

**ROCKY MOUNTAIN CENTER  
FOR OCCUPATIONAL AND ENVIRONMENTAL HEALTH –  
EDUCATION AND RESEARCH CENTER FOR OCCUPATIONAL SAFETY AND HEALTH**

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# The Rocky Mountain Center for Occupational and Environmental Health

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## List of Terms and Abbreviations

AAOHN	American Association of Occupational Health Nurses, Inc.
ABET	American Board of Engineering Technologies
ABIH	American Board of Industrial Hygiene
ABPM	American Board of Preventive Medicine
ACGIH	American Conference of Governmental Industrial Hygienists
ACGME	American Council on Graduate Medical Education
ACOEM	American College of Occupational & Environmental Medicine
AFL-CIO	American Federation of Labor-Congress of Industrial Organizations
AIHA	American Industrial Hygiene Association
AIHCE	American Industrial Hygiene Conference and Expo
ASAC	Applied Science Accreditation Commission
ASH	Agriculture Safety & Health
ASSE	American Society of Safety Engineering
ATK	Alliant Techsystems
AV	Audio/Visual
BLS	Bureau of Labor Statistics
BS	Bachelor of Science
CAOHC	Council for Accreditation in Occupational Hearing Conservation
CDME	Commercial Driver Medical Exams
CE	Containing Education
CEC	Center Executive Committee
CERT	Community Emergency Responder Training
CIH	Certified Industrial Hygienist
CME	Continuing Medical Education
CO	Colorado
COSH	Certificate of Occupational Safety and Health
CPE	Certified Professional Ergonomist
CQI	Continuous Quality Improvement
CTS	Carpel Tunnel Syndrome
DEQ	Department of Environmental Quality
DFPM	Department of Family and Preventive Medicine
E&S	Ergonomics and Safety
EHS	Environmental Health and Safety
EMG	Electromyography
EPICOH	Epidemiology in Occupational Health
ERC	Education Research Center
FM	Family Medicine
FMCSA	Federal Motor Carrier Safety Administration
FPE	Full-time Professional Effort
FPMD	Family Practice Medicine
FT	Full-time
GME	Graduate Medical Education
GPA	Grade Point Average
GRE	Graduate Record Examinations
GS	General Session
HAZWOPER	Hazardous Waste Operator and Emergency Response
HB	House Bill
HFES	Human Factors Ergonomics Science
HHS	Health & Human Services

HRSA	Health Resources and Services Administration
HYG	Hygiene
IATA	International Air Transportation Association Training
ICOH	International Conference on Occupational Health
ID	Idaho
IH	Industrial Hygiene
ILCD	Intelligent lifting Coach and Dosimeter
IM	Internal Medicine
IT	Information Technologies
JOEM	Journal of Occupational and Environmental Medicine
LBP	Low/Lower Back Pain
MA	Masters of Art; Massachusetts
MAP ERC	Mountains and Plains Education & Research Center
MBA	Master of Business Administration
MD	Medical Doctor; Maryland
ME	Mechanical Engineering
MEEN	Mechanical Engineering
MEP	Manufacturing Extension Partnership
MH	Master of Humanities
MOH	Master of Occupational Health
MPH	Master of Public Health
MS	Master of Science
MSDs	Musculoskeletal Disorders
MSOH	Master of Science in Occupational Health
MSPH	Master of Science in Public Health
MT	Montana
NASA	National Aeronautics and Space Association
ND	North Dakota
NIEHS	National Institute of Environmental Health Sciences
NIH	National Institute of Health
NIOSH	National Institute of Occupational Safety and Health
NM	New Mexico
NORA	National Occupational Research Agenda
NP	Nurse Practitioner
NURS	Nurses
OEH	Occupational & Environmental Health
OEHS	Occupational & Environmental Health & Safety
OEM	Occupational & Environmental Medicine
OHN	Occupational Health Nursing
OIE	Occupational Injury Epidemiology
OIP	Occupational Injury Prevention (short for OIPRT)
OIPRT	Occupational Injury Prevention Research Training
OK	Oklahoma
OM	Occupational Medicine
OMB	Office of Management and Budget
OMR	Occupational Medicine Residency
OSE	Occupational Safety Engineering
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Association
OSU	Oregon State University
OT	Occupational Therapy

PA	Physician Assistant; Pennsylvania
PFT	Pulmonary Function Testing
PGY	Post Graduate Year
PhD	Doctor of Philosophy
PMR	Physical Medicine and Rehabilitation
PPRT	Pilot Project Research Training
PTO	Patent and Trademark Office
r2p	Research to Practice
RAM	Residency//Resident in Aerospace Medicine
RATS	Research Administration Training Series
Rep.	Representative
RMCOEH	Rocky Mountain Center for Occupational & Environmental Health
RMAOEM	Rocky Mountain Academy of Occupational and Environmental Medicine
SACNAS	Society for Advancement of Chicanos/Hispanics & Native Americans in Science
SAMHSA	Substance Abuse and Mental Health Services Administration
SB	Senate Bill
SBIRT	Screening, Brief Intervention and Referral to Treatment
Sc.D	Doctor of Science
SD	South Dakota
SEEU	Statistical and Economic Evaluation Unit
SER	Society for Epidemiologic Research
SHARP	Safety & Health Assessment & Research for Prevention
SLC	Salt Lake City
SRVP	Senior Vice President
TPG	Training Program Grant
TRT	Targeted Research Training
TWH	Total Worker Health
U	University
UAOHN	Utah Association of Occupational Health Nurses
UCSF	University of California, San Francisco
Ulowa	University of Iowa
UNA	Utah Nursing Association
UNLV	University of Nevada, Las Vegas
UofU	University of Utah
U.S.	United States
USAF	United States Air Force
USF	University of South Florida
UT	Utah
UUMEP	University of Utah Manufacturing Partnership
UUtah	University of Utah
UVU	Utah Valley University
UWM	University of Wisconsin – Milwaukee
VAMC	Veterans Administration Medical Center
VPCAT	Vice President's Clinical and Translational
WashU	Washington University
WC	Workers' Compensation
WY	Wyoming
XRF	X-Ray Fluorescence

## **Abstract: The Rocky Mountain Center for Occupational and Environmental Health (RMCOEH)**

The RMCOEH is an energetic, innovative and growing Occupational Safety and Health (OSH) Education and Research Center (ERC) housed at the University of Utah since 1977. We are one of only two ERCs in Region 8 (UT, CO, WY, MT, ND, SD), although these states are the worst region for occupational fatalities and thus having urgent needs for more OSH professionals. In the past grant period, we have made major progress, including multiple pieces of Legislation supporting (OSH) training [e.g., Senate Bill (S.B.) 3, 2015 Utah General Legislative Session to support initiation of a BS in OSH program], along with growth and quality of our programs. We have 5 OSH degree programs [MOH, MSOH, PhD in OEH (3 emphases: IH, OIP and general OEH); MS and PhD in Mechanical Engineering]. We are uniquely honored with 2 OSH endowed chairs (one each in OSH and mining safety).

The RMCOEH has academic programs in Ergonomics and Safety (E&S), Industrial Hygiene (IH), Occupational Injury Prevention Research Training (OIPRT), and Occupational Medicine (OM). We have a Research Training Core including Targeted Research Training Program (TRT) and Pilot Projects Research Training (PPRT). We have a robust Outreach Core, including Continuing Education (CE). RMCOEH curricula includes Occupational Health Nurses to emphasize their importance in OSH.

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

RMCOEH is primarily housed in the Department of Family & Preventive Medicine (DFPM), University of Utah (UofU) School of Medicine. The RMCOEH's E&S Program and one-half of each of the OIPRT Program (the Occupational Safety Emphasis) and TRT are housed in the Department of Mechanical Engineering, College of Engineering. The Center's Statistical and Economic Evaluation Unit (SEEU) is housed in the Department of Internal Medicine, while including other faculty with biostatistical, economic, epidemiological and business expertise. RMCOEH has collaborative relationships with other UofU entities that include the College of Nursing, College of Health (Occupational Therapy, Physical Therapy, Community Health, Exercise and Sport Science, Foods and Nutrition, Health Promotion and Education), Public Health Programs (DFPM), School of Business, College of Mining, and the Departments of Pediatrics, Orthopedics, Neurosurgery, Physical Medicine and Rehabilitation and numerous other departments at the School of Medicine. The RMCOEH also has collaborative ties with the sole Training Program Grantee (TPG) in Region 8 (Montana Tech), the other ERC (Mountains & Plains), and with the next seven largest universities (Boise State, BYU, BYU-ID, Idaho, Utah State, UVU, and Weber State Universities). These extensive collaborative ties support our training, research and service missions.

The RMCOEH has seven Program Directors (CE, IH, E&S, OIPRT, OM, and Outreach; Dr. Handy also directs the TRT). Along with the Center Director, Deputy Director and SEEU Director (Dr. Murtaugh), they constitute the Center Executive Committee (CEC), which meets monthly and as needed between meetings. Ad hoc CEC members are the Associate Director, IT Professional and Technical Writer. 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 Advisory Board Executive Committee periodically as circumstances necessitate.

The vibrancy of the RMCOEH is hard to translate onto paper, but perhaps it may be best exemplified by three major facts. **First**, our students are highly sought after, with nearly all placements occurring prior to graduation. The feedback from both our alumni and their supervisors, including those in major U.S. governmental organizations, is that they are better prepared than counterparts trained elsewhere. **Second**,

our research programs have expanded in scope and impacts, with a tripling of our rates of publications. **Third**, the importance of this ERC and its students is exemplified by the continuing passage of a series of nine unsurpassed legislative bills in support of OSH! These legislative efforts are the brainchildren of RMCOEH Advisory Board members. These are then translated into draft legislation and successfully passed by other RMCOEH Advisory Board members [the late Senator Ed Mayne (D), Senator Karen Mayne (D) and/or Senator Curt Bramble (R)] including assistance from three members who are lobbyists. This has already resulted in over \$5.8 M in support that has allowed expansion of our programs. These legislative bills are groundbreaking. Other ERCs are discussing templating these methods. It is only through the major interactions between the RMCOEH Center Administration, Center Executive Committee, Advisory Board, and the business, labor, trade, governmental and employee communities that we are able to achieve support of our mission, address regional needs, and achieve our goals and produce a vibrant RMCOEH.

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. At the August 2016 retreat, these were reviewed and revised below. 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 the leading international Center in meeting current and future occupational and environmental health and safety challenges.

**MISSION:** Protect workers and the environment through interdisciplinary education, research, and service.

**GOALS:**

1. Advance superior OSH academic programs.
2. Conduct meaningful OSH research.
3. Provide exceptional continuing education, service, and outreach.
4. Engineer OSH solutions.

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 can be evaluated and measured 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 (also 285 of the 663 RMCOEH graduates (43%) reside in Region 8 states (+Idaho), 2) conducting formal needs assessments and targeting Region 8's needs, 3) targeting academic and Outreach/CE programs' contents to regional needs for 8,279 trainees from 7,810 businesses, 4) active involvement of the RMCOEH Advisory Board and addressing their concerns, 5) answering concerns raised by each program's Advisory Committee, and 6) tying future research endeavors to NORA goals. That so many graduates remain in Region 8 attests to the strong, previously unfilled, need for OHS professionals and RMCOEH's success in meeting this need. Our graduate surveys confirm these comments and underscore the RMCOEH's ability to continue to meet Region 8's critical needs.

**Over the next 5 year period, we plan to:**

- (1) Increase our existing academic programs (augmenting faculty numbers and external support);**
- (2) Advance our robust Targeted Research Training program for interdisciplinary NORA-related trainee experiences and translational research activities/r2p;**
- (3) Grow our extramural NORA research programs;**
- (4) Implement a distance-based Master of Occupational Health program; and**
- (5) Build on our legislative successes.**

## Core Programs, Center-Wide Activities Summaries

### ADMINISTRATION and Center-Wide Activities

#### Summary of RMCOEH Accomplishments in the Past 5-year Period

The RMCOEH has accomplished much in the past 5 years. These include increasing research, augmenting training programs, improving and growing our funding base and further diversifying our revenue streams. We have met and exceeded all but 1-2 goals and objective we have set from the last 5-year period as follows:

- 1) Increase our existing academic programs
- 2) Develop a robust Targeted Research Training program
- 3) Grow our extramural NORA research programs
- 4) Implement a distance-based Master of Occupational Health program
- 5) Further invigorate our Pilot/Small Projects Program
- 6) Re-start our OHN Program
- 7) Begin PhD IH training

The sole exception to complete accomplishment of major progress is unfortunately, resumption of the OHN program. The distance-based Master of Occupational Health program is in process, and soon to be realized.

**Our top achievements for the past 4-5 years (2013-18) include:**

#### 1. State and other support

- a. **Eliminated sunseting on Eddie Mayne Funds (2018), (original bill from 2009 GS).**
- b. **Funding for starting up a BS in OSH degree program (SB3, 2015 General Session, (GS)).**
- c. **Renewed HRSA funding for the OMR.**
- d. **Successfully renewed partnership with U. Texas for our NIEHS training grant.**

Through the RMCOEH Advisory Board, RMCOEH has received >\$5.5M in state budgetary support and tax credit mechanisms over 10 years. This support includes: 1) SB159 (2005 GS), a dollar-for-dollar tax credit against worker's compensation premium taxes paid, and 2) Eddie Mayne Funds, which is a State budget line item. These lines of funding are expected to continue indefinitely. SB159 was renewed up to the 10-year statutory limit in 2010 (1HB221, 2010 GS; 100% unanimous votes). Mayne funds have gradually increased. The underlying basis is the statutory establishment of the RMCOEH in the Utah Code (**S.B. 234, 2007 GS**), the first in the U.S. That bill also codified the RMCOEH Advisory Board. This highly unique legislation achieved two major goals: 1) Utah must operate the Center, and 2) this established the Center's name in statute, which now allows legislative bills to name the Center in the text of bills. These legislative achievements were conceptualized by the Advisory Board, particularly one member (Mr. Dennis Lloyd, Chief Council of the Workers Compensation Fund). Legislation was authored by the late Senator Ed Mayne, Utah State AFL-CIO President and founding RMCOEH Advisory Board member.

A bill to extend the Eddie Mayne funds (1SSB15, 2009 GS above) was successfully passed under the stewardship of Sen. Karen Mayne. This eliminated the sunseting provision in the 2018 General Session.

#### 2. Increased numbers of trainees; re-secure HRSA funding.

- a. **The IH Program is among the U.S.'s largest master's programs at an ERC.**
- b. **The OM program is among the U.S.'s largest non-military programs.**

In 2012, we had trained 517 students over the Center's lifetime since 1977. This is now 663 (increased ~28% in only 6 years), increasing the sizes of all programs. The IH program is among the largest with 14-20 FT students; we have now successfully added doctoral IH training. The E&S is among the larger U.S. programs. The OMR is off-years, the U.S.'s largest non-military program, having leveraged ERC funding, with 9-12 residents in the past few years. Unfortunately, the HRSA funding was not renewed in 2018, thus the size of the OMR will reduce, yet we are highly viable without it due to existing funding from graduate medical education, VAMC, and clinical support.

#### 3. Net increase in RMCOEH-dedicated Lab Space (by 6) and FPE faculty (by 5).

- a. **Increased lab space (from 3 to 9 labs).**

RMCOEH has increased our RMCOEH-dedicated labs used for teaching and research (from 3 to 9). We have secured access to many other labs. We have also worked to increase the breadth and diversity of our faculty

members. We have added a net of five FPE faculty. There has been a net increase in three female faculty additions. Tenure and tenure-track faculty numbers have also increased. RMCOEH now involves 392 full-time, adjunct and other supporting faculty. RMCOEH space has also increased ~33%.

#### **4. Advanced training in our 5 graduate OSH/OEH degree programs**

- a. **Master of Science in Occupational Health (5 emphases; IH, Ergo, Safety, General; optional OM).** (Nearly all E&S students obtain MS or PhD in Mechanical Engineering deg.).
- b. **Master of Occupational Health (1 emphasis used for OM).**
- c. **PhD in OEH [3 emphases: IH, Occupational Injury Prevention (OIP), General OEH].**
- d. **MS in Mechanical Engineering (E&S).**
- e. **PhD in Mechanical Engineering (E&S, OIPRT).**

RMCOEH faculty have advanced training through hybridizing nearly all graduate courses. Faculty have also successfully “flipped” classes. These actions have demonstrably increased learning and retention. The TRT program has further increased our curricular quality via advanced courses such as *Advanced OSH Solutions*.

#### **5. Uniquely honored with 2 dedicated endowed OSH chairs, one in OSH and one in mining safety.**

The RMCOEH has two dedicated endowed chairs in OSH, including one in mining safety.

#### **6. Broadened, deepened, and diversified funding**

As the federal line item funding for ERCs remains in place, but has been unfortunately zeroed out for 10 years by OMB, we believe there is a critical need for all ERCs to build and diversity funding streams. Accordingly, we are continuing to diversity revenues, build dependable funding support, and thus, **overall RMCOEH funding has increased 53.1% over the last grant period!** Legislative successes have been particularly prominent and important. Our program to diversity funding also includes further research program development. Our diverse funding sources include (no particular order): 1) SB 159 tax credit contributions, 2) Eddie Mayne funds, 3) State funds (typical University source), 4) Research grants, 5) Contracts, 6) Tuition, 7) Clinics, 8) Continuing Education, 9) Training grants, and 10) NIOSH ERC. Nevertheless, it remains true that the RMCOEH’s ERC funding is a cornerstone on which other funding above is leveraged.

#### **7. Further developed major research programs in musculoskeletal disorders, respiratory protection and trucking issues**

- a. **Published 48 peer-reviewed articles/chapters in the past year, including 24 with student authors.**  
- **Exceeds 6,000 pages of peer-reviewed materials.** Note that per NIOSH, our research publication rate is strikingly disproportionate: NIOSH reported 514 total research publications from all funding streams in 2015, including 35 Centers (ERCs, ASHs, TWHs), R01, R03 etc. (NIOSH 2017)], yet RMCOEH authored 52 publications or 10.1%.

The faculty emphasized research productivity, output has sharply increased, and will further increase through the Targeted Research Training program. There are several major research foci with nationally impacts:

- Epidemiological study of upper extremity MSDs (9-year cohort now with results and publications)
- Truck driving studies (crash risk; ingress/egress studies in Dr. Merryweather’s ergonomics lab)
- Aerosol/respiratory protection studies
- Epidemiological study of low back pain (8-year cohort study now in analysis phases)
- Direct reading instrument studies for defining when these instruments may be most useful to hygienists
- Opioid guidelines and studies of fatalities
- Lower extremity studies of walking on non-smooth surfaces

#### **8. Increased the CE student head counts. Also, renewed the RMCOEH as an OSHA training center.**

The CE Program has increased student counts (see Fig. 2) despite a mediocre economy. CE courses over the past 5 years have increased from 845 to 1,026 (increase of 21.4%). Enrollments have also increased from 14,985 students in 2007-12 to 18,628 students in 2013-18, **a 24% increase!** The quality of the CE Program offerings includes such statements as the “best conference I have ever attended” from seasoned attendees.

#### **9. Broadened Outreach and Service, including Region 8’s TPG and the MAP ERC (Colorado)**

The RMCOEH encourages local, regional, national and international Outreach. Many faculty hold prominent, visible positions in virtually all major professional organizations. We have tracked and quantified **20,859**

**Outreach students/contacts in the past grant period** (not including CE)! **This includes 3,814 faculty-staff contact time** (when known and not including peer review). We track and report these figures by state to the relevant HHS Region 8 (plus Idaho) Congressional staff, as this has tremendous impact (see Outreach). **The total RMCOEH Outreach contact hours are 79,682 contact hours!**

We have an Outreach Policy and produce a center newsletter. The RMCOEH has deep interactions with both the sole TPG (Montana Tech) and other ERC (MAP), e.g., the TPG's Dr. Jensen is a RMCOEH Advisory Board member. We solicit and fund PPRT proposals from his program. We also fund PPRT proposals with the MAP Center; Dr. Hegmann serves on the MAP CME advisory board to develop opioids training materials. RMCOEH co-sponsors the annual Rocky Mountain Academy of OEM meeting.

## **INTERDISCIPLINARY**

Interdisciplinary interactions remain a major RMCOEH strength including its training and research programs. From orientation throughout numerous courses, the students are in interdisciplinary settings. Several classes require that the students work in interdisciplinary teams to perform research, problem solve, and present. The capstone *OSH Solutions* course, which exemplifies interdisciplinary interactions, is further discussed in the Interdisciplinary Coordination Plan.

## **Strategic Plan: Administration Goals and Objectives (5-year progress)**

### **Goal 1. Provide a Proactive Administration so Faculty May 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 meets 2+/year. The Board is instrumental in RMCOEH's great successes as detailed above. It continues to provide leadership, e.g., legislative support, and as a sounding board for OEHS programmatic content.

**Objective 1.b.** Complete surveys of students and graduates of RMCOEH programs. Track career progress.

**Progress and Plans:** Current students are surveyed for course evaluations and programmatic improvements. A RMCOEH graduate survey was administered in summer-fall 2016, and a mini-survey in August 2017. (See program narratives for program-specific results.) It is noteworthy that **97% of RMCOEH graduates rated their satisfaction with our training programs highly! Similar results were given to the question regarding whether they would recommend our programs to other potential students.** We continue to administer graduate surveys ~2x/cycle, avoiding annual surveys that foment survey fatigue. We also track career progress. We use these inputs to improve programs.

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

**Progress and Plans:** We recorded all classes and hybridized most. We moved some to fully distance-based and have advanced all 5 graduate degrees. Through our TRT Program, we have implemented an advanced OSH problems solving course. These advances are essential to plans for a distance-based MOH degree.

**Objective 1.d.** Assist in developing and implementing plans to maintain and expand RMCOEH faculty.

**Progress and Plans:** We have achieved this goal (see discussion above). We plan further increases.

**Objective 1.e.** Monitor numbers of, and increase student diversity in all programs.

**Progress and Plans:** We have considerably expanded our diversity recruitment activities. **Our overall minority student ratio from 2012-18 is 26.4%, far exceeding Region 8 statistics!** While our under-represented ratio is 9.1%, our numbers of African-American/Black trainees is and has been remarkably ~4x Region 8 population percentages. We have had no (100%) retention issues in underrepresented groups in the past 5 years. We still have more to do to advance diversity.

### **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 related to NORA, r2p and WorkLife Initiative priority areas.

Progress and Plans: Recent RMCOEH proposals focus on NORA priority areas: Exposure Assessment, Musculoskeletal Disorders, 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 also targets these NIOSH research priority areas.

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

Progress and Plans: Junior faculty have received research training, e.g., Dr. Cheng received Vice President's Clinical & Translational Scholars (VPCAT) funding from the UUtah SRVP office and then obtained an opioids Screening, Brief Intervention and Referral to Treatment (SBIRT) grant and then in 2017 received follow-on funding (\$1.1M total extramural support). Faculty successfully completed 2 K01 awards. We are especially working on proposals with the TRT trainees. Our large, interdisciplinary projects have provided wonderful, practical training in major research projects for our junior faculty.

Objective 2.c. Explore potentials for joint research programs and efforts with other academic institutions.

Progress and Plans: We have succeeded in initiating and conducting trucking research with Virginia Tech; two major joint research programs that have involved large teams of researchers from many institutions on musculoskeletal disorders (e.g., UCSF, NIOSH, OSU, UWM, Washington State's SHARP, Ulowa, Wash U.). Those projects are continuing with extramurally-funded pooled analyses. We have secured funding for other inter-institutional research projects (e.g., respirator studies) and plan to continue such efforts.

### **Goal 3. Assist Faculty in Providing Superior CE, Service and Outreach to Protect and Enhance Health and Safety of Workers, Families, and Those Exposed to Environments Impacted by Work Activities**

Objective 3.a. Provide support to CE efforts to develop distance-based training programs.

Progress and Plans: The Center's distance based courses continue to prove popular and are expanding in scope. The distance-based education course plan includes a combination of hard-copy and computer-based courses. The program offers a full slate of hard-copy distance education courses as they continue to meet a market need. In addition, the program offers online courses in specialized areas such as an ethics course directed at Industrial Hygienists. The conversion of academic course curriculum to CE delivery continues.

Objective 3.b. Improve CE facilities.

Progress and Plans: RMCOEH facility has larger, newer facilities; also, a larger conference room with 2 SmartBoards™. Other classroom space is adjacent and available with remote AV tech. UUtah has modern facilities, including a Guest House with recently expanded conference and meeting facilities.

Objective 3.c. Provide administration support to outreach and service support activities.

Progress and Plans: This objective is discussed under the Outreach section.

### **Goal 4. Provide Administrative Support to Programs and Activities that 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.

Progress and Plans: The greatest improvements include the OEH Programs with new courses (e.g., *Advanced OSH Solutions*) and the PhD curriculum. A new Biostatistics course was first offered Fall 2017 to train all cores in biostatistics that emphasize relevant and common OEHS approaches and techniques. This was extremely successful and eliminated prior critiques about the difficulty of our biostatistics curriculum, while fostering better abilities for our students to analyze data and produce their theses and dissertations.

Objective 4.b. Assist Center faculty in expanding local, regional, and national collaborations with government, industries, and professional organizations.

Progress and Plans: We have major outreach. See summary statistics above.

## OUTREACH

### **Outreach in OSH / Research to Practice Program Plan**

**Background:** RMCOEH faculty recognize the significance of Outreach and have long underscored it as one of the four major goals of the RMCOEH, (previously, "Provide superior service and outreach"), (now, "Provide exceptional continuing education, service and outreach"). Thus, we have a deep, rich, innovative and integrated Outreach in OSH Program focused on:

1. **Supporting and interacting with other University departments and with other local and regional academic institutions to enhance OSH education programs.**
2. **Supporting our Region 8's sole TPG (Montana Tech) and only other ERC (MAP).**
3. **Leading, assisting, and supporting local and national OSH professional organizations.**
4. **Assisting and supporting businesses, labor organizations, and government entities through provision of OSH information and other OSH activities.**
5. **Assisting homeowners and the public with OEH issues.**
6. **Designing OSH programs to translate research to practice and to encourage submission of follow-on research applications.**
7. **Complementing the RMCOEH's CE Program with activities designed to further enhance the capabilities of OSH practitioners to translate research into practice (r2p).**

RMCOEH faculty determined that outreach efforts could be accomplished more efficiently, and have greater visibility with a more formal structure. As a result, an Outreach program director was selected 17+ years ago, and all faculty committed to provide support to Outreach. A tracking program was developed and implemented to help delineate progress in accomplishing outreach goals. The significance of the Outreach Program was emphasized by the appointment of Matthew Hughes, MD, MPH, RMCOEH Deputy Director, as Director of Outreach Core and the Outreach Program. The commitment of the faculty members is documented in a formal policy (see Figure 1 below).

Outreach activities were captured through an electronic reporting tool during the past grant period. The examples are too numerous to fully detail in succinct progress report. **RMCOEH members provided over 288 separate outreach activities directly to over 13,400 learners during 2014-2018, with outreach efforts providing over 38,000 contact hours of information.** Outreach and CE activities in 2012-2018 included over 8,000 different businesses!

#### **Outreach Program Plan:**

RMCOEH faculty provide outreach to broad groups, particularly including:

1. **Governmental entities locally**
2. **Governmental entities nationally**
3. **Research and teaching communities at the University of Utah**
4. **Academic institutions regionally**
5. **Academic institutions nationally**
6. **Business and trade groups locally and regionally**
7. **Insurers**
8. **Community groups, underserved groups, underrepresented groups, and the public**
9. **OEHS professional organizations**
10. **National and international professional conferences**

Planned activities include the following emphases:

1. Provided support to OSH professionals by:
  - a. Making presentations of advances in OSH practice or research at national and regional professional meetings, such as for AIHA, ACOEM, AAOHN, HFES, ASSE, etc.
  - b. Publication of peer-reviewed articles in professional journals to document proven interventions and other practice advances.
  - c. Updating and providing outreach lectures on the ACOEM Practice Guidelines to improve the health of injured workers.
  - d. Provide support and assistance to Region 8's sole other TPG (Montana) and ERC (MAP).

- e. Provide support for other Region 8 Universities to include OSH curricular materials.
  - f. Preparation of additional multi-media tools, such as online practical videotapes of evidence-based musculoskeletal physical examination techniques that are in use in the United States, Korea, and other locations.
2. Interacted with other University departments and with other local and regional academic institutions by:
    - a. Making OSH-relevant examples in lectures to first year medical students in the introductory Epidemiology and Biostatistics curriculum (Evidence-based Medicine curriculum).
    - b. Serving as a facilitator in the first year medical school program to acquaint students with OSH.
    - c. Presenting OSH graduate degree opportunities to students in the Utah State University undergraduate Industrial Hygiene program and to other students at regional institutions (e.g., Boise State).
    - d. Encouraging medical students to enter an OM career at the School of Medicine's Career Day.
    - e. Presenting OSH discussions in the new undergraduate course, FPMD 4500/5500, Introduction to Public Health, A Global Perspective.
    - f. Obtaining support for visiting scholars such as Brad Joseph, PhD (Ford Motor Co.), David Rempel, MD, Roy Rando, PhD, Barbara Silverstein PhD, Lee Newman, MD, MA and James Locky MD (NORA Symposium; Dr. Paul S. Richards Endowed lectureship funding).
    - g. Including U School of Business faculty in RMCOEH programs to evaluate financial benefits of OSH.
    - h. Developing additional diversity recruitment programs to include Tribal Colleges in Region 8 and efforts with Hispanic and Latino groups.
    - i. Collaborating with UUtah OEHS and depts. to improve program compliance and delivery of care.
  3. Supported OSH professional organizations by:
    - a. Providing scholarships for student membership in local AIHA chapter.
    - b. Advising the local AIHA and ASSE student sections.
    - c. Serving as Chair of the Evidence-Based Practice Committee of ACOEM.
    - d. Serving as member of the AIHA Academic Section.
    - e. Serving as a trustee of the American Board of Preventive Medicine.
    - f. Serving as Chair of the State of Utah Drivers' License Medical Advisory Board.
    - g. Accepting new committee and officer positions in professional organizations (RMAOEM, AOEC, etc.).
    - h. Working with professional organizations to develop educational programs for members and others who attend conferences and meetings.
  4. Supported businesses, labor organizations, government entities by:
    - a. Providing consultations or other support to local and regional businesses to the benefit of over 2,000 organizations annually.
    - b. Continuing to have the President of the Utah State AFL-CIO as a member of the RMCOEH Advisory Board (ongoing since its inception in 1977-78).
    - c. Providing consultations regarding toxic exposures to Salt Lake County Risk Management.
    - d. Working with Utah legislators to develop proposals for enhanced funding of the RMCOEH.
    - e. Evaluating and reporting effectiveness of intervention programs to improve workplace OSH.
    - f. Developing distance learning OSH programs for businesses and workers.
    - g. Developing and promoting programmatic response and solutions to the pandemic threats of regional businesses.
  5. Designed programs to translate research to practice by:
    - a. Conducting the Regional National Occupational Research Agenda (NORA) Young/New Investigator Symposia annually.
    - b. Designing and conducting information programs for large and small businesses on etiologies and prevention of musculoskeletal disease of the upper extremity and of the back.
    - c. Preparing professional publications and presentations from research studies as it becomes available.
    - d. Including noteworthy r2p items in the RMCOEH Newsletter.
    - e. Preparing news releases and publications for members of the workforce to assist in disseminating practical information on prevention of illnesses and injuries, using results of research as the information becomes available.

- f. Designing and conducting quality review of opioid practice guidelines to develop and disseminate responsible prescribing methods to reduce misuses of opioids for chronic conditions.

**Figure 1. RMCOEH Outreach Policy**

**Outreach is a critical element of the vision, mission and goals of the RMCOEH, as specifically delineated in Goal 3.**

**Purpose(s): To improve knowledge and awareness of work-related safety and health issues; to meaningfully impact regional and national OEHS needs.**

**All faculty are expected to help achieve the Outreach goal. Specific activities are reviewed on the faculty Annual Review Form.**

**Outreach is defined as any educational, consulting, or other professional activity that impacts non-RMCOEH personnel and does not meet the criteria for academic courses, CE presentations, or research activities. Outreach includes support to local/regional universities, Regional Training Program Grantees, local and regional business/worker communities, local, regional or national professional or other organizations and groups, and international activities. All who have been faculty at the RMCOEH for over 1.5 years must partake in Outreach activities.**

- 1. Faculty are expected to accomplish five outreach activities each year in any of the following categories:**
  - a. University of Utah or other Region 8 University educational seminar, session, academic class, advisory committee, board or other service.**
  - b. Local or Region 8 business, trade, employee group educational seminar, session, class, consultation, or service on organizational committees or boards.**
  - c. National or international educational seminar, session, class, consultation, research presentation, study sections, or professional committee service.**
- 2. Other activities may be included as determined by the Outreach Core Program Director.**

**Representative Examples of Outreach**

RMCOEH faculty presented extensively at national conferences on ACOEM Evidence Based Practice Guidelines, Opioids, Truck Driving Safety, Ergonomics, Air Sampling, and other IH and medical topics. Additionally, Outreach has expanded through our Hazardous Waste Worker and Emergency Response Training programs. A focused effort targeting at risk populations included holding free HAZWOPER classes for the Navajo Nation, creating the first online Community Emergency Responder Training (CERT) in the country, and a free online emergency preparedness training tool for business and neighbor organizations. Other noteworthy activities include Drs. Wood, Hughes, and Hegmann’s participation in national committees and guideline developers (e.g., ACGME, AOHC, ACOEM, respectively); Dr. Pahler’s service to the public; and our increase in media with Dr. Hegmann and Dr. Thiese’s interviews).

**INNOVATION**

The RMCOEH’s Outreach Program includes numerous innovative activities. We consider several of these to be among our most important undertakings. These sustain and grow the Center despite a challenging national funding environment. The following are examples of our more innovative Outreach activities that are legislative (note these initiatives are begun in the RMCOEH Advisory Board:

- 2005 SB 159, “Assessment Offset for Donations Promoting Occupational Health and Safety.” Sen. E. Mayne, Sponsor. **(Established tax credit support mechanism via WC premium taxes).**
- 2007 1SSB 234, “Occupational and Environmental Health Amendments,” Sen. E. Mayne, Sponsor. **(Statutorily Established the RMCOEH, first in the U.S.).**
- 2009 1SSB15, “Workers’ Compensation Premium Assessment and Related Funding,” Senator K. Mayne, Sponsor. **(Establishment of the Eddie Mayne Funds for RMCOEH)**
- 2010 1HB221, “Sunset Act and Repealers Reauthorization,” Rep. Garn. **Reauthorized SB159.**

- 2015 SB3, "Appropriations Adjustments," Senator Lyle W. Hillyard, Sponsor. **(\$125k, 1-time startup funding for Bachelor of Science in Occupational Safety and Health program).**
- 2017 HB 175, "Opioid Abuse Prevention and Treatment," Rep. Eliason. **(Supports training and healthcare provider reimbursement for opioid screening services)**
- 2018 SB14, "Industrial Accident Restricted Account Sunset," Sen. Karen Mayne. **(Eliminates the sunset provision on the Eddie Mayne Funds for the RMCOEH).**

A few innovative aspects of our Outreach program, include:

- Developing consultative services to businesses, labor, Federal Government and organizations using students to help facilitate their training,
- Assisting labor with legislative bills that do not directly involve the RMCOEH (e.g., SB135, 2015GS),
- Fostering relationships between our Technical Writer and public relations, e.g., global reach of our research (e.g., JOEM 2017;59(2):154-160 went global with over 83 articles produced in 17 countries),
- 5-minute videos have been developed to train r2p for workers in industries (e.g., scientifically-based lifting techniques). Videos are short for use by industry for safety meetings, while also succinct and pithy for ease of memorability (see RMCOEH website <http://medicine.utah.edu/rmcoeh/>). Our Advisory Board has plans to further broadcast these videos through their trade organizations (e.g., Utah Manufacturing Association),
- Developed online tools for community and worker emergency preparedness and response training, and
- Development of an impact evaluation process for Outreach (see below).

## Interdisciplinary Approach

The RMCOEH's Outreach Program includes interdisciplinary activities where possible. As the academic programs incorporate numerous, broad and deep interdisciplinary activities, further incorporation of interdisciplinary activities into Outreach is similarly broad and deep. The following are some examples of interdisciplinary outreach activities:

- Passage of all of legislation is universally interdisciplinary, as we need broad support to pass bills
- Lectures are interdisciplinary when possible to improve content/learning (e.g., IH & OM for asbestos for workers)
- The *OSH Solutions* class takes problems of businesses and returns the solutions to the workplaces with a broad interdisciplinary approach (usually at least 3 disciplines/team). This same approach is used for homeowner and other issues.
- The 3-5min training videos for workers are a fully interdisciplinary effort.
- Team co-teaching of epidemiology and biostatistics to medical students is with OIP and OM.
- National lectures at conferences have included OM and OIP (trucking safety); E&S, OIP and OM (musculoskeletal disorders). This provides a better discussion of the issues and improved learning per lecture/conference evaluations.

## Impact Evaluation

The RMCOEH Outreach program has instituted an Impact Evaluation Matrix for our Outreach activities to determine breadth of impacts, quality and effectiveness. Activities are rated on a scale of 1-4 with 1 point being awarded for each of the following: 1) at least 5 people; 2) NORA sector; 3) NORA cross sector; 4) disseminates new knowledge. At the beginning of the next grant cycle an additional measure will be added: course evaluations. The Matrix allows for a semi-quantitative measure of the impact of faculty/staff Outreach, and also indicates areas for improvement. In addition to the Impact Evaluation Matrix, other impact factors are calculated and some may eventually be included in the Matrix point system. These measures include active tracking of:

- Course evaluations
- Feedback from homeowners we have assisted (e.g., unsolicited donations after service by Dr. Pahler!)
- Numbers of hits on YouTube and website videos
- Followers on social media (e.g., Facebook, LinkedIn), and feedback from social media
- Trainee's impacts on OSH, e.g., consultations to help recent graduates implement OSH programs
- Reach of articles (see above), including TV and radio interviews
- Numbers of businesses using our 5-min. OSH training videos; employees (n) of those businesses.

We plan to attempt to define improved OSH practices in the next grant period (e.g., lifting techniques in plants and reduced injuries from the 5-min OSH training videos), although we anticipate that will be difficult.

## **Management Plan**

Matthew Hughes, MD, MPH has overall management and responsibility of the Outreach Core and Outreach Program. He works closely with Connie Crandall, MBA, for program administration. They closely coordinate Outreach and CE activities, particularly as one may evolve into the other. Their offices are in close proximity (~30 ft.) in the same office suite, which facilitates easy daily communications. Resources are utilized to emphasize high-impact activities and/or services to underserved populations and/or at-risk populations, especially if resource-limited.

Dr. Hughes also chairs the RMCOEH Outreach and CE Program Management Committee, which assists with the overall management, strategy, direction and evaluation of the Program. The composition of this committee is designed to include significant input from the RMCOEH Center Executive Committee (members: Dr. Hughes, Connie Crandall, Dr. Hegmann, Tracy Rees, and Tom Boeger). The Outreach and CE Program Management Committee discusses and prioritizes activities to maximize the RMCOEH's reach. The committee also seeks to develop additional innovations, measure impacts and assess meaningful OSH changes. Outreach activities are also discussed and managed at Center Executive Committee meetings.

The RMCOEH Center Advisory Board is also included in the Outreach planning processes through identification of Outreach Program needs, identification of opportunities, access to underserved populations, and through inclusion of Advisory Board members in numerous activities.

## **The Outreach Program's Continuous Quality Improvement Program** (Brief Description)

The Outreach Program uses an adaptation of the RMCOEH's CQI program and includes numerous sources of data and feedback to provide ongoing guidance to improve the Outreach Program. These sources and efforts include:

- a. Immediate feedback from stakeholders, businesses, unions, public, Advisory Board members,
- b. Course evaluations
- c. Ongoing discussions and OEH faculty meetings on methods and improvements in course content
- d. RMCOEH Retreats (Quite a prominent Outreach input source, with both faculty and staff present)
- e. RMCOEH Advisory Board. At least 2 meetings/yr. (another critical Outreach forum)
- f. OEH Programs faculty meetings
- g. Graduate surveys of students (some venues arise from these surveys)
- h. The NORA agenda and any other NIOSH information on OEHS needs
- i. Benchmarking against other Outreach programs
- j. Benchmarking against content at meetings (i.e., AIHCE, ASSE, ICOH, EPICOH, SER, ACOEM)
- k. 2011 NIOSH Workforces Survey information, especially regarding OEHS topics and needs

**Outreach Summary and Plans: Access to and communication with the above organizations and populations is critical to the success of the RMCOEH. We are fortunate to be able to demonstrate and enjoy such vigorous support in academia, business, organized labor, trade associations, government, healthcare organizations, insurers, community groups, and professional organizations. We plan to enhance our extensive Outreach efforts and will seek to optimize the impacts of our efforts through selecting the most beneficial venues and further quantifying impacts.**

## PILOT PROJECT RESEARCH TRAINING

The RMCOEH **Pilot Projects Research Training Program** (PPRT) is ongoing. We have made improvements in advertising and recruitment. This has resulted from program announcements and we also have continued to announce the program at each NORA New/Young Investigator's Conference since 2010. We have implemented changes in scoring to reflect the NIH review process using the standard NIH templates while maintaining the focus on NIOSH and Region 8/RMCOEH research priorities. These and other procedures initiated in 2010 including that the program director reviews all submissions for consistency ensure a fair and rigorous review.

### A. **2013-2017 Awards:**

We received 35 applications for PPRT funding between 2013 and 2017 resulting in 29 awards (See **Table 1**). The applications were received from the University of Utah and six other academic institutions. These funded applications covered many different sectors and cross-sector programs (some address more than one Sector or Cross-Sector, see **Table 2** below). The recipients supported 15 graduate student projects, 1 resident project, 4 post-doctoral fellow projects and several junior faculty projects. We made 6 awards to female primary investigators though more women were involved in projects in other roles such as research assistant or co-investigator.

**Table 1. PPRT awards made between 2013 and 2018.**

Paul, Seth	Innovaflex tendon rehabilitation device	PhD student Assistant	2013
Cheng, Melissa	Opioid-related overdose with work related injuries	Professor	2013
Pahler, Leon	Solubility of metals in hard rock mine ores in simulated lung fluids	Assistant Professor	2013
Groberg, Erik	Submaximal hand forces and shoulder muscle activation during simulated work	PhD Student	2014
Kim, Hanseup	Wireless communication electronics assemble toward a hand-carry volatile organic compounds.	Assistant Professor	2014
Roundy, Shadrach	Reducing physical stresses and falls among drywall installers through a PLD	Assistant Professor	2014
Myers, Krista Marie	Cooling options for underground miners	Graduate student	2014
Fehlberg, Mark	Characterization of contributing factors to slips	Instructor Assistant	2015
Thiese, Matthew	Pilot intervention: Exercise for the long haul	Professor	2015
Tung, Kryztopher	Evaluation of a novel hazard exposure monitoring device	Research fellow	2015
Ulrike Ott	Opioid misuse on a worker's compensation systems basis	Research Analysis	2016
Riches, Naomi Clingenpeel, Scott	Development of an airborne contaminant exposure model at the Great Salt Lake based upon environmental sampling of mercury arsenic and lead by portable xfr	grad student	2016
Thompson, Brennan	Evaluation of a novel hazard exposure monitoring device	MSOH student	2016
	The effects of meal replacement intervention on functional lower body strength	Assistant professor	2016
Tung, Kryztopher	A real-time method for evaluating and monitoring heat stress potential using wearable biosensors	research fellow	2016
Yazdani, Mojitaba	Improve human safety in human robot collaboration for industrial tasks	PHD student	2016
Watson, Rex	Effect of auricular acupuncture on grip, pincer strength and forearm blood flow	Resident	2016

Philips	Effect of medically-focused safety videos on success of toolbox talks	Graduate Student	2017
Sleeth	Carbon monoxide and nitrogen dioxide in ice rink maintenance	Graduate Student	2017
Thatcher	Job physical factors that lead to low back pain in vehicle drivers	Graduate Student	2017
Pahler	Slip resistant shoes in the workplace Intelligent lifting coach and dosimeter (ILCD): Improved exposure monitoring to prevent LBP	Graduate Student	2017
Trkov		Post-doc	2017

**Table 2. Number of funded PPRT applications in NORA sectors by year.\***

Sector Programs	2013	2014	2015	2016	2017
Construction		1			
Healthcare and Social Assistance	2			3	1
Manufacturing		1		1	1
Mining	1	1			
Public Safety Services			1	1	
Transportation, Warehousing and Utilities			1		1
Wholesale and Retail Trade					
<b>Cross-sector Programs</b>					
Musculoskeletal Health		1			1
Respiratory Health				1	1
Traumatic Injury Prevention		1		1	3
Total Worker Health			1	1	

\*Some applications pertain to more than one sector.

**B. PPRT Outcomes (Peer-reviewed Publications, Grants and Degrees Completed)**

1. Eilertsen, M., **Merryweather, A.**, Roundy, S. Characterization of load reduction while lifting drywall using an unpowered drywall lifting device. Applied Ergonomics.
2. Yazdani, M., Sabbagh Novin, R., **Merryweather, A.** (2017) Improvement of human safety in fault-tolerant human and robot collaboration using convex optimization and receding horizon control. NIOSH State of the Science Conference, June 2017, Aurora, CO.
3. Holm CA, **Pahler L, Thiese MS**, Handy R. (2016) Evaluation of physiological strain in hot work areas using thermal imagery. Journal of Thermal Biology, 61;8-15, ISSN 0306-4565.
4. Adams DS, Koyle JC, **Pahler LF, Thiese MS, Larson RR.** (2015) Dissolution rates of five inorganic mine ore inorganic elements in synthetic lung fluid. Journal of Chemical Health and Safety, 22(3):3-10, ISSN 1871-5532.
5. **Ott U**, Stanford JB, Murtaugh MA, et al. (2015) Predictors associated with changes of weight and total cholesterol among two occupational cohorts over 10 Years. Journal of Occupational and Environmental Medicine / American College of Occupational and Environmental Medicine. 57(7):743-750. doi:10.1097/JOM.0000000000000484.

6. **Ott U**, Stanford JB, Thiese MS, Murtaugh MA, Greenwood JL, Gren LH, Garg A, Hegmann KT (2015). Two industrial cohorts: baseline characteristics and factors associated with obesity. *J Occup Environ Med*, 57(5), 562-70.
7. **Ott U**, Stanford JB, Greenwood JL, Murtaugh MA, Gren LH, Thiese MS, Hegmann KT (2015). Stages of weight change among an occupational cohort. *J Occup Environ Med*, 57(3), 270-6.
8. **Shorti R**, Merryweather AS, Thiese MS, Kapellusch J, Garg A, **Hegmann KT**. (2014) Fall risk factors for commercial truck drivers. *J Ergonomics*, S3:209.
9. **Passey DG**, Robbins R, Hegmann KT, Ott U, **Thiese MS**, Garg A, Kinney AY, Murtaugh MA (2014). Long haul truck drivers' views on the barriers and facilitator to healthy eating and physical activity: A qualitative study. *Int J Workplace Health Manag*, 7(2), 121-135.
10. **Thiese MS**, Effiong AC, Ott U, Passey DG, Arnold ZC, Ronna BB, Muthe PA, Wood EM, Murtaugh MA. (2015). A clinical trial on weight loss among truck drivers. *Int J Occup Environ Med*, 6(2), 104-12.

## **B. Selected posters and presentations**

Graduate students who work on PPRT projects routinely present their work at the Annual Regional NORA Young/New Investigator Symposium. However, graduate students and junior faculty present work related to PPRT project funding at meetings aligned with their specific expertise across the country. A small sampling is listed below.

1. **Ott, U**. Opioid misuse on a workers compensation systems basis Workers Compensation Research Institute Conference, Boston. March 2017.
2. **Merryweather, A.**, Sabbagh Novin, R., Yazdani, M. (2017) Optimal motion and mobility aid manipulation planning to enable personal activity monitoring and facilitate safer sit-to-walk transition. The Fifth International Conference on Ambulatory Monitoring of Physical Activity and Movement, Bethesda, U.S., 2017.
3. **Tung, K., Shorti, R.,** Downey, E., Bloswick, D., **Merryweather, A.** (2014). Evaluation of an ergonomic laparoscopic handle design and upper extremity musculoskeletal disorder risk factors. 7th World Congress of Biomechanics, Boston, MS, July 6-11, 2014.
4. **Thiese, MS**. Turning the weight loss WHEEL(s) with commercial truck drivers. International Conference on Commercial Driver Health and Wellness, Baltimore, MD 2014.

## **Extramural grant applications**

One of our aims is to fund pilot projects that may go on to be a source of extramural grant funds. To this end we have begun to follow-up with awardees regarding their external funding applications that result from pilot project awards. Five recent PPRT projects led to applications for external funds. One project led to a successful SAMHSA training grant ("Opioid-related overdose with work related injuries") for Screening, Brief Intervention and Referral to Treatment (SBIRT), which to date has led to \$1.1M in funding to Dr. Cheng (\$900M + \$200K in follow-on) to train the entire University of Utah healthcare system of students in SBIRT; this includes MDs, NPs, PAs, dental students; the follow-on funding awarded August 2017 is due to prior successes and its purpose is to develop SBIRT videos for current practitioners across the state.

Several projects have collected preliminary data for external funding (1 R03, 1 R21, 2 R01s). The application was scored but not funded and the pilot data will be used in a resubmission. Another R21 project was scored but unfunded (“Innovaflex tendon rehabilitation device”). University of Utah faculty submitted 2 R01s related to pilot projects: (title: Opioid misuse on a workers’ compensation systems basis and Worksite Health Eating and Exercising for the Long Haul, 18-WHEEL).

### **Academic Advancement of Junior Faculty**

Another aim of our PPRT program is to develop and advance junior faculty by funding pilot projects, especially where they help develop or augment new lines of research, particularly with extramural support. The following junior faculty were awarded PPRT funds in the past cycle and had recent career advancements:

- Steven Charles, PhD. Advanced to Associate Professor at Brigham Young University in 2015.
- Kim, Hanseup, PhD. Advanced to Associate Professor in 2016.
- Ulrike Ott, PhD, MSPH. Appointed Instructor in 2016.
- Leon Pahler, PhD, CIH. Advanced to Associate Professor (Lecturer Track) in 2017.
- Andrew Phillips, MD, MOH. Appointed Instructor 2017.
- Darrah Sleeth, PhD, CIH. Advanced to Associate Professor with Tenure in 2017.
- Matthew S. Thiese, PhD, MSPH. Advanced to Associate Professor with Tenure in 2017.

It is noteworthy that there are likely many others, particularly at more remote universities that should be added to the above list.

## **ERGONOMICS AND SAFETY**

### **Highlights from the period July 1, 2013-June 30, 2018.**

- Reduced the student/faculty ratio by 200% by increasing faculty to 6 (4 full-time ME faculty and 2 instructors).
- Successfully grown our research portfolio: Extramural proposals submitted (50), Funded (28), In process of resubmission (5), Total extramural awards to E&S (\$1,570,325).
- Expanded dissemination of research.
- Dr. Merryweather promoted to associate professor with Tenure.
- Approved new emphasis area in Department of Mechanical Engineering (Industrial Engineering – focus on E&S and Manufacturing coursework and training).
- University of Utah Manufacturing Extension Partnership (UUMEP) Center created

### **Progress Regarding Goals and Objectives from Last Cycle**

The E&S Program has met and surpassed almost every goal and objective established at the beginning of this current grant period in July, 2013. Many of these objectives are naturally ongoing in addition to “accomplished.” We have addressed prior reviewers’ critiques. Our greatest areas of development have been centered on:

- (1) Improvements in the E&S Academic Program
  - a. New course offerings, research topics, and additional faculty/staff
- (2) Increasing the quantity and quality of our E&S students (emphasis on PhD), and their output, and
- (3) Improvements in our research programs, including new collaborations with other disciplines.

### ***Goal 1. Provide a quality E&S academic program.***

**Objective 1a. Offer a comprehensive program of didactic courses that addresses the NIOSH Guidelines for MS Programs in E&S that facilitate masters-level research and prepare graduates to assume journeyman E&S positions in industry.**

Accomplished. E&S MS Program graduates rated their training 8 or greater on a 1-10 pt. scale. Courses required for the E&S MS program are mapped against the NIOSH Guidelines for Graduate Programs in Occupational Safety.

**Objective 1b. Offer a comprehensive program of didactic courses that addresses the NIOSH Guidelines for PhD Programs on OSH that will facilitate PhD-level research and prepare PhD graduates as corporate-level E&S directors, university faculty, or researchers at nationally recognized labs.**

Accomplished. The courses required for the E&S PhD program are mapped against the NIOSH Guidelines for Graduate Programs in Occupational Safety. All “highly recommended” and “recommended” topics are covered in PhD program courses or pre-requisites.

**Objective 1c. Offer at least one E&S course/year via distance learning.**

Accomplished. The Orbital ATK distance based program has provided instruction and advising for 39 MS degrees off-campus. Dr. Thomas Bernard (Sunshine ERC at USF) taught ME 6960 (Work Physiology and Occupational Heat Stress) to E&S students via a distance option that included two-days on the UofU campus in face-to-face didactic format. A hybrid section of Dr. Merryweather’s Occupational Biomechanics class (MEEN 7100) was offered in spring 2016. Additional course modules from MEEN 6100 – Ergonomics will be formatted and ready for distance learning by summer 2018.

### ***Goal 2. Accomplish NORA-related E&S research and translate it into practice (r2p).***

**Objective 2a. Involve all E&S MS and PhD trainees in field and/or laboratory NORA II research.**

Accomplished/Ongoing. All E&S students participated in data collection (field work) and/or ergonomic analysis (laboratory work) relating to NORA. Students also used laboratory research methods using EMG, force plates, load cells, and optical motion tracking equipment to perform advanced ergonomics experiments to also reinforce E&S fundamentals. An example of this is development of safety algorithms for improved human-robot collaborations in the workplace.

**Objective 2b. Publish the research of most E&S trainees in at least one referred journal and have all present NORA II-related research in conference settings.**

Accomplished. Subjects for thesis and dissertation were not considered by E&S faculty unless a publishable endpoint addressing NORA areas was clear. Students presented their research at the annual Regional NORA

Young/New Investigators Symposium, which was founded by E&S faculty and has been held on the UofU campus annually for the past 15 years. Other work has been presented and/or published at prestigious conferences and in refereed journals.

**Goal 3. Provide superior E&S-related continuing education, service and outreach.**

**Objective 3a. Provide service to UofU Department of MEEN, Departments outside of ME, and University in General**

Accomplished. E&S faculty presented 6-8 hours/yr. of E&S in undergraduate classes. Service included annual lectures on E&S to Occupational Therapy (OT) students (4 hours X 25 OT students annually). Merryweather and Bloswick co-taught ME 6140/OEHS 6715 (*Occupational Safety and Health Solutions*). Faculty lectured annually in OEHS courses. Faculty served on numerous graduate committees, including Mining Engineering, Health Education and Promotion, and Bioengineering. E&S program faculty also support the Manufacturing Extension Partnership (MEP) Center with E&S requests and serve on the Center for Aging at the UofU.

**Objective 3b. Offer 40 hours of E&S continuing education annually.**

Accomplished. Faculty lectured annually on ergonomics at the RMCOEH CE's *Fundamentals of Industrial Hygiene* CIH preparatory course (2 hour lecture 3x/year). Lectures and seminars were presented at the Center on Aging Annual Retreat, College of Mines, and the Utah Falls Prevention Coalition (6 hours). E&S faculty and students help plan and organize sessions, speakers, and registration for the annual regional NORA Young/New Investigators Symposium and the Annual Conference on Safety and Industrial Hygiene.

**Objective 3c. Provide 32 hours/year service/consultation to regional industries and outreach to regional industries, schools, colleges, and universities.**

Accomplished. E&S consultation services to 6-9 local industries were conducted. Drs. Merryweather and Bloswick toured businesses to suggest E&S improvements and coordinated student projects at these facilities. Six to eight laboratory tours are provided annually, and Merryweather participates on a faculty panel for incoming freshman in the College of Engineering. Bloswick, Merryweather, Coats, Monson and Fehlberg supervised numerous ME Senior Design projects that benefited disabled populations, rehabilitation and safety. Availability of CE and outreach activities are also publicized in the Center Newsletter.

**Goal 4. Accomplish comprehensive interdisciplinary efforts.**

**Objective 4a. Involve E&S students in academic courses with students from other core programs.**

Accomplished. The E&S program collaborated extensively with other disciplines in multiple courses.

**Objective 4b. Involve E&S in research with students and faculty from other core programs.**

Accomplished. Three collaborative projects: 1) Exposure-Response Relationships for Low Back Pain from Pooled Data, 2) Targeted Research and Training Program, and 3) Exposure Response Relationships for CTS and Epicondylitis from Pooled Data best exemplify frequent communication, coordination and cooperation between E&S, IH, OM and OIP. Other projects include Ergonomic Analysis of a Radiation Protection Vest, Upper Extremity MSD Evaluation and Abatement Recommendations for a Commercial Cake Icing Line, Comprehensive Ergonomic Analysis and Recommendations for a Bacon Processing Plant, Ergonomic Analysis and Abatement Recommendations for Unloading Coke from Railcars, Ergonomic Assessment of Patient-Driven Unscheduled Ambulation in a Medical Surgical Unit, Industrial Hygiene and Ergonomic Assessment of an Aluminum Foundry.

**Objective 4c. Involve E&S in professional and informal activities with other core programs.**

Accomplished. ASSE's student chapter is active and includes diverse membership across RMCOEH and College of Engineering. Student membership is incentivized by E&S development funds. The ASSE student chapter sponsors guest lectures including corporate Safety Managers, distinguished lectures on project management, global OSH programs, consultations, OSHA and Liberty Mutual. E&S faculty advise ASSE and participate in many activities including hosting the 2nd annual ASSE Region II Student Leadership Conference.

**Objective 4d. Involve E&S Faculty in research with other universities and Health and Safety entities.**

Accomplished. E&S faculty worked with College of Nursing, Department of Physical Therapy, and Division of Physical Medicine and Rehabilitation on proposals and funded projects. We have ongoing research relationships with the UW-Milwaukee, Colorado State U, Auburn, Utah State U, BYU-Provo, the Ohio State U and USF.

### ***E&S Program's CQI Program for the Academic Program (Brief Description.)***

The E&S Program follows the RMCOEH's Continuous Quality Improvement (CQI) program (see below) to improve the program on an ongoing basis.

In the future, we anticipate additional research on wearable technology to measure workplace exposure to MSD risk factors, human-robot collaborations in manufacturing and healthcare, safety flooring and footwear, and the design of hospital furniture and technology to reduce patient falls and employee injuries.

### ***Brief Progress Narrative, Bulleted by Calendar Year***

#### **2013:**

- Ergonomics Team comprised of trainees was awarded **Top 5 Finisher** - National Ergonomics Student Design Competition by Auburn Engineers
- Georgia Pacific - \$5000 Gift to E&S Lab to support efforts to enhance E&S in paper production facilities

#### **2014:**

- Trainees presented at the World Congress on Biomechanics, July 2014
- Trainees published in reputable journals and at conferences
- A national search for new E&S/Biomechanics faculty was conducted
- Dr. Merryweather appointed as web master and member of Utah ASSE executive board
- Four Invention Disclosures were made to the Technology Venture Commercialization office by E&S faculty and students, demonstrating increased efforts for r2p.

#### **2015:**

- Created new website and updated content on E&S website ([www.ergo.mech.utah.edu](http://www.ergo.mech.utah.edu))
- In July 2015, hired Associate Instructor and Post-Doctoral Scholar, Dr. Mark Fehlberg, PhD
- Ms. Tracy Rees, an expert in technical writing and reviewing documents such as thesis, dissertation and project manuscripts, was hired by RMCOEH to assist E&S faculty and students in writing and oral skills
- Hired Dr. Ken D'Entremont, PhD in Mechanical Engineering with 15 years of corporate safety experience to develop course in Product Safety and to teach Industrial and Systems Safety
- October 2015, Dr. Merryweather awarded Utah Chapter of ASSE Safety Professional of the Year

#### **2016:**

- January 1, 2016, Dr. Andrew Merryweather was appointed by NIOSH, on recommendation of Dr. Hegmann, as the Director of the E&S Program for the RMCOEH
- In January 2016, the RMCOEH initiated a new bachelor's course in OSH
- Fall 2016, Developed and taught Product Safety
- Spring 2016, Developed and taught Design of Experiments
- Spring 2016, Implemented a hybrid offering of Advanced Ergonomics & Occup Biomechanics (MEEN 7100)
- Created new NORA Symposium website ([www.nora.mech.utah.edu](http://www.nora.mech.utah.edu)), increasing participation by 15%
- Two E&S students received Pilot Funding for research (Slips/Falls, Shoulder Disorders)
- A patent for a Tendon Rehabilitation Device is pending (Dr. Merryweather and student) with the U.S. PTO, March 2016.

#### **2017:**

- Intro to Biomechanics Course was developed and approved for Fall 2017 (Dr. Brittany Coats)
- A short video on proper lifting techniques was designed and published to the web. This started a conversation with the RMCOEH Advisory Board who enthusiastically and unanimously approved developing additional targeted videos to release to employers and employees in Region 8
- Student presentations at prestigious conferences increased significantly over previous years (+67%)
- Dr. Merryweather expanded relationships with the College of Mines by presenting "Occupational Biomechanics, Ergonomics and Safety: Applications for Job Tasks in the Mining Sector" at the Mining Engineering Department Seminar at the UofU, February 2017
- Three students were supported to attend the Student Leadership Meeting ASSE Region II, April 2017

- Rami M. Shorti (Trainee), **Outstanding Dissertation of the Year Award** in Mechanical Engineering at the University of Utah, in recognition for Rami's devotion to advancing research intellectual merit and benefiting the broader impacts to society, May 2017
- RMCOEH Faculty awarded **2017 IEA/Liberty Mutual Medal** for *Relationships between job organizational factors, biomechanical and psychosocial exposures* by Bao, Kapellusch, **Merryweather AS, Thiese MS**, Garg A, **Hegmann KT**, Silverstein BA, *Ergonomics*, 2016;59(2):179-94.

#### 2018:

- 2018 NIOSH Bullard-Sherwood Award for Research to Practice Honorable Mention Intervention Category, **Hegmann KT, Bloswick D, Merryweather A, Thiese MS.**
- 2018 Undergraduate Design Project Competition in Rehabilitation and Assistive Device. World Conference of Biomechanics. Dublin, Ireland. **Andrew Merryweather**, Mikaela Hayward, Hyrum Peterson Kort Cross, Quincy Stevens, Irsyad Badri.
- Top Teaching Performance. College of Engineering. **Andrew Merryweather** (MEEN 5100, F2017)
- 6 Publications, 3 Conference proceedings/presentations (refereed/reviewed), 5 Other papers published or presented, 15 Poster presentation and 5 conferences attended.

#### Program Deliverables

The E&S Program involves students in designing and conducting in-depth research and data analyses for a variety of subjects related to E&S, rehabilitation engineering, and biomechanics. Projects include (e.g.): i) impact of external exposure to heat, altitude and hydration, on core body temperatures and heat stress; ii) evaluation of truck cab ingress/egress systems and driver falls; iii) effects of footwear and flooring surfaces on slip and trip potential as a function of gait and physical impairment; iv) job physical and personal factors associated with CTS and epicondylitis; and v) submaximal shoulder exertion and reaching to describe subacromial impingement syndrome. Information obtained from these studies is expected to lead to improved technologies, methods and understanding to prevent MSDs and other acute and chronic disorders/injuries.

#### Publications 2013-2018

The E&S Program has increased research, producing the following publications since 2013:

- 43 peer-reviewed publications
- 1 book chapter
- 38 posters
- 29 abstracts

#### Program Future Plans

In August, 2013 the UofU Board of Trustees approved the RMCOEH's proposal to add a new Graduate Certificate in Occupational Safety and Health (COSH) Program. This certificate has five areas of emphasis, one of which is E&S. Each emphasis area requires 15 to 17 credit hours of graduate credit course work, with a set of 2 to 3 core courses and the remainder to be taken in the applicable emphasis area. At present, there are no students currently enrolled in this certificate's E&S program, but this is an area that is being reviewed for how to best increase recruitment. This may be an option to also recruit further students into the E&S program who do not come from a background in engineering, thus strengthening our MSOH in E&S as well.

Plans are underway for an undergraduate Bachelor of Science (BS) degree Program in Occupational Safety and Health. Besides producing bachelors training for safety professionals in industry, this program is expected to especially assist both the E&S, IH and OIP programs with graduate student recruitments for each of their graduate degree programs. The plans for developing this new BS degree program are based in part on the results of the NIOSH U.S. Workforces survey (2011). Based on requests from local companies, a new undergraduate course in Occupational Safety and Health was started at the RMCOEH in January 2016.

#### SUMMARY of E&S PROGRESS in the Past 5-Year Period

**We have made major progress in the past 5-year period:**

- (1) Increasing numbers and quality of E&S trainees, especially PhD;

- (2) Implementing and refining a visionary *OSH Solutions* class;
- (3) Increasing our tenured/tenure track faculty from 1 to 4;
  - a. Offering 3 new core courses: 1) Product Safety (D'Entremont), 2) Design of Experiments (Merryweather), and 3) Introduction to Biomechanics (Coats).
- (4) Beginning a new innovative TRT curriculum, including an occupational biomechanics emphasis that improves the E&S curriculum;
- (5) Increasing dissemination through increased publications, conference presentations, and outreach;
- (6) Developing stronger extramurally funded research programs and collaborations; and
- (7) Developing more state funding (e.g., Senate Bill 159, Eddie Mayne Funds)

## **INDUSTRIAL HYGIENE**

The IH Program has met and surpassed almost every goal and objective established at the beginning of the just completed current grant period of July, 2013 through June 2018. We have addressed reviewers' critiques. Many of these objectives are naturally ongoing in addition to "accomplished." Our greatest areas of development have been:

- (4) Improvements in the IH Academic Program
- (5) Implementation of the new PhD in OEH with an IH emphasis
- (6) Starting an active recruitment program to increase the quantity and quality of our IH student body, and
- (7) Improvements in our NORA research programs

### **Goal 1. Provide Quality Academic Programs**

#### **Objective 1.a: Maintain ABET accreditation.**

The IH Program renewed ABET accreditation of the MSOH in 2017 through September 30, 2023.

Accomplished.

#### **Objective 1.b: Hold an annual faculty retreat to critique and modify Program as needed.**

We have annual retreats that discuss and review continuous curricular quality improvement/CQI/total quality management. Our programmatic improvements have been marked and highly impactful. Accomplished.

#### **Objective 1.c: Evaluate, replace, purchase, and calibrate IH equipment and instrumentation.**

A new IH Equipment Lab has been formed. Equipment has been obtained and maintained, with annual calibration by the manufacturer for all major monitoring equipment. IT infrastructure is strong. Accomplished.

#### **Objective 1.d: Have students attend at least three AIHA-Student Section meetings per academic year.**

Students continue to be strongly encouraged to attend AIHA meetings. Typically, student attendance at these meetings is 15-20% of those in attendance. The local chapter keeps a roster of all attendees. Accomplished.

#### **Objective 1.e: Enhance current educational offerings.**

We follow the RMCOEH CQI system that includes inputs from students, faculty, the IH Advisory Committee and the University course evaluation system. We continue to proactively modify our curriculum for improvements (see above and course syllabi). Accomplished.

#### **Objective 1.f: Support faculty development.**

We support faculty attendance and involvement in AIHA and international conferences of value to further develop faculty skills. This includes mentoring of faculty research proposals by senior faculty. Accomplished.

### **Goal 2: Accomplish NORA-related, Research to Practice (r2p) and Work Life Initiative-related Research**

#### **Objective 2.a: Emphasize NORA related areas.**

We have made major strides in increasing our NORA related research, especially in the area of mining and aerosol monitoring as detailed above. Accomplished and ongoing.

#### **Objective 2.b: Develop a research strategy capitalizing on the strengths of a multi-disciplinary faculty.**

We have successfully obtained funding on interdisciplinary research projects. Accomplished and ongoing.

#### **Objective 2.c: Maintain research mentoring and the development of faculty and graduate students' research skills through a research manual, research seminars, and research projects.**

Research mentoring has been formalized and implemented. Research manuals are distributed annually. Didactic sessions and courses are taught. As detailed above, results are tangible. Accomplished.

### **Goal 3: Provide Superior Service, Outreach, and Support of Continuing Education**

#### **Objective 3.a: Increase student participation in local and national professional organizations and conferences.**

Students are engaged in the AIHA local section and are strongly encouraged to become student members of both AIHA and ACGIH. We incentivize national participation with travel funds in support of accepted presentations. As a recent example, nine (9) students attended the AIHCE in Philadelphia, collectively presenting four (4) posters. Many of our students also volunteer and attend the annual Utah Conference on Safety and Health. Accomplished.

#### **Objective 3.b: Increase the IH Program's internet available resources to assist students.**

The website is completely redesigned and significant progress has been made to develop and implement most of the curriculum in hybrid and/or distance-based course options for IH students. Accomplished.

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

Partnerships with multiple organizations are in place (e.g., Utah State University, Colorado State University, Montana Technical University, Weber State University, Salt Lake County Health Department, Utah Labor Commission, Utah Department of Environmental Quality, U.S. Department of Labor, NIOSH, and the U.S. Environmental Protection Agency). Efforts to partner with the Goshute, Navajo, and Northern Arapaho tribes have begun, with heavy student involvement expected. These activities will continue and additional partnerships sought. Additionally, we improved the content and distribution of the RMCOEH Newsletter to further our partnerships and outreach. Accomplished.

**Objective 3.d: Increase quality and diversity of recruitments.**

We engage in an active student recruitment program that includes focused diversity efforts. As evidence, the overall diversity of our student body has increased significantly over the last three years. Accomplished.

**Goal 4: Accomplish Strong Interdisciplinary Efforts**

**Objective 4.a: Continue to develop research and outreach activities with core occupational health and safety disciplines, related occupational health and safety disciplines, and allied professionals.**

Extensive interdisciplinary research, teaching and outreach activities are accomplished on a regular basis as noted throughout this application. Accomplished.

**IH Program's Continuous Quality Improvement Program for the Academic Program** (Brief Description)

The IH Program follows the RMCOEH CQI Program that uses numerous sources of data and feedback to provide ongoing guidance to improve the IH Program. These sources and efforts include:

- a. Immediate feedback from students
- b. Course evaluations
- c. Ongoing discussions and IH faculty meetings on methods and improvements in course content
- d. OEH Programs faculty meetings
- e. Graduate surveys of students
- f. The NORA agenda and any other NIOSH information on IH needs
- g. Benchmarking against other IH programs
- h. Benchmarking against content at AIHCE meetings
- i. National IH Program Director's meetings (when held)
- j. AIHA's Academic Section meeting information
- k. NIOSH Workforces Survey (2011) information, especially regarding IH and needs of graduates
- l. Development and reports of new technology related to IH to determine if it/they should be added to the content of a specific course.
- m. IH Advisory Committee. At least two (2) meetings/year. This committee provides input, ideas, and methods for improving both existing courses and recommendations for future curricular needs.
- n. RMCOEH Advisory Board. At least two (2) meetings/year.

**Brief Progress Narrative, Bulleted by Calendar Year**

**2014:**

- The first online sections of IH courses were offered, including Fundamentals of Industrial Hygiene (Fall 2014).
- Dr. Darrah Sleeth was the Chair of the AIHA Aerosol Technology Committee and received a 2014 Leadership Award for this service.
- In May 2014, four (4) student posters were presented at AIHce in San Antonio, one of which won a Best Volunteer Group Student Poster award.
- In May 2014 Dr. Darrah Sleeth passed her CIH examination.
- In August 2014 we initiated a national search for a new IH faculty member.

**2015:**

- In May 2015, two (2) IH students and in August 2015, 1 IH student graduated with MSOH degrees. Two of these three (3) 2015 graduates had employment at the time of graduation.
- In May 2015 Dr. Leon Pahler passed his CIH examination.

- On July 1, 2015, Dr. Rod Handy, PhD was hired into the RMCOEH Industrial Hygiene (IH) Program as a tenured professor. He was subsequently approved by NIOSH as the Director of the IH Program in April 2016, replacing Dr. Rod Larson.
- In August 2015 Ms. Tracy Rees, an expert in technical writing and reviewing documents such as theses, dissertations, and project manuscripts, was hired by RMCOEH to assist both faculty and students in writing. She is also responsible for updates to the RMCOEH Policy and Procedures Manual, ensuring compliance and consistency with government or University or RMCOEH changes in those areas.
- Also in August 2015, two (2) new PhD in OEH students were matriculated and added to the existing two (2) students in the PhD in OEH Program, all four (4) with emphasis in IH (one (1) is now on a leave of absence).

#### **2016:**

- January 1, 2016, Dr. Rod Handy assumed responsibility as the Director of the Occupational and Environmental Health Degree Programs for the RMCOEH.
- In January 2016, the RMCOEH initiated a new bachelor's course in OSH, which is expected to assist in educating undergraduates in program areas, as well as serve as a tool for recruiting students to the graduate degree programs, e.g., in Ergonomics and Safety (E&S), and IH.
- Dr. Darrah Sleeth submitted an R01 research grant proposal to continue her aerosol research.
- Dr. Leon Pahler expanded his role for teaching and research related to the Hazardous Substance portion of the IH Program with added research on chemical agent exposures related to hard rock mining.
- Dr. Darrah Sleeth completed her work related to the K01 award that she received for her research to evaluate and improve, as applicable, air monitoring methods for measuring the fraction of aerosols that actually deposit into the body using a low speed wind tunnel. This research relates to her previous research and has resulted in three (3) publications to-date, with others pending.

#### **2017:**

- Dr. Darrah Sleeth served as the president of the local chapter of AIHA for 2016-2017.
- The ASAC-ABET reaccreditation self-study with site visit was conducted. We received notification on August 2, 2017 that our accreditation had been renewed for another 6-year cycle, which ends on September 30, 2023. There were no deficiencies, weaknesses or concerns. Our program's materials are cited nationally as an example of what to do.
- In April, 2017 Dr. Leon Pahler was promoted from to Associate Professor (Lecturer Track).
- In May 2017, eight (8) IH students graduated with MSOH degrees. Seven of eight (88%) graduates had employment at the time of graduation.
- In June 2017 Dr. Darrah Sleeth received her letter from the University President indicating promotion to Associate Professor with Award of Tenure.
- In June 2017 Drs. Handy and Pahler attended the AIHce in Seattle. Eight (8) IH students also attended the conference, with seven (7) posters and one (1) podium presentation given. In addition, one (1) AIHA Volunteer Group Best Student Poster was also awarded.

#### **2018:**

- In May 2018, seven (7) IH students graduated with MSOH degrees. Seven of eight (88%) graduates had employment by the end of summer.
- In May 2018 Drs. Sleeth and Pahler attended the AIHce in Philadelphia. Nine (9) IH students also attended the conference, with four (4) posters being presented.

### **Program Deliverables**

The IH Program involves students in conducting in-depth literature searches, research and data analyses for development of information for a variety of occupational health exposures. Examples of projects include evaluations of: i) the impact of external exposure to heat, such as at a smelter, on core body temperatures and heat stress; ii) the use of X-ray fluorescence (XRF) monitoring instruments in models of direct-read instruments to measure concentrations of certain metals on surfaces in industry or in the general environment; and iii) new aerosol sampling devices for measuring concentrations of various size aerosols in low air-speed environments

to also determine likely site for particle deposition in the human respiratory system. Information obtained from these studies is expected to lead to improved methods for evaluation of exposure(s) to physical and chemical agents, and provide methods for determining efficiency of various emission and/or exposure control systems.

### **Publications 2013-2018**

The IH Program has produced the following publications since 2013:

- Thirty-seven (37) peer-reviewed publications
- Six (6) book chapters
- Forty-two (42) posters

### **Program Future Plans**

In May 2012, the State of Utah Board of Regents gave final approval to begin a Doctor of Philosophy (PhD) degree program in Occupational and Environmental Health (OEH) for the University of Utah's (UUtah) RMCOEH. This PhD in Occupational and Environmental Health has 3 emphases: 1) Industrial Hygiene (IH), 2) Occupational Injury Prevention (OIP), and 3) General Occupational and Environmental Health (Gen OEH). This allowed the RMCOEH to have doctoral students in IH for the first time. As of July 2018 there are four (4) students (two full-time and two part-time) in the OEH doctoral Program with an emphasis in IH who are satisfactorily progressing through the process. It is expected that a new cohort of four to five (4-5) PhD students will be recruited for the 2019-20 academic year.

In addition to the new PhD in OEH Program approval in 2012, in August, 2013 the University of Utah Board of Trustees approved addition of a new Graduate Certificate in Occupational Safety and Health (COSH) Program for the RMCOEH. This certificate program has five areas of emphasis, one of which is IH. Each emphasis area requires 15 to 17 credit hours of graduate credit course work, and each has a set of 2 to 3 core courses, with the remaining courses to be taken in the applicable emphasis area. One student earned a Graduate Certificate in OEH with emphasis in IH in 2014 and 2 in 2016. At present, there is one student currently enrolled in this certificate program; this is an area that is being reviewed for its potential to increase student interests and recruitments.

Plans are underway for an undergraduate Bachelor of Science (BS) degree Program in Occupational Safety and Health. Besides producing bachelors training safety professionals for industry, this Program is expected to especially assist both the E&S, IH and OIP programs with graduate student recruitments for each of their graduate degree Programs. The plans for developing this new BS degree Program are based in part on the results of the NIOSH U.S. Workforces survey (2011). Based on requests from local companies, new undergraduate courses in Occupational Safety and Health and Risk Assessment were developed and offered at the RMCOEH in January 2016. As a precursor activity, a new minor in OSH was established and approved during the Spring semester at the University of Utah. This minor is currently being offered by the Department of Health Promotion and Education.

In the future, we anticipate additional research on aerosols, evaluation of new direct-read air monitoring devices for aerosols, evaluation of physical stresses such as heat on workers, and improved methods for evaluation of composition (e.g., metals) on workplace and environmental surfaces.

## **SUMMARY of IH PROGRESS in the Past 5-Year Period**

**We have made major progress in the past 5-year period:**

- (1) Increasing numbers of IH trainees,
- (2) Implementing a successful PhD in OEH (IH emphasis) curriculum,
- (3) Increasing the numbers of full-time, terminally degreed IH faculty by one (1),
- (4) Obtaining CIH Certifications for all full-time IH faculty,
- (5) Expanding research training for students,
- (6) Developing extramurally funded research in occupational and environmental monitoring, and
- (7) Developing more state funding.

# **OCCUPATIONAL INJURY PREVENTION RESEARCH TRAINING**

## **Progress regarding Goals and Objectives from Last Cycle**

The OIPRT Program has addressed helpful reviewer critiques and met and surpassed almost every goal and objective established at the beginning of this current grant period in July 2013. Many of these objectives are naturally ongoing in addition to “accomplished.” Our greatest areas of development have been in the areas of

- (1) Improvements in the OIPRT Academic Program
- (2) Implementation of the new PhD in OEH with an OIP emphasis (2012)
- (3) Implemented an active recruitment program to increase the quantity and quality of our OIPRT students
- (4) Improvements in our NORA research programs, including breadth, depth and the rate of publications

## **Goal 1. Provide quality OIPRT: Occupational Safety Engineering (OSE) and Occupational Injury Epidemiology (OIE) emphasizes academic programs.**

### **Objective 1a. Offer a quality interactive program of OEH and engineering didactic courses that addresses the NIOSH Guidelines for Programs in OIP.**

Accomplished. The curriculum is mature but naturally evolving. The OSE uses the PhD in Mechanical Engineering and the OIE uses the PhD in OEH degree. The PhD in OEH addressed and completely resolved weaknesses (i.e., we continue to utilize relevant public health courses, but the PhD degree for the OIE emphasis optimized the curriculum by eliminating some prior Public Health degree requirements of low value, applicability of course work to OEH, and credit burden issues). Additional courses have been designed to further improve the OIPRT. The PhD in MEEN is also mature and provides excellent OSE emphasis training.

### **Objective 1b. Facilitate PhD-level research to prepare OIPRT trainees to assume positions as corporate safety directors, injury epidemiologists, university faculty, or researchers at nationally recognized labs.**

Accomplished. The RMCOEH OIPRT Program provides formal and practical experiences in the development, implementation and execution of research programs. We have further developed our mentoring program to help achieve this.

## **Goal 2. Accomplish NORA-related OSE and OIE research and translate it into practice (r2p).**

### **Objective 2a. Involve all OSE and OIE trainees in field and/or laboratory NORA research.**

Accomplished. The OIPRT program is currently involved in research studies that include nearly all major areas of Region 8 needs, as well as many common OIP injury concerns.

### **Objective 2b. Present NORA-related research in conference settings.**

Accomplished. All trainees present at conferences (usually 3-4+ times) in the course of the curriculum.

### **Objective 2c. Publish the research of every OSE and OIE trainee in at least one refereed journal.**

Accomplished. We have increased our emphasis on publications. Also, since facilitating this activity with our Technical Writer (Ms. Rees) in the past 2 years, we have made major progress in improving technical writing skills, including increasing our publication rate. The rate of publications of our recent graduates also far exceeds the usual 2/year of academic expectations.

## **Goal 3. Provide superior OIPRT-related continuing education, service and outreach.**

### **Objective 3.a Provide outstanding Continuing Education courses (at least 2 CE programs/year).**

Accomplished. While the OIPRT Program is relatively young, we have significant OIPRT-related CE, service and outreach activities. We have courses that address trucking industry safety. We also are leading the implementation of distance-based modules on occupational epidemiology, and the RMCOEH has a distance-based course on management. We are implementing modules on other OIP topics.

### **Objective 3.b. Maintain high quality outreach activities.**

Accomplished. OIPRT faculty have extensive Outreach activities, including contacts with more than 90 companies, insurers, state, federal and academic/non-profit organizations.

## **Goal 4. Accomplish comprehensive interdisciplinary efforts.**

### **Objective 4.a. Augment current interdisciplinary teaching activities**

Accomplished. The OIPRT program excels in interdisciplinary teaching, both with its two emphases.

### **Objective 4.b. Foster interdisciplinary research efforts**

Accomplished. All research activities are interdisciplinary.

**Objective 4c. Involve OSE and OIE students with students and faculty from other core programs.**

Accomplished. These activities are institutionalized 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. Published manuscripts and presentations demonstrate interactions between OIPRT students and both students and faculty from other core programs.

**OIPRT Program's Continuous Quality Improvement Program for the Academic Program**

The OIPRT Program has used, and continues to use numerous sources of data and feedback to provide ongoing guidance to improve the OIPRT Program. This is an adaptation of the RMCOEH's CQI program.

These sources and efforts include:

- a. Immediate feedback from students
- b. Course evaluations
- c. Ongoing discussions and OIPRT faculty meetings on methods and improvements in course content
- d. OEH Programs faculty meetings
- e. Graduate surveys of students
- f. The NORA agenda and any other NIOSH information on OIPRT needs
- g. Benchmarking against other OIPRT programs
- h. Benchmarking against content at meetings (i.e., ASSE, ICOH, EPICOH, SER)
- i. 2011 NIOSH Workforces Survey information, especially regarding occupational injury epidemiology and occupational safety engineering topics and needs of graduates
- j. Development and reports of new technology related to OIPRT to determine if it/they should be added to the content of a specific course
- k. OIPRT Advisory Committee. At least 2 meetings/year. This committee provides input, ideas, and methods for improving both existing courses and recommendations for future curricular needs
- l. RMCOEH Advisory Board. At least 2 meetings/year

In the future, we anticipate additional research on truck driver safety and crash avoidance; musculoskeletal disorder prevention; prediction of opioid misuse prevention among Workers Compensation patients.

**Brief Progress Bulleted Narrative by Calendar Year**

**2013:**

- Andrew Merryweather was awarded the American Society of Safety Engineers Foundation Research Fellowship at the Liberty Mutual Research Institute for Safety in Hopkinton, MA.
- Andrew Merryweather hired as Tenure Track Assistant Professor of Mechanical Engineering.
- Online and hybrid sections of Occupational Epidemiology offered in the fall.
- Dr. These K01 awarded to study causes of truck crashes in a large retrospective cohort.

**2014:**

- Recruitment of 3 new OIPRT students, including 1 underrepresented minority.
- 38 peer-reviewed publications by OIPRT faculty.

**2015:**

- In August 2015 Ms. Tracy Rees, an expert in technical writing and reviewing documents such as theses, dissertations, and project manuscripts, was hired by RMCOEH to assist both faculty and students in writing. She has also assisted in updating to the RMCOEH Policy and Procedures Manual, ensuring compliance and consistency with government or University or RMCOEH changes in those areas.
- Andrew Merryweather was named Safety Professional of the Year 2015 by the Utah Chapter ASSE.
- Graduation of Drs. Ott and Shorti from the OIP Program.
- Hiring of Dr. Ott as Instructor in OIP program.

**2016:**

- January 1, 2016, Dr. Matt Thiese appointed Director of the OIPRT Program for the RMCOEH by NIOSH, on recommendation of Dr. Hegmann.
- In January 2016, the RMCOEH initiated a new bachelor's level course in OSH, which is expected to assist in educating undergraduates in program areas, as well as serve as a tool for recruiting students to the graduate degree programs, including OIPRT.
- Added one doctoral trainee in OIPRT via funding from the newly approved supplemental RMCOEH Targeted Research Training program.

**2017:**

- Dr. Matthew Thiese was promoted to Associate Professor with award of Tenure.
- Active recruitment of underrepresented minority students resulted in a summer internship by a quite promising doctoral candidate, with planned program entry January 2018.
- International Ergonomics Association/Liberty Mutual Medal Award for: Relationships between job organizational factors, biomechanical and psychosocial exposures, written by Stephen S. Bao, Jay M. Kapellusch, Andrew S. Merryweather, Mathew S. Thiese, Arun Garg, Kurt T. Hegmann & Barbara A. Silverstein. *Ergonomics*, 2016;59(2):179-94.

**2018:**

- Active hiring of additional OIPRT faculty.
- OIPRT students Andria Thatcher and Onwuka Okorie having committee approval and beginning on their dissertations, with expected defense in Spring 2019.
- Successful recruitment of a OIPRT student, Uchenna Ogbanya.
- Dr. Andrew Merryweather was promoted to Associate Professor with award of Tenure.

**Program Deliverables**

The OIPRT Program involves students in conducting in-depth literature searches, research and data analyses for development of information for a variety of occupational health exposures. Examples of projects include evaluations of: i) impairing medication use in the commercial truck driving population and their associations with crash risk; ii) effect modification of personal psychosocial factors on the relationship between work organizational factors and lateral epicondylitis; iii) accident risks from multiple medical conditions; iv) exposure monitoring device to monitor back compressive forces using a wearable system; and v) predictive relationships between opioid use and long term disability.

**Publications 2013-2018**

The OIPRT Program has produced the following publications since 2013:

- 74 peer-reviewed publications
- 5 book chapters
- 15 posters
- 9 occupational health guidelines

**Program Future Plans**

In May 2012, the State of Utah Board of Regents gave final approval to begin a Doctor of Philosophy (PhD) degree program in Occupational and Environmental Health (OEH) for the University of Utah (UUtah) RMCOEH. This PhD in Occupational and Environmental Health has 3 emphases: 1) Occupational Injury Prevention (OIP), 2) Industrial Hygiene (IH), and 3) General Occupational and Environmental Health (Gen OEH). This improved the OIPRT program's training for RMCOEH students by allowing greater breadth and depth of OIP-specific curricula to be developed and implemented. As of July 2017, there are three full-time students in the OIPRT program with two students in the OEH doctoral Program with OIPRT's Occupational Injury Epidemiology emphasis and one PhD in Mechanical Engineering in the OIPRT's Occupational Safety Engineering's emphasis who are progressing on schedule. As noted above, one slot is open with a prospective, underrepresented minority student for matriculation in January 2018 already identified.

The UUtah Board of Trustees approved a new Graduate Certificate in Occupational Safety and Health (COSH) Program in August 2013. This certificate program has five areas of emphasis, one of which is Occupational Health, and another is general, without emphasis. Each emphasis area requires 15 to 17 credit hours of graduate credit course work, and each has a set of 2 to 3 core courses, with the remaining courses to be taken in the applicable emphasis area. One student earned a Graduate Certificate in OEH with emphasis in IH in 2014 and 2 in 2016. At present, there are no students currently enrolled in this certificate program, but this is an area that is being reviewed for how to best increase recruitment. This also is another avenue to recruit further students into the OIPRT Program.

An undergraduate Bachelor of Science (BS) degree program in Occupational Safety and Health is planned and initial classes have begun, with the first Introduction to OSH class already having been taught in 2016. In addition to producing bachelors training safety professionals for industry, this Program is expected to especially assist the OIP, E&S, and IH programs with graduate student recruitments for each of their graduate degree programs. The plans for developing this new BS degree program are based in part on the results of the NIOSH U.S Workforces survey (2011).

### **SUMMARY of OIPRT PROGRESS in the Past 5-Year Period**

#### **We have made major progress in the past 5-year period:**

- (1) Markedly increasing our publication rate from 5/year for 2007-12 to 17/year for 2013-18;
- (2) Increasing numbers of OIPRT trainees and graduates;
- (2) Implementing a successful PhD in OEH (OIP emphasis) curriculum
- (3) Hybridization of curricula and development of new courses
- (4) Increased the numbers of full-time, terminally degreed OIPRT faculty by one
- (5) Expanding research training and experiential learning opportunities for students
- (6) Developing extramurally funded research in trucking safety and occupational epidemiological investigations
- (1) Developing more state funding (e.g., SB15 Eddie Mayne Funds).

# OCCUPATIONAL MEDICINE

## Progress Regarding Goals and Objectives from Last Cycle

The OM Program met and surpassed almost every goal and objective in the 2013-2018 grant period. Many objectives are naturally ongoing in addition to “accomplished.” Our greatest achievements are:

- (1) Advancements in the OM Academic Program (courses and rotations),
- (2) Enhancing an active recruitment program to increase OM resident quantity and quality,
- (3) Improvements in our NORA research programs, and
- (4) Markedly higher publication and presentation productivity with resident authors.

### **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.**

**Accomplished.** In 2009, the OM residency was again accredited by ACGME for the 5-year maximum. There were **no** citations **or** negative comments. ACGME revised its procedures and extended that to a 10-year accreditation. Our next accreditation site visit is scheduled for 2019.

#### **Objective 1.b. Continually review and improve the quality of OEH instruction.**

**Accomplished.** Faculty meet monthly to evaluate the CQI processes including analyzing the curriculum, devising strategies to improve instruction, and planning implementation and evaluation(s). There have been numerous changes over time including: (1) implementation of the MOH program; (2) construction of an *Intro to Occupational Epidemiology* course; (3) development of a skills seminar series to, e.g., practice eye foreign body removals; (4) development of new rotations (e.g., Sports Med); and (5) incorporation of training in Utah Miner’s Clinic. A significant curriculum change in the MOH includes hybridization of nearly every MOH course with markedly improved satisfaction, depth of learning, and retention among the residents.

#### **Objective 1.c Provide excellent training opportunities.**

**Accomplished.** The OMR program provides the highest quality training available. We are one of the few programs that continues to maintain the breadth of rotations for OMRs (e.g., industry, OM clinics, health departments, NIOSH, etc.). Nearly all (96%) residents have passed the ABPM exam in the current grant period. We encourage new rotations that provide unique and valuable learning opportunities. Industrial and population-based rotations included: Chevron, NIOSH, U.S. OSHA, Puget Sound Naval Shipyard, NASA, New Mexico Toxicology Association, Idaho National Labs, UT Department Health, UT DEQ, and Workers Comp Fund of Utah.

#### **Objective 1.d. Provide for OEH training of medical students and residents in other specialties.**

**Accomplished.** We augmented our ongoing involvement in training others. We are co-course faculty for the medical students’ MS1 and MS2 Evidence-based Medicine course, teach them Environmental Health, and provide MS2s with longitudinal rotations. Medical students and other residents, including residents from other institutions from across the country, are provided OM rotations. Our highly successful program has created added medical student interest in OM! Program faculty also provide instruction to Family Medicine (FM) residents (2x/monthly teaching sessions), Internal Medicine (IM), and PMR residents with plans to teach other residents (e.g. Orthopedic Surgery). We facilitated the FM residency’s new rotation in Community and Preventive Medicine to have an option of spending two weeks in the OM Clinic. We support numerous summer medical student research projects, some with publications(!)

#### **Objective 1.e Train and graduate ≥2 OM residents each year qualified to take the ABPM Board exam.**

**Accomplished.** The OM residency has graduated 3-5 residents each year since 2012. The program had 3 graduates in 2017-2018. The OMR is approved for 10 residents in each year (20 total).

#### **Objective 1.f. Train qualified individuals who are sponsored by other agencies.**

**Accomplished.** Residents are supported with funds from NIOSH, VAMC, UUtah GME, HRSA and our clinics. Additionally, in the past 5 years, 4 residents from the U.S. Air Force Residency in Aerospace Medicine (RAM) Program completed our MOH. This is largely due to our highly acclaimed and innovative MOH curriculum that allows completion in 1 year (as the USAF requires). Their presence enriches the OM curriculum.

#### **Objective 1g. Enhance current educational offerings.**

**Accomplished.** OEH courses use Canvas, an internet based tool, to post lectures for hybridized courses, other content, administer exams, and evaluate residents. The RMCOEH’s resident website section has a library of resident presentations. We have a library of OM Grand Round presentations. We videotaped our

standardized musculoskeletal exams of the upper extremity and low back. We provide annual procedural skill sessions each summer including advanced suturing, slit lamp exam/foreign body removal, casting/splinting, joint injections, etc. This past grant period, we also developed a Certificate Program in Occupational Health.

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

### **Objective 2a. Emphasize NORA-related areas.**

**Accomplished.** We emphasize NORA, r2p, and WorkLife Initiative projects. We have two major, prospective cohort studies in data analysis phases (upper extremities and LBP; >100M data pts. each) available for residents to analyze for another 5+ years. Available studies also include: (i) Two truck drivers' health studies in data analyses; (ii) a consortial study of CTS risks across 6 cohorts; (iii) public and (iv) industry-funded projects on air pollution, mining, minerals processing, and chemotherapeutics. Others in start-up phases.

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

**Accomplished.** Residents are required to complete a research project. Besides the excellent existing datasets above, residents may pursue independent research or participate in an industry or preceptorship site's research project. For example, two residents were awarded pilot grant funding with faculty preceptors for the following research: 1) barriers to breastfeeding in the workplace, and 2) acupuncture and upper extremity disorders. Clinical research projects are also possible. To facilitate this, residents are required to complete OEHS 6910 Project Research (2 credits) as part of their MOH degree. Since 2015, we have incorporated a Technical Writer, which markedly increased the publication rate by improving writing skills.

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

### **Objective 3.a. Continue to enhance OM consultative services.**

**Accomplished.** Consultations have more than doubled through our OM clinic over the last 5 years.

### **Objective 3.b. Expand clinical and OEH services.**

**Accomplished.** Residents learn by managing OM patients under OM faculty supervision in all of our clinics, including: (1) Two full-service OM clinics providing primary to secondary patient care for our own institution, businesses and municipal clients with clinical services including acute and continuity care of injured and ill workers; (2) a tertiary consultative clinic; (3) industrial consultative service staffed by OM faculty at several local businesses; (4) evaluating Federal Occupational Health cases (beginning 2017); and (5) the Utah Miner's Clinic.

### **Objective 3.c. Increase CE and maintain outreach activities. Conduct 6+ training programs/year.**

**Accomplished.** OM faculty increased CE and Outreach efforts and will maintain these. Drs. Hegmann and Wood continue to teach ACOEM's Commercial Drivers Medical Examination (CDME) course, having founded it along with Natalie Hartenbaum, MD, MPH since inception (1995); in this grant period, we trained many examiners to meet certification requirements of the FMCSA's National Registry. Faculty and residents always participate in the NORA New/Young Investigators Symposium with residents producing many presentations and abstracts. Dr. Wood teaches at the NIOSH approved Spirometry course several times each year. OM Residents present on health effects of asbestos and asbestos medical surveillance during RMCOEH asbestos contractor/supervisor CE courses (~10x/yr). OM Residents also provide lectures on Occupational Lung Diseases to miners through the Miners Hospital.

## **Goal 4. Accomplish Strong Interdisciplinary Collaboration**

### **Objective 4.a. Augment current interdisciplinary teaching activities.**

**Accomplished.** The OM program collaborates extensively with other disciplines in teaching and several courses are team taught with faculty from different OSH disciplines. *Introduction to Industrial Toxicology and Physiology* has been co-taught by Drs. Wood (OM) and Handy (IH). Drs. Pahler (IH), Blowski/Merryweather (E&S), and Wood (OM) have very successfully implemented the summative course, *OSH Solutions*, which takes real-world businesses' OSH problems and solves them with multidisciplinary teams of students under close faculty supervision. Students also present the solutions to the businesses and the projects analytical results at the annual NORA New/Young Investigators Symposium.

### **Objective 4.b. Foster interdisciplinary research efforts.**

**Accomplished.** The OM program collaborates extensively with other disciplines in research activities. Nearly all major RMCOEH research is interdisciplinary. The 4 MSD cohort studies involve OM, E&S and OIPRT. The two trucking studies include OM, OIP and E&S. IH faculty welcome OM participation in their respiratory protection studies. A HRSA Equipment and Training Grant has allowed residents to develop state-of-the-art

training in functional capacity evaluation and work with OIPRT, E&S and TRT faculty and graduate students to explore clinical applications and research into musculoskeletal function and disorders.

### **OM Program's CQI Program for the Academic Program** (Brief Description)

The OM Program has used, and continues to use an adaptation of the RMCOEH's Continuous Quality Improvement (CQI) program that uses numerous sources of data and feedback to provide ongoing guidance to improve the OM Program. These include:

- a. Immediate feedback from students and residents.
- b. Course evaluations
- c. Ongoing discussions and OM faculty meetings on methods and improvements in course content.
- d. Clinical Competence Committee meetings
- e. Program Evaluation Committee meetings
- f. OEH Programs faculty meetings and annual faculty retreat
- g. Graduate surveys of residents and students
- h. OM Alumni/Resident network
- i. The NORA agenda and any other NIOSH information on OM needs
- j. OMR Task Force (a NIOSH collaborative working group)
- k. ACGME's Milestones
- l. Benchmarking against other OM programs
- m. OM Program Director's meetings
- n. ACOEM's Academic Section meeting information
- o. 2011 NIOSH Workforces survey information, especially regarding OM and needs of graduates
- p. Residency Advisory Committee (RAC), (2+ meetings/year). The RAC provides input, ideas, and methods for improving both existing courses and recommendations for future curricular needs.
- q. RMCOEH Advisory Board. At least 2 meetings/year.

### **A Few Progress Highlights, Bulleted by Academic Year (please see Tables for graduate numbers)**

#### **2013-2014:**

- **New Faculty:** addition of Kelli Graziano, MD, MOH as OM faculty with role of clinical faculty and course director for OEHS 6504 *Clinical and Behavioral Aspects of Preventive Medicine*.
- **South Jordan Health Center OM Clinic:** opened a second clinical training site staffed by OM faculty.

#### **2014-2015**

- **New Rotation:** Began resident training site at Civil Aerospace Medicine Institute Oklahoma City, OK.
- **ACGME Increase in Residents:** ACGME approved request for increase to 10 residents per year.

#### **2015-2016:**

- **SBIRT Training Grant:** OM faculty Melissa Cheng awarded SAMHSA training grant (\$1 million, 3-year) to develop and implement new Screening, Brief Intervention and Referral for Treatment for substance abuse (SBIRT) curriculum for 7 different Utah health professions.
- **New Rotation:** Started training at Integrated Disability Occupational and HC Consultants in Clinton, PA.

#### **2016-2017:**

- **New Faculty:** addition of Andrew Phillips, MD, MOH as OM faculty with role of clinical faculty and course director for PPMD 6702 *Advanced Topics in Occupational and Environmental Medicine*. Dr. Phillips performs clinical reviews at Workers Compensation Fund.
- **New Rotation:** implemented residents training at SLC VAMC Employee Health Clinic.
- **University of U and UCSF Resident Exchange:** the OMR hosted the UCSF residency program for site visits at industrial sites in Utah in January 2017.
- **SBIRT Training:** Dr. Melissa Cheng awarded follow-on training support of \$200K for Utah healthcare providers.

#### **2017-2018**

- **New Faculty:** addition of Sarang Yoon, DO, MOH as OM faculty with role of clinical faculty and course director for OEHS 6504 *Clinical and Behavioral Aspects of Preventive Medicine*. Dr. Yoon performs clinical reviews, and leads the faculty and resident teams for at Federal Occupational Health.

- **New Rotation:** implemented residents training experience with Federal Occupational Health in Salt Lake City.
- **Resident Wellness:** implemented resident wellness program including group activities such rock climbing, tennis, Boot Camp, and a day of skiing along with an occupational health site visit at Brighton Ski Resort.

### **Program Deliverables**

The OM Program involves residents in conducting research, in-depth and data analyses to develop information for a variety of occupational health conditions and exposures. Examples of projects include: i) Low Back Pain: Quantifying Risk Factors; ii) Upper Limb Musculoskeletal Disorders: Quantifying Risk Factors; iii) Low Back Pain in Commercial Drivers; iv) Preventing Work Injuries and Chronic Illnesses in Truckers; and v) Healthy Eating and Activities in Firefighters, among many others. Information obtained from these studies is expected to improve methods for diagnosing and managing occupational injuries and illnesses, improving worker health, and reducing workplace morbidity and mortality.

### **Publications 2013-2018**

The OM Program has produced the following publications since 2013:

- 78 peer-reviewed publications,
- 3 book chapters,
- 100+ posters, and
- 12 evidence-based, peer-reviewed medical treatment guidelines.

### **Program Future Plans**

The OM Program has achieved demonstrated success addressing all goals over the prior grant period. The Center has a well-established, seasoned faculty with international reputations, broad expertise, and with senior members in key national and international leadership positions. Accordingly, we plan to leverage this expertise to build on our success, further broaden our reach, and lead our specialty into the future. Specifically, there are three areas where we plan to develop and demonstrate impact over the next 5 years: (1) National OM Education, (2) evidence-based curricula development, and (3) research in Health and Wellness as key component of Total Worker Health, and development of resources for addressing the entry of medical students and residents into the OM “Pipeline.”

### **SUMMARY of OM PROGRESS in the Past 5-Year Period**

**We have made major progress in the past 5-year period:**

- (1) Increasing numbers of OM trainees;
- (2) Increasing the numbers of full-time, terminally degreed OM faculty by three;
- (3) Obtaining Board Certification of all eligible full-time OM faculty (one is first-time eligible 10/2018);
- (4) Expanding research training for residents;
- (5) Markedly improving the publication and national presentation rates for residents;
- (5) Developing new extramurally funded research in CTS and a second regarding Low Back Pain, and
- (6) Developing more state funding (e.g., SB15 Eddie Mayne Funds).

## TARGETED RESEARCH TRAINING

\*The Targeted Research Training (TRT) Program was incepted July 2016, thus we provide a 2-year progress report.

RMCOEH's Targeted Research Training (TRT) program was established in July of 2016. It has been highly successful, having already met all first year goals, including filling all available training positions with quality students!

There are 2 PhD programs used by RMCOEH that are used by the TRT program's PhD students:

1. **PhD in Occupational and Environmental Health** (emphases in Industrial Hygiene, Occupational Injury Prevention, General OEH), and
2. **PhD in Mechanical Engineering** (emphasis in Ergonomics & Safety).

The TRT program provides opportunities for students to pursue a track in one of:

- (i) **Exposure Science,**
- (ii) **Transportation Safety or**
- (iii) **Occupational Biomechanics**

Other focus areas are selectively possible (e.g., Mining Safety; Healthcare Worker Safety, Total Worker Health), as the expertise is available at the University of Utah.

The ultimate TRT Program outcome is to graduate ground-breaking, independent researchers in OSH who have received advanced training via a TRT core curriculum, in addition to specialization-specific research curriculum.

The TRT program objectives are mapped to the RMCOEH's four specific Center goals, which are:

- 1.) **Advance superior OSH academic programs.**
- 2.) **Conduct meaningful OSH research.**
- 3.) **Provide exceptional continuing education, service, and outreach.**
- 4.) **Engineer OSH solutions.**

Our progress is detailed for each TRT goal and objective below. **Please Note:** NIOSH funding began July 1, 2016, yet the following were initiated and, in some cases, accomplished in just 1-2 years of existence.

### **Goal 1. Implement a quality TRT curriculum for doctoral students**

**Objective 1.a: Concentrate TRT program efforts on three defined expertise areas: (1) Exposure Science, (2) Transportation Safety, and (3) Occupational Biomechanics.**

As of June 2018, four (4) quality student trainees had completed their second year of the TRT program: two (2) in Exposure Science, one (1) in Transportation Safety, and one (1) in Occupational Biomechanics. All new courses created to support the program are in one of these three defined expertise areas or are multi-disciplinary. Three of the five new core courses (60%) to be created have been developed and taught on multiple occasions. The TRT program has been further integrated with the Pilot/Small Projects Program (PPRT) program to constitute the RMCOEH's current Research Training Core. Accomplished and ongoing.

**Objective 1.b: Target NORA and R2P goals.**

For the first two years of implementation, NORA and r2p goals have been considered in all appropriate discussions and decisions regarding the program. Targeting these goals are discussed during each TRT Program Management & Review Committee meeting (at least quarterly). All discussions on dissertation topics have been NORA-related; a research-to-practice element has also been included in all proposed topics. Initiated, ongoing.

**Objective 1.c: Foster and build upon current strengths in interdisciplinary education.**

The TRT Program has been designed to foster interdisciplinary education. This is also in keeping with the organization and culture of RMCOEH that has robust strengths in interdisciplinary education. Perhaps the best example is the TRT Program's successful implementation of the *Advanced Occupational Health and Safety Solutions* class (initial offering in Spring 2017). The TRT student trainees' main responsibility in the class was

to be the team leader for one of the groups as well as the individual who provided the critique and overall grade for their group (under faculty guidance and mentorship). Accomplished.

**Objective 1.d: Incorporate and promote the TRT Expert Lectureship Series.**

During the first two years of the TRT's implementation, seven (7) external expert lectures were scheduled and delivered. In addition, we have reached out to three (3) more outside expert lecturers, and they have agreed to provide lectures during the 2018-2019 contract year. Initiated, ongoing.

**Objective 1.e.: Sponsor and support a unique Summer Practicum Opportunity.**

All of the four (4) current trainees have been accomplishing practicum opportunities in summers 2017 and 2018. One example of a summer practicum involves working with a State toxicologist on air contaminant research and health outcomes. A second example involves transportation safety research and assessment for several companies. Initiated, ongoing.

**Objective 1.f.: Execute a recruitment plan for diverse trainees to recruit a pool of qualified candidates.**

One (1) of the four (4) current TRT trainees is Black/African-American (25% underrepresented diversity ratio, exceeding 9% rate in HHS Region 8) and all four (4) are women. There is a plan in place to continue to actively recruit from a pool of qualified, diverse applicants. Accomplished.

**Objective 1.g.: Implement a research-oriented, concentration-specific mentoring program.**

Since the inception of this program in July 2016, we have further defined our TRT Program's Mentoring Program (see details above and below). This program begins with pairing a faculty member with the student in the same focus area of exposure science, transportation safety, or occupational biomechanics. Each of the four (4) current trainees has a concentration-specific mentor since his/her matriculation into the TRT program. Accomplished.

**Goal 2: Implement a quality TRT curriculum for post-doctoral trainees**

**Objective 2.a: Create a focused TRT certificate of participation program for post-doctoral trainees.**

Housed within the RMCOEH is a very successful Continuing Education (CE) program. Discussions are underway with the TRT program team and the CE director regarding how to best accomplish this process. The program will tentatively use some of the existing applied research courses offered by CE combined with several of the new TRT courses developed by various faculty. Initiated, ongoing.

**Objective 2.b: The remaining specific aims for post-doctoral trainees (2.b-2.g) mirror the TRT's doctoral specific aims provided above (i.e., 1.b-1.g)**

During these initial two years of funding, this program has admitted and enrolled both PhD and post-doctoral students/trainees. For this cycle, one post-doctoral trainee was admitted and is currently working in the occupational biomechanics concentration.

During these initial years of funding, three (3) new TRT-focused courses were developed and offered during the Spring 2017 term: (1) *Quantitative Exposure Assessment*, (2) *Advanced Occupational Solutions*, and (3) *TRT Seminar*. Student/trainees and their specific advisors planned their TRT Practicum experience in late Spring 2017. All four (4) of these students/trainees began their Practicums during the summer of 2017 and continue to work on data collection, research proposals, and scientific presentations for these experiences into the summer of 2018. Accomplished.

**Progress and Accomplishments**

As of June 2018, our first TRT cohort of four (4) PhD students were on track to complete their second year. We are also happy to report that we filled our post-doctoral student position with a high-quality candidate as planned. The post-doctoral candidate began his appointment in March 2017 after a national search. He is already proving to be a high-quality trainee.

- Of the four (4) PhD students (all full-time) currently in the TRT program, two (2) PhD students are focused on exposure science, one (1) on transportation safety, and one (1) on occupational biomechanics. One (1) of the exposure science students status is continuing in the program on a part-time basis after accepting full-time OSH employment in industry. Currently, this student is on a leave of absence. In essence, this brings some further depth and size to the program.
- In addition, one (1) new post-doctoral student (full-time) was added to the program. The post-doctoral student is focusing on occupational biomechanics.

- The total number of TRT students/post-doctoral trainees is six (6), five (5) of whom are NIOSH-supported.
- In October 2016, Rod Handy, the TRT Program Director, hired Ms. Emilee Eden as the Program Coordinator to assist with creating reports and tracking databases, as well as assist with overall program staff management. This position was partially funded by the TRT award.
- In January 2017 a new course in *Quantitative Exposure Assessment* was introduced as an elective course for the TRT program curriculum. This course provides the student/trainee with an enhanced understanding of the quantitative aspects of worker exposure assessment, concentrating on the research-related issues involving chemical, biological, and physical stressors.
- The TRT curriculum includes two (2) research seminar electives each year. The first of these new TRT seminar courses was successfully conducted in Spring 2017. Seminars include germane lectures presented by outside expert faculty on various research topics. The initial offering of this seminar has been focused on providing the student/trainee with a background in the pertinent history of research in the area of OSH sciences. Since Spring 2017, these seminars have been held each Fall and Spring semester and have been taught by various research experts from each of the three (3) targeted areas of OSH or another area of relevant expertise (e.g., mining safety). These seminars will continue to be offered.
- In January 2017, a new course, *Advanced Occupational Safety and Health Solutions*, was included as an elective course for the TRT program curriculum. This is the advanced course offered in the area of evaluating OSH problems and providing solutions to businesses and is currently restricted to only doctoral students. In the *Advanced OSH Solutions* course, the student/trainee has faculty supervision and mentorship to lead an applied research group on various field projects with business and industry. Nearly all TRT students successfully completed this course. Both the faculty and TRT trainees found the experience to be professionally and personally rewarding.
- Two (2) additional courses were also implemented, both specifically created for the TRT program: *Advanced Occupational Biomechanics* and *Topics in Transportation Safety Research*. These are planned to be delivered during the next grant period, during the 2018-2019 academic year, one during the Fall semester and the other during the Spring semester.
- The TRT Program Management and Review Committee meets quarterly to strategize and plan TRT-related activities. Minutes have been kept for each of these meetings.
- Student/trainees and their advisors planned Practicum experiences in Spring semester (2017), which were completed in Summer and Fall of 2017. Four (4) of the student/trainees participated in the TRT Practicum during the summer of 2017, with one (1) participating in a second practicum during the Summer of 2018. Students/trainees continue to work on data collection, research proposals and scientific presentations for these experiences into the summer of 2018.

### **Student Recruiting Activities**

Active student recruitment continues to be a significant activity within the TRT Program. In this last period from July 2016 to present, program faculty have continued to cultivate contacts with surrounding universities and colleges to build further awareness of the RMCOEH TRT Program. Advertising has also taken place in several outside organizations and employment centers. The results of our recruiting efforts have resulted in the recruitment of the six (6) TRT students/trainees since the beginning of this program. In addition, our diversity recruitment efforts have yielded benefits to the TRT program, evidenced by admitting one (1) student from an underrepresented minority. Additionally, all (4) of the currently fully-TRT-funded PhD students are female.

### **Program Deliverables**

Each student is required to author a dissertation, research manuscripts and publications, and oral and poster presentations. Students are also expected to write and apply for at least one grant to fund their research, at least in part, while being supported on the TRT program. So far, two (2) of the four (4) (50%) current TRT-funded students have introduced their ideas for external funding to the departmental-level research committee for comments and recommendations. The TRT program significantly engages student trainees in research and data analyses to develop information in a variety of occupational health areas. As part of these processes,

students are also taught systematic literature search and synthesis skills. The TRT Program's aims include to assist the student focus on a specific OSH concentration area and provide initial funding for student research.

### **Program Future Plans**

One major component of the TRT program consists of the creation of specialized, doctoral-level research classes. Three (3) classes have already been created and are currently being taught (see above). In addition to these efforts, several other elective classes are in the process of being created and implemented. Examples of these classes include:

- (1) *Advanced Biomechanics*,
- (2) *Advanced Topics in Transportation Safety*,
- (3) *Advanced Technical Writing* (under development by the RMCOEH's Technical Writer, Tracy Rees), and
- (4) several *Research Administration Training Series (RATS)* courses in each of the 3 focus areas.

These classes will provide a more in-depth learning experience for each student in his/her specified concentration as well as provide him or her with knowledge and skills to become adept, state-of-the-art OSH researchers.

A plan to hire an additional post-doctoral trainee was created and implemented during the Spring and Summer of 2018. Interviews were held in June 2018 and a qualified candidate has been selected to join the center in July 2018, thus beginning in the next grant period.

Along with participating in specific elective courses and the summer practicum previously delineated, students are also expected to complete appropriate University of Utah's RATS courses geared specifically towards his/her TRT track. Students will perform outreach to external employers and work a predetermined number of hours with these employers resulting in the student producing a final deliverable, which will be realized through a publication draft, and/or an oral or visual presentation.

In keeping with the RMCOEH's Logic Model, meetings of the TRT Program Management and Review Committee are held to analyze:

- (1) Student progress,
- (2) Student's future plans,
- (3) Active recruitment plans,
- (4) Diversity recruitment,
- (5) Mentorship plans & progress,
- (6) Course(s) management,
- (7) Course quality & evaluations,
- (8) Semester practicum,
- (9) Outcome indicators,
- (10) TRT program evaluation plans,
- (11) Integration with the PPRT program in the RMCOEH's Research Training Core,
- (12) Inputs from the E&S Advisory Committee; IH Advisory Committee; OIPRT Advisory Committee,
- (13) Reporting requirements including to the RMCOEH Advisory Board and NIOSH, and
- (14) The overall program quality.

In these meetings issues are highlighted and addressed. Meetings are held at least once quarterly.

The TRT program is on track to produce a cohort of highly-trained, independent, OSH researchers with advanced skills to address specific NORA and R2P (research-to-practice) needs in Region 8 and beyond.

## CONTINUING EDUCATION

This progress report summarizes accomplishments toward meeting the CE Program's goals for the current grant period beginning July 2013 through June 2018. 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 OEHS professionals and to others. Accomplished.** This goal was achieved through four major objectives: 1) Provide short-term OEHS post-graduate training (2+ per core discipline/year) on current topics to 400+ participants/year; 2) Facilitate exchange with other OEHS professionals through course co-sponsorship with other organizations involved in OEHS; 3) Obtain highly-qualified faculty from private and public sectors to bring both theoretical and practical knowledge to the issues presented; and 4) Hold 6+ courses/year regionally outside of SLC.

The first objective was accomplished: From July 1, 2013 through June 30, 2018, **18,720 trainees attended 948 CE activities!** We delivered more than two courses per core. The distribution of the course attendees follows:

a. Trainees in Attendance (current budget period)

Most (n= 8,954, 48%) came from industry, 2% (n= 3,981) came from government agencies, and 21% (n= 4,020) were from academic institutions. The remainder of course participants (10%, n = 1,765) were from allied occupational safety and health employers and labor representatives, including construction and renovation, chemistry, insurance, law, physical therapy, occupational therapy, wellness coordination, and private consulting and contracting.

b. Categories of Participants

During the current grant period (July 1, 2013 – June 30, 2018), attendees were distributed among the four core professions as follows: MD=6% (n= 879), NURS=4% (n= 556), HYG - 21% (n= 4,017), SAFETY – 32% (n= 5,838) and OTHER – 37% (n=6924). Based on AAOHN's data, Region 8 has ~150 OHN members. In view of these low numbers, OHN representation in regional CE courses will likely be low until more OHN education program(s) are implemented, which is a long-term goal of the RMCOEH.

Distance-Based Education: The CE Program continued to take steps to expand distance-based education efforts utilizing technology. Hard copy distance learning courses continued to be successfully offered. These courses included *Accident Investigation; Analysis & Prevention; Behavior-Based Safety; Environmental Strategies; Environmental Management in the 21<sup>st</sup> Century; Fundamentals of Industrial Hygiene; Groundwater Contamination Remediation; Practical Aspects of Management; Successful Project Management; Time-Based Management: A Tool for Improvement for the Health and Safety Professional; and Understanding and Managing Legal Issues: Safety Emphasis.*

The CE Program made further advances in developing on-line distance education programs. The most notable success is the online course (*Professional Ethics and the Practice of IH*) designed to meet the ethics training requirement established for IHs. It can be taken anytime and incorporates videotaped lectures with selected readings. Proficiency is demonstrated through quizzes that are progressively completed as the student moves through the course. Over 300 people have taken the course since its initial offering in 2009!

In addition, Ms. Crandall has coordinated with Dr. Thiese to utilize the online graduate-level Occupational Epidemiology academic course content as the basis for a modular continuing education course. The implementation of this course has been delayed, so it was not offered during the 2013-2018 grant period.

Finally, to demonstrate use of technology and social media, Dr. Lillquist, Course Chair for the Comprehensive Review of IH, established a blog site on LinkedIn for those who have taken our review course and still seek added input to prepare for the ABIH examination. In addition, the Center now has an active Facebook page and the CE program has used the site to disseminate information regarding upcoming courses.

**Minority Populations:** We have made concerted efforts to identify underserved populations at our courses. Since 2008, a demographic form has been included in the course packets with completed forms gathered and data compiled. The highest race/ethnicities reported were white 90% (90.7% regional comparison population, and Hispanic/Latino (n = 197, 5% (8.7% regional comparison). As the second highest underserved population in RMCOEH CE courses, the program targeted marketing and needs to the Hispanic/Latino population although the political climate discouraged attendance.

The RMCOEH identified needs to conduct an *Asbestos Worker* course refresher course in Spanish. To accommodate this need, the program applied for and received approval from the State to conduct the course; the first course was held in 2008, and is now primarily conducted on a contract basis. Asbestos workers refresher courses had been held annually but, with drop in demand, they were only offered on a contract basis.

Finally, as an OSHA Education Center, the CE Program is provided with numerous brochures and pamphlets that have been translated into Spanish. Two of the most notable and widely applicable include “Worker Rights” and “Employer Rights and Responsibilities after an OSHA Inspection.” These brochures were made available at all OSHA courses. Although the courses themselves are not conducted in Spanish, these Spanish-translated resources were made available to attendees who might find them useful, including those who conduct training in Spanish.

**Facilitation with other OEHS professionals through course co-sponsorship with other organizations involved in OEHS.** Throughout the grant period, the RMCOEH collaborated and co-sponsored programs with other organizations with a shared interest in promoting OEHS. 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. We, collectively, planned and conducted the Utah Conference on Industrial Hygiene and Safety every year during the 5-year grant period. We also collaborated with the Utah AAOHN Chapter (UAOHN) to develop and promote courses for nurses including a fall seminar each year.

**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 has 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 participated in the CE program. In addition to RMCOEH faculty participation in CE courses, **the CE Program enjoyed faculty support from 306 highly qualified adjunct faculty each year representing both the private and public sectors!** The entire team of trainers included a wide range of expertise and knowledge, including practicing IHs, safety professionals, occupational physicians and nurses, hazardous materials and other technical specialists. Many of these faculty members have departmental adjunct faculty appointments and represent a wide cross-section from industry, government agencies, and academic institutions.

**Hold ≥6 courses per year outside of Salt Lake City:** We sponsored courses in CO, ID, ND, NM, MT, WY, although courses held outside of SLC are very cost-intensive (long distances on airline monopoly routes) and attendance is variable. Numerous courses were held around UT (Clearfield, Dugway, Moab, Murray, Orem, Park City, Provo, Springdale, St. George, Tremonton, and Woods Cross) to accommodate attendees from surrounding states that might not otherwise be willing or able to attend in SLC.

**Goal 2. Conduct research to identify CE training needs and impact. Accomplished.**  
**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.** Data have been obtained from the needs

assessment that were conducted in 2016 in which all ERC CE programs participated along with the 2015 assessment that the Center conducted on its own. These assessments served as the basis for new course development and retention of existing courses for the grant period. In addition, the most recent RMCOEH graduates survey included questions directed to CE needs.

Additionally, needs assessments were distributed at each RMCOEH-sponsored training course and summarized annually. Several new courses were added to the schedule as a result of the needs assessment activities including *Analytical Tools for Evaluating Musculoskeletal Hazards*, *Managing Change in Safety and Health Programs*, and *Indoor Mold*. A new set of courses that were offered in late 2017 included 1) *Construction Safety and Health Programs in Mining*; 2) *IH for the Safety Professional*; 3) *Musculoskeletal Risk Assessment Using Fatigue Failure Methods and Increased Personalization*; and 4) *Taking a New Look at Preventing Slips, Trips and Falls*.

The CE program sought input from the Center Executive Committee and the RMCOEH Advisory Board with the CE Advisory Committee as an integral part of the strategy used to evaluate the program's offerings. Most recent meeting focused on the impending retirement of the CE Director and potential transition strategies.

Finally, regulatory and licensing requirements as well as annual review of BLS injury and illness statistics were used to gauge the trends driving the need for future training.

**Goal 3. Provide superior service and outreach that enhances and promotes the field of occupational and environmental safety and health. Accomplished.**

**This goal was supported by two objectives: 1) Increase awareness and understanding of OEHS issues throughout the region and 2) Support activities that serve the needs of the target populations.**

The CE Program promoted, provided registration support, and issued certificates for the Paul S. Richards Memorial Lectureship, which is the keynote address for the annual NORA symposium for the past 5 years. This is a free public service that is supported through an endowment. Presenters during the current grant period were:

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- ✓ Barbara Silverstein, PhD, State of Washington's SHARP (2014)
- ✓ Roy Rando, Sc.D., Tulane University (2015)
- ✓ David Rempel, MD, University of California, San Francisco (2016).
- ✓ Bradley Joseph, PhD, CPE, MH, Ford Motor Company (2017)
- ✓ James Lockey, MD, University of Cincinnati (2018)

The Center also promoted awareness of the field by exhibiting at national and regional professional association meetings as funds have permitted including the AIHCE and the Utah Conference on Safety and Industrial Hygiene. It also exhibited at the National ASSE meeting held in Denver in June.

Finally, capitalizing on electronic delivery systems, the CE Program distributed monthly course notifications to an electronic mailing list that it has steadily built over the last 10 years (n = over 9,000). It also listed its courses in the semi-annual RMCOEH Newsletter.

Activities that support the needs of the target population included courses that help practitioners prepare for professional certification. These included programs such as the *Comprehensive Review of (IH)* and the CAOHC-approved *Occupational Hearing Conservation* course. Courses were also designed to maintain professional certifications and help meet practitioners meet licensure requirements. CE credits are a major need of the target populations and the CE Program has long provided appropriate specialty credit, as well as CE credits to meet this need. Credits were awarded by the American Board of Industrial Hygiene for most courses. The CE Program also obtained Utah Nursing Association (UNA) credits for the Compensable Disability Forum to assist nurses who are not OHNs with licensure. Additionally, several of the CE Program's courses underwent formal review and were authorized by the Utah Division of Occupational Licensing for approved hours to meet contractor, plumber and electrician licensing requirements.

An intensive short-term certificate program was offered for the OSHA courses. It requires completion of a set of core courses complemented by a set of electives from which participants can choose. This is intended to help round out his/her certificate based on current employment and interests. In addition, online academic course content is being made available for continuing education use. Five courses (*Occupational Epidemiology, Occupational Injury and Diseases, Management, Toxicology, and Fundamentals of Industrial Hygiene*) are planned as the basis for an online safety and health certificate program. It will be made available for both academic and continuing education credit.

The Center also worked with other ERCs and other OSHA Training Centers to meet participants' needs. Attendees were referred to other Centers if their training needs could not be met by our program. In addition, the ERC CE Directors met annually and openly shared ideas about the development, marketing and presentation of programs.

As noted previously, the RMCOEH annually co-sponsored seminars with the Utah Chapter of AAOHN (UAOHN). RMCOEH donates its share of the event's proceeds to support the ongoing activities of the UAOHN, especially as the organization is small.

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

Finally, as a service to RMCOEH students, CE courses are offered 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. Accomplished.**

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

Interdisciplinary experiences were provided through the majority of CE courses and conferences. In addition to interdisciplinary faculty support, IH and safety professionals frequently intermixed in IH and safety courses. OM and nursing professionals intermixed in medical-related course offerings. For example, of the 359 trainees enrolled in IH courses, there were 110 IHs, 93 safety professionals, 6 nurses, 1 physician, plus others. In addition, there are different employer groups represented in the courses. These include private industry, federal, state, and local government, and academia offering different points of view and perspectives that allowed others to understand an issue from more than one vantage point, allowing an open dialogue similar to what one might find at a worksite. Examples of interdisciplinary activities include the following:

- a) Annual Utah Conference on Safety and Industrial Hygiene was a mix of approximately 300 EHS professionals attend this annual event. The primary target audience is IH and safety professionals, the most recent (2017) conference drew 102 IHs and 194 safety professionals with 42 identified as "Other."
- b) The Annual Compensable Disability Forum was another large multi-disciplinary effort. The target audience included insurance adjusters, claims managers, risk managers, employers, human resource managers, physicians, therapists, case managers, and safety practitioners. Of the 189 trainees enrolled in the forum in January 2018, 2 were MDs, 23 were nurses, 1 was an IH, 8 were safety professionals, and the majority of the remainder were insurance professionals specializing in compensable disability issues such as return-to-work.

The RMCOEH used needs assessment surveys and evaluation instruments to identify interdisciplinary training needs. It also engaged in service activities that were applicable across the disciplines. The "Richards Lectureship" and exhibiting at national meetings were both interdisciplinary efforts. Certification maintenance credits were awarded across the disciplines with each course as appropriate. **Center graduate students were eligible for reduced tuition at CE courses.**

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## PEER-REVIEWED GUIDELINES and BOOKS

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## **PROCEEDINGS**

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