

A. COVER PAGE

Project Title: The Environmental Health Science Program at Western Kentucky University	
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Final Closeout Report (WKU TPG #10637)

Recent Implementation: 7/01/2021 – 06/30/2022

During the most recent year of implementing the NIOSH TPG (07/01/2021 – 06/30/2022), the program has seen significant successes in meeting its programmatic goals and objectives. These highlights are summarized below:

1. Through this implementation period of the Training Program Grant (TPG) at Western Kentucky University, five undergraduate student trainees and seven graduate trainees were supported, all are United States citizens, Kentucky residents, and full-time students in the Environmental & Occupational Health Science (EOHS) programs. A total of seven NIOSH supported trainees graduated during the project period (07/01/2021 – 06/30/2022), three undergraduates and four graduate students. Students received stipends and tuition under the NIOSH TPG as shown in the tables below.

Undergraduate Student Trainees

Name	Ethnicity	Sex	Amount (\$)
Jayden Bickett	White	Female	6,000
Christopher Bussell	Black or African American	Male	6,000
Allyson Garretson	White	Female	6,000
Ariel Powers	White	Female	6,000
Jackson Woodall	White	Male	6,000

Graduate Student Trainees

Name	Ethnicity	Sex	Stipend Amount (\$)	Tuition Amount (\$)
Ashley Adams	White	Female	9,000	5,500
Cody Ashley	White	Male	9,000	5,500
John Bevil	White	Male	3,000	1,833
Lori Blair	White	Female	9,000	5,500
Darwin Harris	White	Male	9,000	5,500
Taylor Heffelfinger	White	Female	9,000	5,500
Lamin Sanyang	Black or African American	Male	4,500	2,750

2. The B.S. in Environmental and Occupational Health Science had an initial accreditation visit from the National Environmental Health Science and Protection Accreditation Council (EHAC) in April of 2022. A self-study was prepared for this meeting and was approved with minor edits. During the EHAC annual meeting in Spokane, WA on June 26-27, 2022 the program was given approval for full accreditation for a six-year period through June 2028 by the EHAC Board of Directors. The program is listed on the EHAC Undergraduate Accredited Degree Programs list at <https://www.nehspac.org/about-ehac/accredited-programs-ehac-undergraduate-programs/>. Additionally, the M.S. in EOHS is a fully

accredited program through EHAC with an accreditation period through June 2025 (<https://www.nehspac.org/about-ehac/accredited-programs-ehac-graduate-programs/>).

3. Four undergraduate and seven graduate students, and the EOHS program faculty, Dr. Taylor, Dr. Sanyang, Dr. Macy, and Ms. Basham attended the 2021 NIOSH Pilot Research Project (PRP) Virtual Symposium organized by the University of Cincinnati's Department of Environmental Health in collaboration with the NIOSH Education and Research Center (ERC) in October 2021. The interdisciplinary focus of the symposium makes the PRP a unique training opportunity for students in the field of occupational safety and health and for faculty career development. Dr. Taylor and Dr. Sanyang also serve as steering committee members of the University of Cincinnati ERC Pilot Research Training Program (PRP).
4. The TPG has provided opportunities for students that have resulted in the success of graduates entering the occupational safety and health field or closely related allied fields. The graduate program has been steadily growing through the 2021/2022 academic year. Therefore, the program will continue to provide degree conferrals in the next one to two semesters. The M.S. in EOHS had 24 students in the program during the annum. The B.S. in EOHS has stabilized and had 18 students in the program during the 2021/2022 academic year. We have documented that the undergraduate EOHS program is a discovery major with most students entering the program as a sophomore or junior.
5. The WKU TPG faculty have implemented a strategy to recruit students, with a focus on recruitment of underrepresented minority trainees, into the B.S. in EOHS by offering ENV 120 Introduction to Occupational Safety and Health and ENV 280 Introduction to Environmental Science as dual credit courses for high school students. Students throughout the south-central region of Kentucky can take these courses as high school students and use the credit to fulfill requirements in their current program of study and at WKU. Again, students are introduced to the B.S. in EOHS, and to the fields of Occupational Safety and Health, and Environmental Health during these courses. Each semester, EOHS faculty offer at least one section of each course in an online high-capacity format, 50 or more students. The faculty will be working to fully develop a recruitment strategy with local High Schools in the FY 2023 implementation period of the TPG.
6. Due to adjustments for COVID-19, we had increased opportunities for in-person training opportunities provided on WKU's campus and at field sites to TPG trainees and students in the EOHS baccalaureate and graduate programs. During the annum students participated in conducting field studies to include firefighter health research, hazardous material commodity flow studies in Northern Kentucky and Pulaski County, KY, and stormwater monitoring and assessment research. Likewise, students were engaged in Occupational Safety and Health internships throughout the region with various businesses and industries.
7. There continues to be numerous virtual opportunities for faculty, trainees, and students in both the B.S. in EOHS and M.S. in EOHS to participate in career development. These have included webinars offered through NIOSH, NIOSH ERCs, partner institutions, and at WKU. A few of these opportunities are indicated below:
 - i. Western Kentucky University, Center for Environmental and Workplace Health, Environmental and Occupational Health Seminar Series, Careers in Occupational Safety and Health: Career Paths, Job Outlook and Requirements, Professional Certifications, and Job Search Process – Dr. Ritchie Taylor – March 4, 2022

- ii. Western Kentucky University, CHHS Research Seminar Series, Center for Environmental and Workplace Health, Engaging Students and the Community through Focused Research, Training, and Outreach – Dr. Ritchie Taylor, Dr. Gretchen Macy, Dr. Cecilia Watkins, Jacqueline Basham, MPH, and Dr. Edrisa Sanyang - February 12, 2022
 - iii. Harvard T.H. Chan School of Public Health, NIOSH ERC, Environmental and Occupational Medicine and Epidemiology Program,
<https://www.hsph.harvard.edu/erc/seminars-and-events/>
 - iv. University of Cincinnati, NIOSH ERC, Occupational Safety and Health Resources and Webinars - <https://med.uc.edu/depart/eh/centers/erc>
8. Fields trips and applied research experiences are provided to TPG trainees in the EOHS programs to increase interest and knowledge of the Occupational Safety and Health (OSH) fields. Field trips are attended by EOHS faculty and students. Field trips and applied research experiences that occurred during the reporting period included the following:
- Green River Firefighters Association (GRFA), WKU Firefighter Health Community Based Participatory Research, Bi-monthly Meetings in September, November, January, March, and May of 2021, TPG awardees and EOHS students with Dr. Ritchie Taylor and Dr. Edrisa Sanyang. Dr. Taylor, Dr. Sanyang, and students participated in the GRFA bi-monthly meeting discussing future research and working with the firefighter community to maintain the research focus for the firefighter health study for 2021.
 - Participation in the Bryant Stiles Firefighters Officers School, February 25-27, 2022. Dr. Taylor, Dr. Edrisa Sanyang, Dr. Gretchen Macy, Ms. Jacqueline Basham, and student Ashley Adams attended. The TPG faculty and student presented research on firefighter health and had a booth open for firefighters to ask questions about the NIOSH TPG at WKU and associated research.
 - Highlights from research can be seen in WKU News items at <https://www.wku.edu/news/articles/index.php?view=article&articleid=10582>, <https://www.wku.edu/news/articles/index.php?view=article&articleid=10414>, <https://www.wku.edu/news/articles/index.php?view=article&articleid=10257>, and <https://www.wku.edu/news/articles/index.php?view=article&articleid=9893>.
 - On February 25, 2022 WKU NIOSH TPG trainees attended an applied research field exercise with WKU TPG PI, Dr. Ritchie Taylor at Felker Brothers Corporation in Glasgow, KY. The students worked with Dr. Taylor to evaluate the Stormwater Pollution Prevention Plan for the industrial site. Also, students conducted an assessment of the stormwater monitoring outfalls and developed a site recommendation for future stormwater pollution prevention. The students worked directly with the Corporate Safety and Environmental Administrator, Ms. Candice Baker to conduct the assessment.
 - May through June, 2022 WKU TPG trainees participated with WKU TPG faculty, Dr. Ritchie Taylor (PI), Ms. Jacqueline Basham, Dr. Gretchen Macy, and Dr. Edrisa Sanyang, to conduct Hazardous Materials Commodity Flow studies in Pulaski County, KY and in Northern, KY in a four county area. The studies included transportation hazmat placard surveys, fixed facility hazmat surveys, and hazmat incident mapping and analysis. This study was conducted in partnership

with Kentucky Emergency Management through U.S. Department of Transportation funding.

9. Recruitment events included presentations in the general education courses for the B.S. EOHS program, ENV 120 Introduction to Occupational Safety and Health, and ENV 280 Introduction to Environmental Science, in summer 2020, fall 2020, Winter 2021, and spring 2021 semesters. These courses primarily have freshmen and sophomore students, as well as dual credit high school students. Dr. Taylor, Dr. Sanyang, Dr. Macy and Ms. Basham taught these courses and provided an opportunity in sections taught for students to learn about the Occupational Safety and Health, and Environmental Health fields, ask questions, and then arrange a virtual advising session, if interested. The EOHS programs were promoted at multiple University sponsored recruitment events during the year including:
 - WKU Majors & Minors Fair – September 29, 2021 – University Event – Ms. Basham presented information to current WKU students about the EOHS program
 - Head for the Hill – October 22, 2021 – University Event – EOHS faculty members presented information to high school juniors and seniors about the EOHS program
 - College of Health & Human Services Career Day – November 5, 2021 – College Event – EOHS faculty members provided an interactive experience in epidemiology to local high school students who have indicated an interest in a career in health and human services. Students were also provided an informational packet about the EOHS programs.
 - Barren County High School College Fair – January 11, 2022 – University Event – Ms. Basham presented information to freshman, sophomore, junior and senior high school students about the EOHS programs
10. Enrollment in the Occupational Safety and Health (OSH) certificate has continued to be stable during the period of performance for the TPG. The OSH Certificate is used to recruit students into the EOHS programs. This is an undergraduate certificate that can be completed by students from majors throughout WKU. A total of seven students are now enrolled in the OSH certificate, and four students graduated from the certificate during this reporting period. This program has experienced stability due to the NIOSH TPG.
11. A companion certificate to the M.S. EOHS is the Graduate Certificate in Environmental Health and Safety (EHS). This certificate can be attained by graduate students at WKU in combination with the M.S. EOHS or other degree programs. As a recruiting tool, the Graduate EHS certificate allows students that do not meet all M.S. EOHS admission requirements an entry point by completing the certificate with a 3.0 GPA or greater.
12. TPG faculty have developed ten proposals for grant funding and participated in multiple research studies during the project period.
 - The greatest proposal accomplishment during this period of performance was the completion of the WKU NIOSH TPG competitive renewal application that received an Impact Score of 20. This was a great achievement and another WKU faculty member, Dr. Katrina Burch from the WKU Department of Psychological Sciences, joined the WKU TPG team. Dr. Burch is an expert in the field of industrial psychology and total worker health. Dr. Burch was trained at a TPG in Occupational Psychology.
 - A great milestone to report is that all proposals submitted by the WKU TPG team for funding were successful. Proposals developed include funding through the Central Appalachian Region NIOSH ERC at the University of Kentucky that

funded a Statewide Assessment of OSH Professionals Training Needs directed by Dr. Gretchen Macy at WKU. Research includes a study to assess work related violence encountered by young minority workers in South Central Kentucky funded by the University of Cincinnati NIOSH ERC, stormwater management projects funded by two separate county stormwater municipalities in Tennessee for a total of three projects, and a hazmat commodity flow study in two regions of Kentucky funded by Kentucky Emergency Management and U.S. Department of Transportation.

- Dr. Sanyang, Dr. Taylor, and Dr. Macy developed a proposal for a pilot project through the University of Louisville, Center for Integrative Environmental Health Sciences that was awarded in January of 2021. The study will assess the impact of COVID-19 on both career and volunteer firefighters. This research will include a partnership with the University of Louisville and Texas A&M University. A recent interdisciplinary proposal was developed between faculty in the EOHS program in the WKU Department of Public Health and faculty in the WKU Department of Chemistry. This proposal was submitted to the NSF Major Research Instrumentation Program to fund acquisition of a Liquid Chromatography Tandem Mass Spectrophotometer (LC/MS/MS). The research above is being conducted by all faculty in the NIOSH TPG and by multiple students in the EOHS program, including TPG trainees.

13. TPG faculty have published research in peer-reviewed journals and/or submitted articles for publication, as well as completed technical reports. Research was also presented at local, state, and national conferences. Faculty have garnered recognition at the state and regional level in the public health field working with hazardous materials emergency management, industry, the firefighting community, and in the stormwater management field. Likewise, TPG faculty are developing expertise in Total Worker Health research.

- Sanyang, E., G.K. Larney, W.N. Mkanta, M. Ndow, R.D. Taylor, P. Bass, and C. Moshiri. 2022. Youths' perceptions of road safety risk behaviours in the roadway environment: a study of college students in The Gambia and Tanzania. *Social and Health Sciences*.
<https://unisapressjournals.co.za/index.php/SaHS/article/view/10692>. (to be published in December 2022 issue).
- Taylor, R.D., G.B. Macy, J. Hwang, V. Golla, C. Cann, and E. Sanyang. 2022. Using collaborative partnerships to engage firefighters in rural communities. *International Journal of Environmental Research and Public Health*. 19(4):2009.
<https://www.mdpi.com/1660-4601/19/4/2009/htm>.
- Taylor, R.D. and J.R. Basham. "Bacteriological Assessment of Streams for Stormwater Compliance, City of Goodlettsville, TN". (2022). *Watershed Health Assessments*. WKU Center for Environmental and Workplace Health. Bowling Green, Kentucky.
- Taylor, R.D., J.R. Basham, and D.S. Harris (TPG trainee). "Qualitative Stream Corridor Assessment and Illicit Discharge Detection, City of Greenbrier, TN". (2022). *Watershed Health Assessments*. WKU Center for Environmental and Workplace Health. Bowling Green, Kentucky.
- Taylor, R.D., J.R. Basham, and D.S. Harris (TPG trainee). "Bacteriological Assessment of Streams for Stormwater Compliance, City of Greenbrier, TN".

(2021). *Watershed Health Assessments*. WKU Center for Environmental and Workplace Health. Bowling Green, Kentucky.

- Taylor, R.D., J.R. Basham, and D.S. Harris (TPG trainee). “Bioassessment of Streams for Stormwater Compliance, City of Greenbrier, TN”. (2021). *Watershed Health Assessments*. WKU Center for Environmental and Workplace Health. Bowling Green, Kentucky.

14. During the project period TPG trainees and EOHS graduates have sustained a 100% success rate of obtaining employment in an OSH or related field, or entering a graduate program for advanced OSH training. Employment opportunities have included private industry and government agencies. Typical job titles are occupational safety and health coordinator, environmental health and safety manager, environmental health and safety specialist, environmental and occupational health consultant, environmental scientist, environmental manager. The TPG created opportunities for students to gain additional training and enhance their experience through applied research, internships, and practice experiences. Graduates are impacting public health in local communities, throughout Kentucky, and beyond its borders. For example, five of the latest graduates from the M.S. in EOHS program are now working in the OSH field Kentucky, New York, and Washington, as safety and health specialists, an environmental safety and health manager, and an environmental protection specialist. The organizations range from a major industry, a privately held consulting firm, and the Kentucky Environmental Protection Cabinet. The TPG at WKU is creating opportunities for graduates to have advanced training that creates opportunities to protect workers from coast to coast in the United States.
15. The EOHS faculty maintain partnerships with communities, industries, government agencies, universities, and across the WKU campus for engagement of students in career development activities related to EOHS. A key component of these partnerships is the EOHS Advisory Board that includes EOHS professionals from these cooperating organizations. The partnerships ensure advanced training opportunities for students through internships and EOHS professional placements. During the Fall 2021 semester a virtual EOHS Advisory Board meeting was held to review the EOHS programs, assess the WKU TPG, and evaluate EOHS programmatic competencies as part of National Environmental Science and Protection Accreditation Council accreditation.

Project Period Results: July 1, 2017 – June 30, 2022

B.S. in EOHS Trainees and Graduates

The WKU TPG was funded through a CDC/NIOSH TPG for the B.S. in EOHS from July 1, 2017 through June 30, 2022. During this timeframe a total of 42 students were in the program. A total of twelve NIOSH supported trainees graduated during the TPG grant period with 20 total graduates. The WKU NIOSH TPG for the B.S. in EOHS was successful in making advanced OSH training available and a total of 11 graduates are now employed by private industry, five are employed by government, one is in academia, and two are pursuing advanced OSH training. Funding of the WKU NIOSH TPG is creating the next generation of entry level practitioners in the OSH profession, including research.

M.S. in EOHS Trainees and Graduates

The WKU TPG was funded through a CDC/NIOSH TPG for the M.S. in EOHS from July 1, 2019 through June 30, 2022. During this timeframe a total of 40 students were in the program. A total of nine NIOSH supported trainees graduated during the TPG grant period with 21 total graduates. The WKU NIOSH TPG was extremely successful in making graduate training available for advanced OSH training and a total of 16 graduates are now employed by private industry, two are employed by government, one is in academia, and two are pursuing doctoral degrees. Funding of the WKU NIOSH TPG is creating the next generation of leaders in the OSH profession, including research.

Relevance of the Outcomes

WKU offers the undergraduate (B.S.) and graduate (M.S.) EOHS programs that are driven by the shortage of trained OSH and EHS professionals in underserved regions of Kentucky that will advance worker safety and health. These programs have dedicated regional support through the EOHS Advisory Board, industries, agencies, first responders, municipalities, schools, colleges, universities, and communities. The success rate of graduates from each program, the inclusion of underrepresented trainees, as well as the accreditation of the graduate and undergraduate programs by the National Environmental Health Science and Protection Accreditation Council, and the programs meeting the Board of Certified Safety Professionals blueprint and becoming qualified academic programs for the Graduate Safety Practitioner designation, has established the credibility of the institution to offer each curriculum. Likewise, the programs have executed a TPG and the faculty are extremely capable in advanced OSH training, as well as extensive OSH research that engages trainees. Both the undergraduate and graduate EOHS Programs are supported by the National Institute for Occupational Safety and Health (NIOSH) through a renewed Training Project Grant (TPG) with an end date of June 30, 2027. A critical need in Kentucky and the region is to create a more diverse EOHS workforce, especially in underserved rural areas. The WKU NIOSH TPG has met this need and provided opportunities for innovative educational strategies relevant to contemporary work exposures, including the COVID-19 pandemic and the recent tornado disaster in Kentucky.

A major advantage to the executed NIOSH TPG is that it focused on a multidisciplinary approach that students benefited from in their various classes, thus leading to a well-rounded training experience which prepared students for OSH and EHS careers. This training program developed a diverse population of entry-level and mid-level OSH and EHS workforce-ready graduates that has helped meet the assessed shortfall of trained OSH professionals, as documented in the National Assessment of the Occupational Safety and Health Workforce (<https://www.cdc.gov/niosh/oshworkforce/default.html#report>) in underserved areas of Kentucky and the region.

A recent survey of OSH and EHS managers, graduates of the WKU EOHS Programs, and alumni was conducted prior to our EOHS Advisory Board Meeting held November 19, 2021. The results of the survey revealed a great need for EOHS professionals in Kentucky and the surrounding region. The EOHS Advisory Board Meeting again indicated a critical need for EOHS professionals in this region. This feedback is corroborated by information from the U.S. Bureau of Labor Statistics Occupational Outlook Handbook (<https://www.bls.gov/ooh/>) that indicates Occupational Safety and Health Specialists and Environmental Scientists and Specialist

are growing fields (U.S. Bureau of Labor Statistics, 2021). A recent job search was conducted through Indeed (<https://www.indeed.com>) on November 15, 2021, for the WKU region, within 100 miles of Bowling Green, KY. This job database search found over 70 current job openings in the OSH and EHS and related fields, indicating the current state of demand for trained OSH professionals and the significant shortfall in the supply, as documented in the 2011 report (<https://www.cdc.gov/niosh/oshworkforce/default.html#report>). There is a critical need throughout the WKU region, and especially in underserved rural communities, for a diverse and trained OSH and EHS workforce to protect the health and well-being of workers and their families. This is an even greater need in Kentucky considering the health disparities that exist throughout many rural communities.

The EOHS Bachelor of Science (B.S.) and Master of Science (M.S.) degree programs at WKU are comprehensive Science, Technology, Engineering, and Mathematics (STEM) programs built on education in basic and applied sciences, and specialized training in anticipation, recognition, evaluation, and control of workplace factors that may affect the health, well-being, and productivity of workers and the public. The overall educational objective is a multidisciplinary approach that provides students a comprehensive understanding of the chemical, biological, physical, and social factors or stressors in the occupational and natural environments that impact public health outcomes.

Specifically, the last funding cycle of the NIOSH TPG provided access to advanced OSH training to underserved students that would otherwise not get this training, or enter the OSH and EHS workforces. The WKU NIOSH TPG was critical in the advancement of worker health and wellbeing in Kentucky and the region, and well as the advancement of public health. In the absence of the WKU NIOSH TPG there would be a dire shortage of adequately trained professional entering the OSH field and the outcome would be increased worker injuries and health disparities in the region. The tuition scholarships and stipends, training opportunities through NIOSH ERCs, webinars, conferences, and OSH applied research opportunities were paramount for OSH in this region. Continued support of the WKU EOHS Programs will promote a diverse and trained OSH workforce expertise in the OSH, EHS, and associated fields in rural and underserved communities in Kentucky, and throughout the region. Likewise, this training program is developing the next generation of OSH and EHS leaders to protect workers and their families throughout the region.