maintains unique and exceptional training opportunities for residents and benefits from the generosity of nationally regarded OM mentors in providing rotations within the state of Utah, in Region VIII and beyond. The program also encourages the establishment of new rotations that provide unique and valuable learning opportunities.
Objective 1.d. Provide opportunities for OEH training of medical students and residents in other specialties
Progress: OM faculty instruct Family Medicine (FM) residents, are co-course masters of the medical student's Science of Medicine course, teach environmental health to the medical students, and provide opportunities for medical students and residents from other specialties to rotate in the OM clinics. Program faculty also provide instruction to Internal Medicine (IM) and PMR residents with plans to teach other residents (e.g. Orthopaedic Surgery).
Objective 1.e Train and graduate a minimum of two OM residents each year who are qualified to take the ABPM Board examination
Progress: The OM residency has graduated 2-4 residents each year since 2001.
Objective 1.f. Train qualified individuals who are sponsored by other agencies
Progress/Result: Besides NIOSH, residents are supported with funds from the Salt Lake City VA Medical Center and the University of Utah GME. Residents have also been sponsored by the Occupational Physicians' Scholarship Fund (OPSF).
Objective 1g. Enhance current educational offerings.
Progress: The OM program is more fully utilizing electronic and internet based educational tools. Most didactic teaching is performed using Powerpoint. The University of Utah supports an internet based classroom

tool “WebCT” that allows instructors to post lecture content, administer exams, and evaluate students on-line. The residency has also recently started using the E*Value system to track resident evaluations and enhance curricular content. The program has a library of OM Grand Round presentations and videotapes of standardized musculoskeletal examinations of the distal upper extremity and low back pain available to all posted on the RMCOEH website.

Goal 2. Accomplish NORA research and translate it into practice (r2p)

Objective 2a. Emphasize NORA-related areas.

Progress: RMCOEH OM research programs include two prospective cohort studies on musculoskeletal disorders (upper extremities and low back pain) through a consortium with the University of Wisconsin, Texas A&M, and the Medical College of Wisconsin. A third major prospective cohort study, the National Children’s Study (NCS), initiated by the University of Utah and others primarily utilizes expertise of the Industrial Hygiene (IH) and Hazardous Substances Academic Training (HSAT) programs with nominal support from the OM core. In addition, OM faculty have a project underway to study back injuries in commercial truck drivers. There are also multiple public and industry-funded projects undertaken by the RMCOEH in which residents can elect to participate.

Objective 2.b. Further augment the resident research experience.

Progress: Residents have virtually endless opportunities to participate in research projects currently underway at the RMCOEH. Additionally, they may elect to participate in an industry or preceptorship site research project. Clinical research projects are also possible through the OM clinics. Residents also participate in FPMD 6710 Individual Research in Occupational Medicine at the start of the PGY-3 year.

Goal 3. Provide Superior Service, Continuing Education, and Outreach

Objective 3.a. Continue to enhance OM consultative services

Progress: Faculty will continue to provide consultative services.

Objective 3.b Expand clinical and OEH services on-campus.

Progress: The OccMed Clinic at Redwood Health Center provides community based OM services to University, municipal, and corporate clients. Discussions to expand these services on campus are ongoing.

Objective 3.c. Increase continuing education and maintain outreach activities. Conduct at least 6 training programs annually.

Progress: OM faculty hosted the 2007 State-of-the-Art Conference on Musculoskeletal Disorders in Salt Lake City. Drs. Hegmann and Wood have been very active in ACOEM’s Commercial Drivers Medical Examination (CDME) course. Faculty and residents have also participated in the regional NORA conference that has been sponsored by the RMCOEH for the past 5 years. About 10 times a year, OMRs present information on the health effects of asbestos and asbestos medical surveillance during RMCOEH asbestos contractor/supervisor CE courses. The RMCOEH is a co-sponsor of Intermountain Health Care’s (IHC) OM Grand Rounds. Dr. Moser provides distance-based instruction in Practical Aspects of Management, approved by ABPM for Maintenance of Certification (MOC) credit.

Goal 4. Accomplish Strong Interdisciplinary Collaboration

Objective 4.a. Augment current interdisciplinary teaching activities

Progress: Several courses are team taught with faculty from different OEH disciplines. For example, FPMD 6752, "Introduction to Industrial Toxicology and Physiology" is co-taught by Drs. Wood (OM) and Larson (IH & HSAT). “Occupational Safety and Health Solutions”, MEEN 6960, is taught by faculty representing the 3 RMCOEH core programs (Drs. Collingwood (IH), Sesek (E&S), and Wood (OM)).

Objective 4.b. Continue to provide IH, HSAT, E&S and OIPRT students with opportunities to join the OM students in the OM clinic.

Progress: In FPMD 6758, "Occupational and Environmental Health Clinic" IH, HSAT, E&S and OIPRT students have the opportunity to attend or review at least one patient encounter that involves a question relevant to the respective discipline.

Objective 4.c. Foster interdisciplinary research efforts

Progress: All major research conducted through the RMCOEH is interdisciplinary with involvement of at least two core disciplines. For example, the 2 MSD cohort studies involve major efforts by all OM, E&S and OIPRT faculty, as well as every student and resident. The third major prospective cohort study, the National Children's Study (NCS) primarily utilizes expertise of the IH core and HSAT program, however, the OM core has been involved in that project for several years and has provided assistance to the other programs.

Trainee Honors and Awards: In 2007, 2 of the RMCOEH's OM residents received scholarships from the Workers Compensation Fund of Utah totaling $3,000.00 for educational, research and ancillary training expenses. A resident won first place in the poster competition at the 2006 WOEMA conference for his review of hazards associated with methamphetamine laboratory investigation. The same resident presented his work at the RMCOEH's regional 2007 NORA conference.

Faculty Honors, Awards, and Appointments: In 2007, Dr. Edward Holmes was promoted to Associate Professor and Dr. Eric Wood was promoted to Assistant Professor. Dr. Holmes completed a one year Diploma in Medical Toxicology through Cardiff University in Wales, UK and is currently preparing his thesis for a Masters degree in Medical Toxicology. Dr. Wood assumed the position of Occupational Medicine Residency Director in July 2007. Dr. Hannah Edwards is currently under review for faculty retention and promotion to Assistant Professor. In Spring 2007, Dr. Edwards became the Associate Medical Director of the OccMed clinic and in October 2007, became a supervising physician at the ARUP Laboratories Employee Health Clinic. Dr. Kurt Hegmann serves as the chair of the Evidence Based Medicine Committee at ACOEM and oversees the development of the third edition of the ACOEM practice guidelines. Dr. Hegmann also chairs the Department of Transportation medical panel. In the summer of 2007, Dr. Hegmann was invited to participate in a several day roundtable discussion of research in clinical prevention where he presented findings from the musculoskeletal studies underway at the RMCOEH. Dr. Moser has been asked to run (unopposed) for President of the Harvard School of Public Health Alumni Council.

New Faculty Positions: The RMCOEH is recruiting an Assistant Center Director who may be an Occupational Medicine physician.

New Courses: All PGY-2 residents are now required to take "Occupational Safety and Health Solutions", MEEN 6960, and "Individual Research in Occupational Medicine," FPMD 6710.

Trainee recruitment: Admission to the training program is restricted to physicians who have completed at least one clinical year of training in an ACGME-accredited residency program. After completion of an extensive application, applicants are invited to interview based on the applicant's probability of successful selection. OM faculty and at least one public health faculty interview each applicant. Selections are made based on a global assessment of all qualifications. The recruitment of trainees under-represented in OM is being given increased emphasis. OM faculty are working to target recruitment efforts toward medical students and primary care residents in Region VIII. These recruitment efforts may consist of on-site visits by OM faculty, dissemination of educational/program advertisement materials, or development of online educational modules for use by primary care physicians, residents, or medical students.

D. Program Products

Aside from quality graduates, the OM program has produced many publications and educational and service outreach efforts. Examples of outreach include participation from all faculty members in the ACOEM Practice Guidelines development, presentations at regional, national, and international conferences, and service on professional and community committees. Examples of educational products include sponsorship of the State-of-the-Art Conference on Musculoskeletal Disorders, participation in ACOEM's Commercial Drivers Medical Examination (CDME) course, and co-sponsorship of OM Grand Rounds.

Presentations and publications: OM faculty conducted extensive outreach activities in the past year.

Conferences/symposia: OM faculty hosted the 2007 State-of-the-Art Conference on Musculoskeletal Disorders in Salt Lake City. Faculty and residents participated in the 2007 regional NORA conference sponsored by the RMCOEH. The OM faculty is also very active in ACOEM's Evidence Based Medicine Committee that is overseeing the third edition of ACOEM *Occupational Medicine Practice Guidelines.*

CE Courses: Drs. Hegmann and Wood have been very active in ACOEM's Commercial Drivers Medical Examination (CDME) course. Dr. Wood also presented at the 2007 Annual Industrial Hygiene and Safety conference sponsored by RMCOEH Continuing Education. About 10 times a year, OMRs present information on the health effects of asbestos and asbestos medical surveillance during RMCOEH asbestos contractor/supervisor CE courses. The RMCOEH is a co-sponsor of Intermountain Health Care's (IHC) OM Grand Rounds. Dr. Moser provides distance-based instruction in Practical Aspects of Management, approved by ABPM for Maintenance of Certification (MOC) credit.

R2P Projects and Research Projects: RMCOEH OM research programs include two prospective cohort studies on musculoskeletal disorders (upper extremities and low back pain) through a consortium with the University of Wisconsin, Texas A&M, and the Medical College of Wisconsin. A third major prospective cohort study, the National Children's Study (NCS), initiated by the University of Utah and others primarily utilizes expertise of the Industrial Hygiene (IH) and Hazardous Substances Academic Training (HSAT) programs with nominal support from the OM core. In addition, OM faculty have a project underway to study back injuries in commercial truck drivers. There are also multiple public and industry-funded projects undertaken by the RMCOEH in which residents can elect to participate.

E. Future Plans

The OM program anticipates further growth and increased success in its efforts to train OM physicians. In the next five years, the program will pursue: (1) increasing the numbers of OM residents, (2) additional growth in extramural research programs that emphasize NORA (as well as NORA II, r2p, and WorkLife Initiative), (3) utilizing the proposed NORA projects for additional resident research projects as well as r2p training aspects, (4) further integrating the RMCOEH's Statistical and Economic Evaluation Unit in support of resident research, (5) further enhancing education programs, (6) further increasing OM consultations through the RMCOEH, (7) increasing on-campus clinical activities, (8) recruiting additional OM faculty after national searches, and (9) developing additional distance-based education programs.

The OM program through the OccMed clinic provides occupational medicine clinical and consultation services to Salt Lake County. In the past 3 years, Salt Lake County has experienced a dramatic decrease in industrial injuries and worker's compensation costs that the county has attributed largely to case management and treatment at the OccMed Clinic run by our faculty.

The impact of the training program can be partly inferred from the program's 2006 survey results. Although the majority of graduates indicated they did not know the magnitude of injury or cost reduction their services provided to their organization, many indicated that their services had saved their clients or organization tens to hundreds of thousands of dollars with substantial reductions in injury rates.

Continuing Education in Occupational Safety and Health

(CE)

Program Title: Continuing Education

A. Program Director: Connie Crandall, MA, MBA

B. Program Description

The Continuing Education (CE) program was established as part of the original University of Utah=s Educational Resource Center (ERC - now designated as Education and Research Center) grant in 1978. It remains as a primary OSH CE resource in HHS Region VIII and continues its mission to reduce human and financial costs by providing excellent short-course training in occupational safety and health that is marked by continuous improvement and response to needs, setting the highest standards for both internal and external service. Target audiences include industrial hygienists, safety professionals, ergonomists, occupational health nurses, occupational medicine physicians, industry managers, and others concerned with OSH. Courses focus on OSH disease and injury recognition and treatment but also, and of equal importance, methods to prevent workplace-related illnesses and injuries.

The program is supported by a broad base of faculty, both internal and external, to accomplish its stated goals: 1) Offer continuing education programs (courses and conferences) to occupational and environmental health and safety professionals and to others involved in the field; 2) Conduct research to identify training needs and training effectiveness; 3) Provide superior service and outreach that enhances and promotes the field of occupational and environmental safety and health; and 4) Accomplish Extensive Interdisciplinary Collaboration.

The Program also enjoys numerous collaborative relationships with businesses, employee groups, governmental units, and other community organizations. The program also has a Continuing Education Advisory Committee that actively supports the program's goals and objectives.

C. Program Activities and Accomplishments

The following is a summary of progress in accomplishing the overall goals for the Continuing Education (CE) program for the grant period beginning July 2006 through June 2007. Four goals were set for the project period with specific objectives established to achieve the goals.

Goal 1. Offer quality CE programs (courses and conferences) to occupational and environmental health and safety professionals and to others involved in the field.
This goal was achieved through four major objectives: 1) Provide short-term occupational safety and health post-graduate training (a minimum of two per core discipline) on current issues and topics to a minimum of 400 participants/year; 2) Facilitate exchange with other safety and health professionals through course co-sponsorship with other organizations involved in occupational safety and health; 3) Obtain highly-qualified faculty from the private and public sector that bring both theoretical and practical knowledge to the issues presented; and 4) Hold at least one course per year regionally outside of Salt Lake City.

Objective 1) Provide short-term occupational safety and health post-graduate training (a minimum of two per core discipline) on current issues and topics to a minimum of 400 participants/year. This objective was accomplished as follows: During the period July 1, 2006 through June 30, 2007, 2,529 trainees attended 120 CE activities. We delivered more than two courses per core. The distribution of the course attendees follows:

a. Categories of Participants: From July 1, 2006 – June 30, 2007, attendees were distributed among the four core professions as follows: MD – 22% (n = 542), NURS – 3% (n = 62), HYG - 11% (n = 275), and SAFETY – 18% (n = 433). Forty-six percent of attendees (n = 1,217) were from allied occupational safety and health professions. The low representation of occupational health nurses in the region based on numbers provided by the AAOHN (153) supports the proportionately low number of nurses trained.
b. Trainees in Attendance: Most attendees (n= 1,523, 58%) came from industry, 20 percent (n= 462) came from government agencies, and 11 percent (n= 271) were from academic institutions. The remainder of course participants (11%) were from allied occupational safety and health employers and labor representatives, including but not limited to construction and renovation, chemistry, insurance, law, physical therapy, occupational therapy, wellness coordination, and private consulting and contracting.

Distance-Based Education: The CE Program continues to draw participants to its hard-copy distance-based education courses. The program was the first ERC to offer hard-copy distance learning courses and has continued to offer them for many years as assessments have indicated a preference for them. The program also directed efforts at distance-based education. For example, Dr. Collingwood coordinated efforts

with the Department of Public Health at Western Kentucky University to offer a WebCT-based course entitled *Occupational Health and Safety*.

Minority Populations: The CE Program has captured data on minorities that attend courses by including an optional question on the registration form which the majority of participants elect to complete. The program has also drawn some minorities to its programs through an initiative sponsored by the Utah Labor Commission, Associated Builders and Contractors, Associated General Contractors, Utah Farm Bureau Federation, Utah Chapter AFL-CIO and the Utah Restaurant Association. This initiative is administered through the Rocky Mountain Center's OSHA Education Center. Subsidized training has been offered to bilingual (Spanish) safety and health practitioners in Utah. Also, as a member of the **Coalition for Multicultural Workers' Safety and Health** that includes the Mexican Consulate, Pete Suazo Business Center, Utah Department of Workforce Services, Utah OSHA Consultation Services, Utah Safety Council and Workers' Compensation Fund of Utah, the group has met to address the safety and health needs of the multicultural workforce. The Coalition successfully offered a conference in February 2007.

Objective 2) Facilitate exchange with other safety and health professionals through course co-sponsorship with other organizations involved in occupational safety and health.

Throughout the 2006-2007 grant period, the RMCOEH collaborated and co-sponsored programs with other organizations with a shared interest in promoting occupational safety and health. These organizations include: the local Chapter of the American Society of Safety Engineers (ASSE), the local Section of the American Industrial Hygiene Association (AIHA), and the Utah Safety Council. This group, collectively, planned and conducted the Utah Conference on Industrial Hygiene and Safety. We also collaborated with the Utah Chapter of the American Association of Occupational Health Nurses (UAOHN) to develop and promote courses for nurses including a spring and fall seminar. We co-sponsor the Practical Aspects of Management course with the University of Utah's Continuing Medical Education Office (previously co-sponsored with the American College of Occupational and Environmental Medicine) course. The CE Program has also collaborated with the Utah Council on Worksite Health Promotion to develop, market, and implement an annual Worksite Health Promotion conference.

Objective 3) Obtain highly-qualified faculty from the private and public sector that bring both theoretical and practical knowledge to the issues presented The CE Program has offered quality programming with the support of highly-qualified and, often, credentialed faculty. It was been fortunate to be surrounded with a cadre of qualified individuals, both within and outside the Center that supports its programs. All RMCOEH faculty members have participated in the CE program. In addition to RMCOEH faculty participation in CE courses, the CE Program enjoys faculty support from numerous, highly qualified individuals outside the RMCOEH representing both the private and public sector. Many of these faculty members have departmental adjunct faculty appointments.

Objective 4) Hold at least one course per year regionally outside of Salt Lake City.
Finally, although courses held outside of Salt Lake City have been very cost-intensive and attendance has been variable, the CE program offered a number of courses in surrounding areas to enhance regional coverage. Asbestos courses were conducted in Moab, Utah, Burley, Idaho, and Pocatello, Idaho. An OSHA 10-hour for General Industry course was held in Plymouth, Utah and an Electrical Safety course was held in Orem, Utah. A Pulmonary Function Testing course was held in Rock Springs, Wyoming and two occupational medicine courses were held in New Orleans, Louisiana.

Goal 2. Conduct research to identify CE training needs and impact.
The sole objective of this goal was to research the needs of each state within the Center's designated region by needs assessment surveys and questionnaires. During the grant period, the CE Program implemented an extensive needs assessment program. Assessments from a variety of sources were utilized. Needs information was collected from standard needs assessment surveys as well as from course evaluation

forms placed in participants' course packets. Training effectiveness was measured through both post-course surveys and impact evaluations. All of these instruments were used to identify new topics as well as evaluate interest in established courses. The last regional needs assessment was conducted in 2005; the next regional assessment is scheduled for late 2007 or early 2008. An impact evaluation was conducted in December 2006. The CE Program also utilized the needs assessment data collected from the CE network that exhibits at national conferences. Reliance on these diverse strategies resulted in the development of a number of new courses over the course of the project period. The new courses conducted during the 2006-2007 period include: the following:

OSHA 6000: Collateral Duty Course for Other Federal Agencies
OSHA 7505: Introduction to Accident Investigation
Effective Occupational Health & Safety Management Systems
Fundamentals of Hearing Conservation and Noise Sampling in Industry
Pandemic Preparedness for You and Your Employees
Physical Assessment Skills for Nurses
Understanding Today's Age-Diverse Workforce

Goal 3. Provide superior service and outreach that enhances and promotes the field of occupational and environmental safety and health.
This goal was supported by two objectives: 1) Increase awareness and understanding of occupational safety and health issues throughout the region and 2) Support activities that serve the needs of the target populations.

Objective 1) Increase awareness and understanding of occupational safety and health issues throughout the region The CE Program promoted, provided registration support, and issued certificates for the Paul S. Richards Memorial Lectureship which has founded a keynote address for the annual NORA symposium. The presenter for 2007 was Philip Harber, MD, MPH, UCLA School of Medicine.

The Center promoted awareness of the field by exhibiting at national and regional professional association meetings including the AIHCE and the Utah Conference on Safety and Industrial Hygiene. It also exhibited at a function sponsored by the Utah Chamber of Commerce for the Hispanic community.

Finally, capitalizing on electronic delivery systems, the CE Program distributes monthly course notifications to an electronic mailing list that it has steadily built over the last ten years. It also listed its courses in the semi-annual RMCOEH newsletter.

Objective 2) Support activities that serve the needs of the target populations.

Activities that support the needs of the target population include courses that help practitioners prepare for professional certification. These included programs such as the Comprehensive Review of Industrial Hygiene. Courses were also designed to maintain professional certifications and help meet practitioners meet licensure requirements. Continuing education credits are a major need of the target populations and the CE Program has consistently provided appropriate specialty credit as well as Continuing Education Credits to meet this need. American Board of Industrial Hygiene, AMA Category 1 CME credit and American Academy of Family Practice prescribed credit for occupational medicine courses have been obtained through course co-sponsorship with both the American College of Occupational and Environmental Medicine (ACOEM) and the American Academy of Family Physicians (AAFP). American Board of Preventive Medicine MOC credits were also obtained for the State-of-the-Art Musculoskeletal Disorders Conference. Insurance, legal, and case manager credits have also been procured as applicable. The CE Program also obtained Utah Nursing Association (UNA) credits for the Compensable Disability Forum to assist nurses who are not occupational health nurses with licensure

In addition, the CE Program has continued to develop and offer intensive short-term certificate programs. The Safety Certificate Program was developed years ago and continues to be successfully attended. Courses are offered at night, one night per week over an 8-week period to accommodate the need to attend at night. Also, an Industrial Hygiene Certificate Program was implemented within the last year. Courses are held during the day to avoid interfering with the Safety Certificate program held in the evenings. An OSHA Certificate Program was also implemented during the 2006-2007 grant period.

The Center also works with other ERCs and other OSHA Training Centers to meet participants' needs. Attendees are referred to other Centers if their training needs can not be met by our program.

As noted previously, the RMCOEH has annually co-sponsored seminars with the Utah Association of Occupational Health Nurses (UAOHN). RMCOEH donates its share of the proceeds from the event to support the ongoing activities of the UAOHN.

When sufficient requests have been received by either phone or through a formal needs assessment, the RMCOEH has made every effort to accommodate the request. Requests for additional asbestos courses, PFT courses and OSHA courses have been offered in response to such needs.

Finally, as a service to RMCOEH academic students, they have been able to attend all CE courses at cost. This is an added benefit to the student and reflects the commitment of the CE program to the efforts of the academic cores.

Goal 4. Accomplish Extensive Interdisciplinary Collaboration

This goal was addressed through three objectives: 1) Provide multi-disciplinary courses and conferences to promote interaction among professionals in all fields of occupational safety and health; 2) Identify needs and topics of interest that are interdisciplinary in nature, and 3) Engage in service activities that are applicable across the disciplines.

Objective 1) Provide multi-disciplinary courses and conferences to promote interaction among professionals in all fields of occupational safety and health. Interdisciplinary in nature, continuing education courses attracted attendees that crossed all core disciplines. This effort was facilitated by organizing efforts that bring different disciplines together. For example, the Annual Utah Conference on Safety and Industrial Hygiene united industrial hygiene and safety associations who assisted in organizing the conference. Many nurses attended occupational medicine courses such as the State-of-the-Art Conference on Musculoskeletal Disorders, and safety professionals supported the Workers Compensation conference, an effort primarily directed to insurance adjusters and risk managers.

Objective 2) Identify needs and topics of interest that are interdisciplinary in nature. The RMCOEH researched interdisciplinary training needs through its needs assessments and evaluation activities, all of which have been described previously. Overlap between interests was identified in each core discipline.

Objective 3) Engage in service activities that are applicable across the disciplines.

Finally, the RMCOEH engaged in service activities that are applicable across the disciplines. The "Richards Lectureship" and exhibiting at national meetings are prime examples of interdisciplinary efforts. As appropriate, certification maintenance credits were also awarded across the disciplines.

D. Program Products

As noted previously, during the period July 1, 2006 through June 30, 2007, 2,529 trainees attended 120 CE activities. These courses and conferences covered a wide spectrum of disciplines including asbestos, lead, industrial hygiene, safety, occupational medicine, occupational health nursing, and OSHA-authorized courses. See Table 12-q for listing of courses conducted in 2006-2007.

E. Future Plans

The CE Program plans to continue to support ongoing and new activities that address the 4 identified goals and the objectives associated with those goals.

Major emphases for the upcoming year include:

1) Annual meeting with CE Advisory Committee
2) Conduct a regional needs assessment in late 2007 or early 2008 and identify unique course to address the identified needs
3) Exceed requirement to train 400 participants annually.
4) Conduct asbestos worker refresher courses in Spanish
5) Implement identified distance education courses
6) Implement 3-6 month post-course impact evaluation plan
7) Implement the workplace safety program-supported fee waiver program for bilingual trainers.
8) Increase number of courses held outside Salt Lake City.

Continuing Education for Hazardous Substance Training

(HST)

Program Title: Hazardous Substances Training

A. Program Director: Connie Crandall, MA, MBA

B. Program Description

The Hazardous Substances Training (HST) Program at the Rocky Mountain Center for Occupational and Environmental Health (RMCOEH) has been providing training for professionals in state and local government agencies, as well as other professionals engaged in the handling of hazardous substances or the management of facilities engaged in hazardous substances-related activities since 1990. During 2006-2007, its offerings included 24 courses to 332 participants (See Table 12a) on a variety of HST-related topics as identified in the original request for application and as identified by needs assessments.

The HST Program is integral to the RMCOEH CE Program as a whole and strengthens it by adding another component to its entire slate of course offerings. It supports the CE program's mission to reduce human and financial costs by providing excellent short-course training in occupational and environmental health and safety

that is marked by continuous improvement and response to needs. Originally developed on the basis of the results of an initial needs assessment survey and grant requirements, the program was intended to supplement, not duplicate, existing training. It serves its target community by offering reduced tuitions through the fee-waiver program that is included as part of the training initiative.

The proposed HST programs for health and environmental professionals will be administered through the CE program, and will consist of short courses and other activities ranging from ½ day to 5 days in length.

C. Program Activities and Accomplishments

The following is a summary of progress in accomplishing the overall goals for the Hazardous Substances Training (HST) for the grant period beginning July 2006 through June 2007. Three goals were set for the project period with specific objectives established to achieve the goals.

GOAL 1: Offer education programs (courses and conferences) to professionals involved in the hazardous substances field.

This goal was accomplished through five major objectives: 1)Provide short-term hazardous substance post-graduate training on current issues and topics; 2) Facilitate exchange with other safety and health professionals through coordination with agencies; 3) Involve the representatives of the target audience in planning and implementing programs through an advisory committee; 4) Obtain highly-qualified faculty from the private and public sector who bring both theoretical and practical knowledge to the issues presented; and 5) Develop and implement a comprehensive marketing program.

Objective 1. Provide short-term hazardous substance post-graduate training on current issues and topics

During the period July 1, 2006 through June 30, 2007, 332 trainees attended 24 HST CE courses. The distribution of the course attendees follows:

1. Trainees in Attendance

The breakdown of attendees by employer for the current project period is as follows: Thirty-six percent (n = 117) were public sector personnel from government agencies, 7% (n = 21) came from academic institutions, and 50% percent (n = 173) from private industry. The remaining 7% were categorized as other which included environmental engineering firms and consultants.

2. Categories of Participants

During the period July 1, 2006 through June 30, 2007, attendees by profession were distributed among the following: IH – 19 (6%); OHN – 7 (3%); and E&S – 114 (35%). Fifty-six percent (n = 192) of the attendees were categorized as Other and include chemical safety officers, environmental compliance officers, environmental engineers, environmental health scientists, firefighters, public works directors and site superintendents.

In accordance with its 5-year plan, the RMCOEH employed a number of needs assessment mechanisms to drive its training schedule for the 2006-2007 period. These mechanisms included needs assessments, post-course evaluations, regulatory requirements, and both RMCOEH Advisory Board and HST Advisory Committee input. As a result, three new courses were offered in 2006-2007. These courses were 1) International Air Transportation Association

(IATA) Training; 2) Personal Protective Clothing Selection and Use; and 3) Practical Chemistry for Hazardous Materials.

Objective 2. Facilitate exchange with other safety and health professionals through coordination with agencies

Because the primary audience for the NIOSH-funded HST courses includes federal, state and local health and environmental agency personnel, the RMCOEH has maintained close coordination with those agencies which include the Utah State Division of Risk Management, the Utah Division of Solid and Hazardous Waste, the Utah Division of Air Quality, the Salt Lake Valley Health Department, and the Salt Lake County Emergency Management Bureau.

In 2007, the HST Program Director participated in the NIOSH-sponsored HST Project Directors meeting to discuss programmatic issues related to the HST Program. The RMCOEH has also worked with the EPA office in Region VIII to identify regional and local health department contacts for further program promotion.

In 2006-2007, RMCOEH continued its collaboration with the Salt Lake Community College. To offer 8- and 40-hour HAZWOPER training courses. The partnership was established to avoid duplication of effort and more effectively reach similar target populations.

Objective 3. Involve the representatives of the target audience in planning and implementing programs through an advisory committee

The coordination process with agencies is formalized under the HST Program Advisory Committee that is comprised, in part, of representatives of the target audience. Committee members were specifically selected on the basis of background and involvement in hazardous substances activities. Representatives from these agencies are connected to other affiliated agencies so that the coordination with agencies has been wide-spread. This committee meets annually.

Objective 4. Obtain highly-qualified faculty from the private and public sector that bring both theoretical and practical knowledge to the issues presented.

During the project period, the RMCOEH was able to successfully draw quality faculty from a wealth of occupational and environmental safety and health professionals in the immediate area. Mark Dumas, Principal Faculty, provided technical oversight of the program. His input was complemented by outside faculty, all of them individuals who are respected and current in the field.

Objective 5. Develop and implement a comprehensive marketing program.

An active marketing program and multi-faceted marketing plan was utilized to recruit prospective HST students, relying on a marketing mix that included a dedicated web site, direct mail and email campaigns, targeted advertising in trade association journals, and trade show exhibiting. HST programs were actively promoted at the local annual Utah Conference on Safety and Industrial Hygiene in October 2006 and at the AIHCE meeting in 2007.

The RMCOEH's web site has individual pages for each core area including continuing education. All hazardous substances courses were listed on the continuing education portion of the site with downloadable brochures available for more extensive dissemination of information.

In support of the direct mail campaign, the HST program brochures were distributed to both in-house (3500 names) and leased lists that specifically targeted the program audience. Each

course was promoted through this direct mail approach. Hazardous substances programs were also included in the CE program's annual calendar

In addition, program ads have been placed in key journals such as *Environmental Health & Safety*, *Facility Safety Management*, *Occupational Health and Safety*, and *Occupational Hazards*,

As an enhancement to the direct mail marketing activities, the program also utilized email notification. An electronic list of several thousand names was used to distribute monthly course notifications. Other electronics lists were also utilized including the safety list maintained at the University of Vermont and the asbestos list maintained at Utah State University. Course notifications were sent monthly to the local chapters of the American Industrial Hygiene Association, American Society of Safety Engineers, Utah Manufacturers Association and Associated General Contractors for distribution to their membership

GOAL 2: Conduct research to identify training needs and training effectiveness.

This goal was accomplished. There were three supporting objectives: a) Periodically estimate the need for hazardous substances training of each state within the Center's designated region by extensive questionnaires and needs assessment surveys; b) Annually evaluate training effectiveness through post-course questionnaires; and c) Solicit advisory committee input.

The HST program has utilized a multi-faceted needs assessment approach comprised of various mechanisms which include the following:

Objective 1. Periodically estimate the need for hazardous substances training of each state within the Center's designated region by extensive questionnaires and needs assessment surveys.

1) Regional needs assessments have been distributed every other year during the project period to various government agencies as well as other facilities and organizations with a projected need for hazardous substances training. The latest survey was mailed in August 2006.

2) During the current project period, Impact evaluations were also distributed on an every-other-year basis (alternate years to the every-other-year needs assessment) to individuals who attended courses. Needs-related questions were included in these impact evaluations. The last evaluation was conducted in late 2006.

Objective 2. Annually evaluate training effectiveness through post-course questionnaires.

Course evaluations and a needs assessment survey were distributed to every course participant as part of their course packets.

Objective 3. Solicit advisory committee input.

Consultations with HST Advisory Committee members, RMCOEH Advisory Board members, and internal and external faculty have also been an excellent and reliable source of needs information. The HST Advisory Committee has been particularly important is it includes representatives of the target audience. HST Program issues were also discussed at the RMCOEH Advisory Board meetings and with course faculty to provide an even wider perspective from agencies outside the Center.

Relying on all these mechanisms, three new courses were offered in 2006-2007. These courses were 1) International Air Transportation Association (IATA) Training; 2) Personal Protective Clothing Selection and Use; and 3) Practical Chemistry for Hazardous Materials.

GOAL 3: Engage in service activities that enhance and promote the field of hazardous substances.

The sole objective in support of this goal was to support activities that serve the needs of the target audience.

Curriculum design and training approach were significant considerations in meeting course participants' needs. For example, the skills-based courses like the 8- and 40- hour hazardous waste operations and emergency response courses included practical activities to prepare participants for the actual types of procedures they will encounter on the job.

In addition, course faculty members queried course participants to assess skills and knowledge levels so that the needs of all participants were addressed. The program also utilized experienced trainers who incorporated a mix of activities to accommodate differing learning styles. Finally, courses have been reviewed and revised as needed to keep course content timely with current and relevant information.

The Certified Hazardous Materials Manager (CHMM) Review course has been offered to meet the participant's need for professional certification. In addition, all RMCOEH continuing education courses, including HST courses, are designed to maintain professional certifications. Since CE credits are a major need of the target populations in order to maintain certification, the credits have been obtained from appropriate professional associations. In addition to the traditional Continuing Education Unit (CEU), credits from the American Board of Industrial Hygiene were requested and awarded for HST courses.

Additionally, attractive tuition fees were offered primarily to state and local government attendees. These attendees were charged at a rate of 50% of non-government participants with some attendees also being considered for full scholarships. Over the July 1, 2006 – June 20067 project period, 51 partial and, in some instances, full fee waivers were awarded. This facilitated attendance by those agencies or groups that would otherwise be unable to attend because of limited funding resources.

Finally, multi-disciplinary experiences have been an integral part of HST courses. Many different types of occupational safety and environmental health professionals including industrial hygiene and safety professionals with an ancillary interest in hazardous substances have intermixed in industrial hygiene, safety, and HST courses.

D. Program Products

As noted previously, during the period July 1, 2006 through June 30, 2007, 332 trainees attended 24 HST courses. See Table 12-a for listing of courses conducted in 2006-2007.

E. Future Plans

The HST Program plans to continue to support ongoing and new activities that address the 3 identified goals and the objectives associated with those goals.

Major emphases for the upcoming year include:

9) Annual meeting with HST Advisory Committee

10) Conduct a regional needs assessment in late 2008 or early 2009 and identify unique course to address the identified needs
11) Implement identified distance education courses
12) Implement 3-6 month post-course impact evaluation plan

Appendices

Ergonomics & Safety

(E&S)

Appendix E&S-1 Master of Science Ergonomics & Safety Option

Course No.	MS/ME in Mechanical Engineering Course Name	MS Credits
ME 6100	Ergonomics	3
ME 6110	Introduction to Industrial Safety	3
ME 6030 or ME 6040 or ME 6960	Reliability or Quality Assurance or Independent Study (1 to 3)	3
ME 6120	Human Factors Engineering	3
ME 6960-3	Occupational Safety and Health Solutions	3
ME 6960-4	Work Physiology and Occupational Heat Stress	2
ME 7XXX	Technical Elective (ME 7110, Systems Safety required unless waived based on past education/experience	3
ME 7XXX	Technical Elective	3
FPMD 6750	Fundamentals of Industrial Hygiene	2
FPMD 6100 or ESS 6560	Biostatistics I or Experimental Design and Analysis	3
FPMD 6754 or FPMD 6753	Noise and Other Physical Agents or Industrial Ventilation	2
FPMD 6759	Occupational Safety & Health Field Trips	1
	Subtotal Course Hours	31
ME 6975	Thesis	9
	Total Semester Hours	40

Appendix E&S-2 Ph.D.
Ergonomics & Safety Option

Ph.D. in Mechanical Engineering

Prerequisites:

M.S. Degree (Engineering) including the following (or equal)

Course No.	Course Name	Credits	
ESS 6560	Experimental Design and Analysis	3	
ME 6100	Ergonomics	3	
ME 6110	Introduction to Industrial Safety	3	
ME 6120	Human Factors Engineering	3	
ME 6960-4	Work Physiology and Occupational Heat Stress	3	
FPMD 6750	Fundamentals of Industrial Hygiene	2	
FPMD 6759	Occupational Safety & Health Field Trips	1	
	Subtotal program prerequisite credits	18	

Program Requirements:

Course No.	Course Name	Credits	
ME 6130	Design Implications for Human Machine Systems	3	
ME 7100	Advanced Ergonomics Occupational Biomechanics	3	
ME 7105	Advanced Ergonomics Occupational Biomechanics LAB	1	
ME 7110	Systems Safety	3	
ME 6XXX	Technical Elective	3	
ME 7XXX	Technical Elective	3	
ME 7960	Computer Applications and Research Methods in Health and Safety	3	
ME 7120	Musculoskeletal Functional Anatomy for Engineers	3	
BIOEN 6210	Biomechanics (BIOEN)	3	
PHYSL 5100	Carpal Tunnel Syndrome	2	
FPMD 6300 or	Epidemiology I	3	
ED PSYCH 7010	Quantitative Methods I, Inferential Statistics	3	Or equal
ED PSYCH 7020	Quantitative Methods II, ANOVA and Multiple Regression	3	Or equal
STATISTICS	Statistics (elective)	3	
	Subtotal Course Hours	39	
ME 7970	Dissertation (Ph.D.)	14	
	Total Semester Hours	53	

Appendices

Hazardous Substances Academic Training

(HSAT)

Hazardous Substance Academic Training (HSAT)

is the science dealing with not only the anticipation, recognition, evaluation, and control of occupational and environmental health hazards, but the management and controls associated with hazardous substances. Like industrial hygienists, individuals in this profession work closely with occupational health physicians, nurses, safety experts, and others in the health field to develop methods and procedures to prevent adverse health effects that may be associated with handling of hazardous materials.

The student entering graduate training in Industrial Hygiene must have an acceptable background in organic chemistry, inorganic chemistry, and mathematics (e.g. through calculus). In-depth undergraduate training in other physical and biological sciences is desirable. Applicants must have a bachelor's degree, with a minimum of 180 quarter hours or 120 semester hours (102 or more quarter hours or 68 semester hours of technical courses). Students with extensive applicable experience or in management type positions related to hazardous substance handling may be approved for the MPH degree. Students with limited applicable experience must seek the MSPH program.

Coursework requirements:

A candidate for the MPH degree in industrial hygiene must complete at least 45 credit hours of coursework. Of these, 37 credit hours are for required courses, 2 credit hours are for electives, and 6 credit hours for the required practicum.

A candidate for the MSPH degree in industrial hygiene must complete at least 55 credit hours of coursework. Of these, 35 credit hours are for required courses, 4 credit hours are for electives, and 6 credit hours for the required practicum, and 10 credit hours for a masters project or thesis.

Specifically, courses required for the MPH, industrial hygiene emphasis are:

Course #	Course Title	Credit Hours	Semester Offered
FPMD 6100	Introduction to Biostatistics	3	Fall & Spring
FPMD 6300	Introduction to Epidemiology	3	Fall
FPMD 6500	Introduction to Public Health	3	Fall
FPMD 6600	Social Context of Medicine and Public Health	3	Fall & Spring
FPMD 6700	Environmental Health Problems (Env. Health Sciences)	3	Spring
HEDU 6790	Health Services Administration	3	Spring
FPMD 6960	Public Health Practicum	**6**	Fall, Spring & Summer
	Core Credits:	**24**	

Course #	REQUIRED IH COURSES	Credit Hours	Semester Offered
FPMD 6750	Fundamentals of Industrial Hygiene	2	Fall

FPMD 6751	Advanced Industrial Hygiene	3	Spring
FPMD 6752	Introduction to Industrial Toxicology and Physiology	3	Fall
FPMD 6730	Quantitative Risk Assessment	3	Spring
FPMD 6756	Hazardous Substances	3	Fall
FPMD 6758	Occupational Environmental Health Clinic	1	Fall, Spring, & Summer
ME 6960	Occupational Health and Safety Solutions	3	Spring
To be Numb.	Publishable Project added to Cse	**2**	Any Term

Core Credits: 20

Electives Students Choice (see below) **1**

MPH-IH Total Credit Hours: 45

IH Electives:

Course #	Course Title	Credit Hours	Semester Offered
FPMD 6754	Noise and Other Physical Agents	2	Spring (Even Years)
FPMD 6753	Industrial Ventilation	2	Spring (Odd Years)
ME 6100	Ergonomics	3	Spring
ME 6110	Safety	3	Spring

MSPH - Industrial Hygiene Emphasis

Take Above Credits for MPH Plus Either Project or Thesis Hours:

Course #	Course Title	Credit Hours	Semester Offered
FPMD 6975	Project Research - MSPH	10	Fall, Spring & Summer
FPMD 6977	Thesis Research - MSPH	10	Fall, Spring & Summer
	Total Credit Hours:	**MPH: 45 / MSPH: 55**	

Note: Not taking 2 cr for MPH publication, **4 cr hr** for electives in MSPH prgrm.

Appendices

Industrial Hygiene

(IH)

Industrial Hygiene

is the science dealing with the anticipation, recognition, evaluation, and control of occupational and environmental health hazards. Individuals in this profession work closely with occupational health physicians, nurses, safety experts, and others in the health field to discover the etiologic agents responsible for work and/or environment-related disease, and to develop methods and procedures to prevent adverse health effects.

The student entering graduate training in Industrial Hygiene must have an acceptable background in organic chemistry, inorganic chemistry, and mathematics (preferably through calculus). In-depth undergraduate training in other physical and biological sciences is desirable. Applicants must have a bachelor's degree, with a minimum of 180 quarter hours or 120 semester hours that include 102 or more quarter hours or 68 semester hours of technical courses. Students with extensive applicable experience or in supervisory positions in IH may be approved for the MPH degree. Students with limited applicable experience must seek the MSPH program

Coursework requirements:

A candidate for the MPH degree in industrial hygiene must complete at least 45 credit hours of coursework. Of these, 35 credit hours are for required courses, 4 credit hours are for electives, and 6 credit hours for the required practicum.

A candidate for the MSPH degree in industrial hygiene must complete at least 55 credit hours of coursework. Of these, 33 credit hours are for required courses, 6 credit hours are for electives, and 6 credit hours for the required practicum, and 10 credit hours for a masters project or thesis.

Specifically, courses required for the MPH, industrial hygiene emphasis are:

Course #	Course Title	Credit Hours	Semester Offered
FPMD 6100	Introduction to Biostatistics	3	Fall & Spring
FPMD 6300	Introduction to Epidemiology	3	Fall
FPMD 6500	Introduction to Public Health	3	Fall
FPMD 6600	Social Context of Medicine and Public Health	3	Fall & Spring
FPMD 6700	Environmental Health Problems (Env. Health Sciences)	3	Spring
HEDU 6790	Health Services Administration	3	Spring
FPMD 6960	Public Health Practicum	**6**	Fall, Spring & Summer
	Core Credits:	**24**	

Course #	REQUIRED IH COURSES	Credit Hours	Semester Offered
FPMD 6750	Fundamentals of Industrial Hygiene	2	Fall
FPMD 6751	Advanced Industrial Hygiene	3	Spring
FPMD 6752	Introduction to Industrial Toxicology and Physiology	3	Fall
FPMD 6753	Industrial Ventilation	2	Spring (Odd Years)
FPMD 6754	Noise and Other Physical Agents	2	Spring (Even Years)
FPMD 6758	Occupational Environmental Health Clinic	1	Fall, Spring, & Summer
ME 6960	Occupational Health and Safety Solutions	3	Spring
To be Numb.	Publishable Project added to Cse	**2**	Any Term
	Core Credits:	**18**	
Electives	Students Choice (see below)	**3**	
	MPH-IH Total Credit Hours:	**45**	

IH Electives:

Course #	Course Title	Credit Hours	Semester Offered
FPMD 6756	Hazardous Substances	3	Fall
FPMD 6730	Quantitative Risk Assessment	3	Spring
ME 6100	Ergonomics	3	Spring
ME 6110	Safety	3	Spring

MSPH - Industrial Hygiene Emphasis

Take Above Credits for MPH Plus Either Project or Thesis Hours:

Course #	Course Title	Credit Hours	Semester Offered
FPMD 6975	Project Research - MSPH	10	Fall, Spring & Summer
FPMD 6977	Thesis Research - MSPH	10	Fall, Spring & Summer
	Total Credit Hours:	**MPH: 45 / MSPH: 55**	

Note: Not taking 2 cr for MPH publication, **6 cr hr** for electives in MSPH prgrm.

Appendices

Occupational Injury Prevention Research Training

(OIPRT)

Ph.D. in Public Health

Prerequisites:

Undergraduate degree including the following (or equal). (May be taken as part of PhD program.)

Course No.	Course Name	Credits	Instructor
FPMD 6311	Research Design	3	Alder
FPMD 6600	Social Context of Medicine	3	Byrd
	OIP Program prerequisite credits	6	

Core Public Health PhD Program Requirements:

Course No.	Course Name	Credits	Instructor
FPMD 6100	Biostatistics I	3	Alder
FPMD 6101	Introduction to SAS Programming	3	Staff
FPMD 6300	Epidemiology I	3	Lyon
FPMD 6340	Infectious Disease Epidemiology	3	Alder
FPMD 7100	Biostatistics II	3	Holubkov
FPMD 7300	Epidemiology II	3	Staff
FPMD 7310	Advanced Research Design	3	Alder
FPMD 7550	Design Implementation and Evaluation of Public Health Programs	3	White
FPMD 7640	Advanced Social Context of Medicine	3	Byrd
FPMD 7501	Ph.D. Seminar	1	
FPMD 7610	PH Ethics	1	
FPMD	Teaching Practicum	3	
FPMD	Research Practicum	3	
	Subtotal core program credits	35	

OIP Emphasis Courses:

Course No.	Course Name	Credits	Instructor
FPMD 6703	Occupational Injuries and Diseases	3	Hegmann
FPMD 7720	Occupational Injury Epidemiology	3	Hegmann
ME 6100	Ergonomics	3	Bloswick
ME 6110	Introduction to Industrial Safety	3	Bloswick
ME 7960	Computer Applications & Research Methods in Occupational Injury Prevention	3	Drinkaus
ME 6960-3	Occupational Safety & Health Solutions	3	Sesek, Collingwood, Wood
ME 6960-6	Interdisciplinary Seminar in Occupational Injury Prevention	0	Bloswick
FPMD 7140	Linear and ??? Regression	3	Sheng
	Subtotal OIP emphasis credits	21	
	TOTAL COURSE CREDITS	56	

Research/Teaching Practicum and Dissertation:

Course No.	Course Name	Credits	Instructor
FPMD 7965	Research Practicum in OIP	0	
FPMD 7900	Dissertation Hours	15	
	Total degree required credits	71	

APP OIP-2: Mechanical Engineering OIPRT Ph.D. – Occupational Safety Engineering Emphasis (OSE)

Ph.D. in Mechanical Engineering

Prerequisites:

M.S. Degree (Engineering) including the following (or equal). (May be taken as part of PhD program.)

Course No.	Course Name	Credits	Instructor
ME 6100	Ergonomics	3	Bloswick
ME 6110	Introduction to Industrial Safety	3	Bloswick
FPMD 6100	Biostatistics I	3	Alder
FPMD 6300	Epidemiology I	3	Lyon
	OIP Program prerequisite credits	12	

Program Requirements:

Course No.	Course Name	Credits	Instructor
FPMD 6101	Introduction to SAS Programming	3	Staff
FPMD 6607	Injury Surveillance	2	Suruda
FPMD 6703	Occupational Injuries and Diseases	3	Hegmann
FPMD 7300	Epidemiology II	3	Staff
FPMD 7720	Occupational Injury Epidemiology	3	Hegmann
ESS 6560	Experimental Design and Analysis	3	Schultz
ME 6040	Quality Assurance	3	Hoeppner
ME 7100	Advanced Ergonomics and Occupational Biomechanics	3	Bloswick
ME 7110	System Safety	3	Bloswick
ME 6130	Design Implications for Human Machine Systems	3	Sesek
ME 6960-3	Occupational Safety and Health Solutions	3	Sesek, Collingwood, Wood
ME 6960-4	Work Physiology and Occupational Heat Stress	2	Bernard
ME 7960	Computer Applications & Research Methods	3	Drinkaus
ME 6960-6	Interdisciplinary Seminar in Occupational Injury Prevention	0	Bloswick
	TOTAL COURSE CREDITS	37	

Research Practicum and Dissertation:

Course No.	Course Name	Credits	Instructor
ME 6960-7	Research Practicum in OIP	0	
ME 7970	Dissertation Hours	14	
	Total degree required credits	51	

Appendices

Occupational Medicine

(OM)

Occupational & Environmental Medicine Required Courses
August 2006
Total of 45 credit hours

http://uuhsc.utah.edu/dfpm/phgroups/

Fall

Course	Title	Credits
FPMD 6100	Introduction to Biostatistics	3
	Biostatistics Laboratory	
FPMD 6300	Introduction to Epidemiology	3
	Epidemiology Laboratory	
FPMD 6703	Occupational Injuries and Diseases	3
FPMD 6750	Fundamentals of Industrial Hygiene	2
MEEN 6100	Ergonomics	3
	Ergonomics Laboratory	
	TOTAL	**14**

* Attend Advanced Topics throughout the year but sign up only in summer semester.

Spring

Course	Title	Credits
FPMD 6400	Health Care Administration in OEH	3
	(or HEDU 6790 Health Admin)	
FPMD 6504	Clinical Prevention	3
FPMD 6600	Social Context of Medicine & Public Health	3
FPMD 6700	Environmental Health Problems	3
FPMD 6752	Introduction to Toxicology and Physiology	3
MEEN 6960	Occupational Safety and Health Solutions	3
	TOTAL	**18**

* Attend Advanced Topics throughout the year but sign up only in summer semester.

Summer

Course	Title	Credits
FPMD 6702	Advanced Topics in OEH	3
FPMD 6960	Practicum (UT OSHA)	6
FPMD 6710	Individual Research in Occupational Medicine	4
	TOTAL	**13**

RMCOEH OCCUPATIONAL MEDICINE RESIDENCY REQUIREMENTS
UNIVERSITY OF UTAH SCHOOL OF MEDICINE

ACADEMIC PHASE: PGY-2

1) Required and elective course work to complete the MPH or MSPH degree programs
2) Occupational Medicine Clinic (UU Hospitals & Clinics) - approximately 8 weeks, varies
3) Clinical Rotations (e.g. UUMC or VAH) - as scheduled
4) Practicum (for MPH or MSPH degree) - 3 weeks

PRACTICUM PHASE: PGY-3

Clinical Rotations -The only mandatory clinical rotations are the University of Utah Occupational & Environmental Medicine clinic and rotations at the Salt Lake VA Hospital. The number of weeks of VA rotations will be determined for each academic year and may vary.

All other clinical rotations are elective and are to be selected based on the resident's prior experience, assessment of clinical skills, and career goals in consultation with the Program Director.

Industrial Preceptorships

All PGY-3 residents must complete 14 weeks of industrial time. Of this time, a minimum of 8 weeks traditional industrial rotations (exclusive of vacation) is required. If desired, resident may select to complete the 14 week requirement with 6 weeks of other population-based rotations. A list of approved current industrial rotations is available from the program coordinator. Rotations at a particular site should be of at least 3 weeks duration. At least one out of state rotation is strongly recommended to help achieve more diversification of educational experiences.

Examples of Recent and Existing Industrial Rotations:

The Boeing Company	Seattle, Washington
Chevron Corporation	Houston, TX
Hill Air Force Base	Ogden, Utah
Los Alamos	Los Alamos, NM
NASA Kennedy Space Center	Florida
Occupational & Preventive Medicine Inc.	Columbus, OH
Puget Sound Naval Shipyard	Bremerton, Washington
Toxicology & Associates	Albuquerque, New Mexico
Workers Compensation Fund	Salt Lake City, Utah

Population-based Preceptorships (elective)*

Agency for Toxic Substance Disease Registry (ATSDR)	Atlanta, GA
National Institute for Occupational Safety & Health (NIOSH)	(Anchorage, AK,Cincinnati, OH, Morgantown, W.V.)
Utah OSHA/Utah Labor Commission (two weeks recommended)	Salt Lake City, UT
Utah Dept. of Health	Salt Lake City, UT
Utah Dept. of Environmental Quality	Salt Lake City, UT
Utah Disability Determination for Social Security	Salt Lake City, UT
U.S. Dept. of Labor/OSHA (minimum two months)	Washington D.C.

**Some of these may contain time that may be credited towards the Industrial Preceptorship time requirement based on content of that experience.*

Journal Club Participation and Attendance

Journal Club is designed to give the resident practical experience in critiquing new articles. An additional goal is to afford the resident an improved ability toward decision making skills regarding whether to integrate this new article's information into clinical practice.

General Format: 2 articles critiqued per session
1 session every other week

Participation: All residents are expected to present at least 3 articles per year. Articles are selected by the presenter, but if desired, faculty members will assist.

Attendance: When a resident is in town (i.e., immediate Salt Lake City area), attendance is expected to be at least 50%. Attendance is not possible from out of state rotations and may be difficult for moderately distant rotations (e.g., Hill AFB) therefore none of those sites will count towards the attendance requirements.

If attendance is less than 50% over a 3 month period (excluding distant rotations as noted above), then the residents will be required to present 2 additional articles that year.

Occupational Medicine Grand Rounds

OM Grand Rounds is held at LDS Hospital and co-sponsored by RMCOEH. It is usually held in the 2nd Tuesday of every month. Topics are generally applied, practical and clinical. You must attend 3 per year and attendance is taken. Sign the attendance logs as we will check to verify attendance!

Occupational Health Nursing Sessions

To facilitate your learning of OHN principles, you must attend the OHN sessions scheduled at noon approx. every month during the school year. This is particularly important as we do no have an OHN program at RMCOEH. Watch for fliers posted and email announcements.

Other Departments' Sessions

There are many other conferences available on campus. Some of them may be of interest to some residents and other topics may be attractive to others {(usually somewhat dependent on the residents' areas of interest or potential subspecialty practice area(s)}.

Examples: Internal Medicine Grand Rounds
Family Practice Grand Rounds
Toxicology Rounds
Orthopedics Rounds
Poison Control Conference
Pregnancy Risk Conference (See bulletin board in Residents office)

Participation/Attendance: Provided you complete your regular residency requirements, in a timely manner, you may attend these as you like. If there is something that is regular/recurring and of special interest to you, please be sure to communicate that the OM residency faculty; we would like to share in your enthusiasm.

NOTE:

1. Residents must develop a yearly schedule and maintain a weekly log to ensure objectives are met.

2. Other duties, including first response to emergency and telephone queries and participation in special projects, are also required and will be scheduled in conjunction with the Program Director.

3. Residents need to be in contact with chief resident at least every other week.

4. Residents need to be aggressive and ASK during a rotation to see the patients who would be good for their Occupational Medicine training. In pulmonary, learn how to read spirograms. Do NOT expect attendees to know what an Occupational Medicine physician does. It is incumbent on you to read all rotation objectives BEFORE starting the rotation, as well as DURING the rotation to be sure you achieve those specific learner centered objectives!

5. You will be required to review and update as necessary the Goals and Objectives prior to starting any rotation. These must meet and achieve the ACGME competencies. These should be reviewed frequently during the rotation to be sure you are achieving the goals of the rotation. These goals and objectives were developed by the faculty to achieve competency as effective OM specialists. Please insure that you do not contribute to ongoing knowledge deficits in our professional community by failing to actively pursue these Goals and objectives.

6. Residents have a research requirement. PGY-3 residents must turn in a copy of their research for their files. Failure to complete this requirement will mean failure to successfully complete the residency. There are many opportunities available to you, so this should not be difficult and should be rewarding. It is possible to take a few weeks of research elective if desired.

7. The NORA conference is scheduled for Spring 2008. All PGY-3 are expected to present at that conference or at the National AOHC Conference.

Publications

ADMIN

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