

Emily A. Caffrey, PhD, CHP

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Education

Oregon State University

Ph.D. Radiation Health Physics, January 2016

Minor in Statistics

Advisor: Dr. Kathryn Higley, CHP

Dissertation: *Development and Application of Voxelized Dosimetric Models for Biota: Characterization of the Uncertainty in the International Commission on Radiological Protection's Wildlife Dosimetry System*

M.S. Radiation Health Physics, October 2012

Minor in Statistics

Advisor: Dr. Kathryn Higley, CHP

B.S. Nuclear Engineering, June 2010

Experience

Radian Scientific, LLC

President and Owner (2016-present)

Health Physics Consulting

- My company performs health physics (HP) consulting in collaboration with numerous other small companies. Together we specialize in radiation dose reconstructions, fate and transport analysis, performance assessments, statistical analysis, and data management and analysis for a wide variety of governmental and industry clients. Key projects include:
 - **H3 Environmental.** I am currently working with H3 Environmental at the Ambrosia Lake site in New Mexico on radon dosimetry and transport modeling, among other tasks.
 - **Arlington Landfill.** I performed radiation dose and risk calculations for a chemical and hazardous waste landfill in Arlington, OR that inadvertently accepted TENORM materials. The assessment included radon dosimetry calculations, an intruder into the waste, and an ecological assessment. I assisted in the development of Pathway Exemption requests for the Oregon Department of Energy.
 - **Sample Management and Analytical Results Tracking (SMART) System implementation at the Hanford Site, WA.** For this project, I developed methods for quantifying measurement uncertainties associated with Hanford's air sampling program. I identified each sampling error parameter, including instrument-specific, location-specific and sample-specific parameters, and developed the appropriate calculations to ensure both measurement and sampling error were propagated correctly through the entire calculation. I worked with the code developers to ensure my calculations were correctly implemented in the software, and I tested the software to ensure it reproduced my calculations correctly.

- **McClurg V. Mallinckrodt, LLC and Butler V. Mallinckrodt, LLC historical dose reconstructions.** This project covers an ongoing legal case over radiation exposures from Manhattan era waste in St. Louis, MO. I was responsible for developing the source term, which includes characterization and quantification of radioactive material released to the environment from uranium processing operations that helped produce the first nuclear weapons. I assisted in reviewing, compiling, and editing the entire expert report for the court, including several thousand supporting documentation files. I was the point of contact with the legal team.
- **Blue Ridge Landfill.** I performed radiation dose and risk calculations for a municipal landfill in Estill County, KY that inadvertently accepted TENORM (Technologically Enhanced Naturally Occurring Radioactive Material). I produced a report in collaboration with Gradient, Inc., combining physical risks from moving the materials with the radiological risks of cancer.
- **Waste Control Specialists (WCS) Radioactive Waste Performance Assessment.** For this project, I helped to develop the conceptual and mathematical model for the WCS low level radioactive waste site in Andrews, TX. This included modeling complex radiation transport dynamics through numerous geologic and anthropogenic layers of material using GoldSim software. The purpose of a performance assessment is to determine potential impacts the buried waste might have on future inhabitants of the area. I presented the results to both the Texas Commission on Environmental Quality (TCEQ) and the Department of Energy (DOE). I was the team manager for this project, and the primary point of contact for the client.
- **WCS Dose Compliance Module.** This project involved assisting in the development and implementation of a radiation dose-based compliance system. Previously, WCS used a system of concentration-based limits that were radionuclide specific. We transitioned them to a simpler, more cost-effective dose-based system that more accurately reflects possible radionuclide releases from the facility.
- **Cooper V. Tokyo Electric Power.** In this legal case, I was responsible for developing the source term, including the quantity and type of radioactive material released to the environment. This project involved in depth knowledge of the Fukushima Daiichi reactors and reactor accident physics. We produced an interim expert report before the case was moved to Japan.

Health Physics Society (HPS)

Ask-The-Experts Editor-in-Chief (2019-present)

- The Health Physics Society sponsors a public information and outreach feature called “Ask-The-Experts” or ATE (see <https://hps.org/publicinformation/ate/>). This service allows anyone with internet access to ask a radiation-related question and receive an answer from an expert in the field. This outreach endeavor is wildly successful, receiving over 1.5 million unique site visits annually.
- As Editor-in-Chief, I have oversight of the entirety of the ATE feature. Key responsibilities include:
 - Establishing categories and subcategories that cover all aspects of radiation safety;
 - Selecting and managing 17 topic editors and hundreds of experts;

- Developing response guidelines for questions with possible legal or ethical implications;
- Determining which questions are of sufficient interest to post to the website;
- Creating other items of interest, including FAQs, information sheets, and fact sheets;
- Tracking and responding to “hot” radiation-related issues that might require special website postings;
- Identification of experts who can be available for media interactions as needed.

University of Alabama at Birmingham

Program Director and Assistant Professor, May 2021

Adjunct Faculty and Supervised Practice Coordinator (2016-present)

School of Health Professions, Department of Clinical and Diagnostic Sciences

- Developed and taught all core HP classes for the 2016-2017 school year, including: Introduction to Health Physics, Principles of Dosimetry, Advanced Radiation Biology, and Non-ionizing Radiation.
- For 2021-2022 school year, developing and teaching two new courses: Monte Carlo Techniques for Health Physicists and Contemporary Health Physics and CHP Exam Review.
- Student mentoring and academic advising. Mentored 18 of the 28 students from 2016-2018 and May 2021 to present in internships, academics, and career goals. Worked with each student individually on their supervised practice requirements from 2019 to present.
- Served as a mentor and academic advisor to the program’s first student and graduate, Misty Liverett, who graduated in August 2018 with an employment offer.
- Currently mentoring four second year students and five first year students.
- Developing research collaborations, affiliation agreements, and MOUs with local industry and government to expand student opportunities and supervised practice sites. New sites added since May 2021 include: National Council on Radiation Protection and Measurements, Yale University, Y-12 National Security Complex, Environmental Protection Agency, Westinghouse, and Mayo Clinic.
- Build connections across campus in Biomedical Engineering and Physics to facilitate student research opportunities.
- Wrote Fast-Track program for entry of qualified BMD students into the MHP program.
- Submitted \$375,000 grant to NRC 31310021K0004 in Sept 2021.
- Manage MHP budget.
- Appointed to Radioisotope and Radiation Safety Committee (RRSC) – October 2021.

Georgia Institute of Technology

Instructor (Fall semester 2019, 2020)

Nuclear & Radiological Engineering and Medical Physics Program

George W. Woodruff School of Mechanical Engineering

- I taught Radiation Dosimetry, a medical physics graduate level course in Fall 2019 and Fall 2020.

Oregon State University

Adjunct Faculty (2017-2018)

School of Nuclear Science and Engineering

College of Engineering

- I created an online Radiological Operations Support Specialist preparatory course in support of the Departments of Homeland Security (DHS) and DOE initiative to train, equip, and certify radiation experts to integrate with the incident command system during a radiological response.
- I redeveloped the External Dosimetry and Shielding course for the online environment.

Oregon State University

Graduate Research Assistant (2010-2016)

School of Nuclear Science and Engineering

College of Engineering

- As a graduate student I performed original research in environmental protection and risk assessment as part of my thesis and dissertation.
- I completed two research projects for the Electrical Power Research Institute, one in examining dose calculation methodologies for Carbon-14 emissions from nuclear power plants and the second in investigating tritium (H-3) separation technologies for groundwater.
- I created and taught a graduate level course in Liquid Scintillation Counting; taught the introductory course in Nuclear Engineering and Radiation Health Physics; and served as a teaching assistant and lecturer for Radioecology and Radiobiology.
- As the lead graduate student in Dr. Higley's research group, I was responsible for a multicultural research group of 10 graduate students for over two years.

Australian Nuclear Science and Technology Organization (ANSTO)

Endeavor Research Fellow (2015)

- I was selected for an Endeavor Research Fellowship, a program sponsored by the Australian government that provides funding for short-term research towards a non-Australian Ph.D.
- While at ANSTO I provided innovative computational modeling capabilities to support several research projects.
- I performed field work at a nuclear waste site near Sydney by obtaining tree cores for plutonium particle analysis.
- I was selected to present my Ph.D. research to the Australian Radiation Protection and Nuclear Safety Agency.

Oregon State University

Radiation Safety Student Technician (2008-2010)

Environmental Health and Safety

- As a student technician, I was responsible for monitoring personnel and laboratories for radiation exposure.
- On my own initiative, I authored operating procedures for the Liquid Scintillation Counter.
- I managed the acquisition, storage, handling, and disposal of radioactive materials.

- I assisted in performing annual inspections of on-campus radiation use laboratories.
- I assisted in verifying that veterinary radiography facilities were in compliance with regulatory requirements.

Honors

- HPS Elda Anderson Awardee, 2020
- Selected as the HPS Young Investigator Delegate to the International Radiation Protection Association (IRPA) 2020 Congress
- Inducted into the Oregon State University Council of Outstanding Early Career Engineers in 2019
- Australian Endeavor Research Fellowship Recipient in 2015
- Inducted into Alpha Nu Sigma Honor Society in 2013
- Selected as an ARCS Scholar in 2012

Professional Society Involvement

- **National Council on Radiation Protection and Measurements, 2021**
 - Elected to the NCRP in April 2021.
- **HPS Public Information Committee (PIC), member since 2018, Chair 2019-2021**
 - The PIC is responsible for developing and disseminating radiation-related information to the public.
 - As chair, I am responsible for managing a small team of volunteers. Together we manage all HPS social media outlets, develop fact sheets, and are in the process of creating informational videos. The videos can be viewed on HPS' [YouTube channel](#).
- **HPS Program Committee, member 2019-2021**
 - The Program Committee develops and manages the technical program of the HPS annual meeting, including both plenary and special sessions.
 - As a new member, the first meeting I am helping to plan is the 2020 annual meeting. I developed two poster sessions and 12 oral technical sessions.
- **National Council on Radiation Protection Scientific Committee (SC) 1-25, 2016-2018**
 - As a member of SC 1-25, I helped to review recent epidemiologic studies to evaluate whether the new observations were strong enough to support or modify the linear nonthreshold (LNT) model as used in radiation protection today.
 - The SC published *Commentary No. 27 – Implications of Recent Epidemiologic Studies for the Linear-Nonthreshold Model and Radiation Protection* in 2018.
- **President of the Alabama Chapter of the HPS, 2017-2019**
 - When I moved to Huntsville, AL, the local chapter of the HPS was derelict. With the help of my UAB colleagues and students, we revived the chapter, growing membership to over 30 members over the course of two years. We restarted biannual meetings at various locations across the state, including joint meetings with the Atlanta Chapter. I served as president for two years.

Certifications

- The American Board of Health Physics is the certifying body for Health Physicists. To become a “Certified Health Physicist” (CHP) there is a two-part exam. I passed Part I in 2014 and part II in 2021.

Affiliations

- Health Physics Society Member since 2010
- American Nuclear Society Member since 2006
- Radiation Research Society Member since 2016
- Alumna of Phi Sigma Rho National Engineering Sorority

Publications

- Caffrey, E.A.**, Rood, A.S., Grogan, H.A., Till, J.E. and Herman, K., 2021. Dose Assessment for Technologically Enhanced Naturally Occurring Radioactive Materials Disposal in Landfills. *Health Physics*, in press.
- Caffrey, E.** and Caffrey, J., 2021. The Health Physics Society’s ‘Ask-The-Expert’ Feature: Widening Public Support through Empathy and Science. *Journal of Radiological Protection*, 41(2), p.S39.
- Caffrey, E.A.**, Voillequé, P.G., Rood, A.S., Grogan, H.A., Mohler, J.H., Meyer, K.R., and Till, J.E. 2021. Estimation of Enriched Uranium Released to Air from the Former Apollo Facility, Apollo, Pennsylvania, USA. *Health Physics*, 120(4), 417-426. DOI: 10.1097/HP.0000000000001343.
- Caffrey, E.A.** 2021. Radiation and the Skeptical Public: Tips and Tools for Communicating Effectively. *Health Physics*. DOI: 10.1097/HP.0000000000001405.
- Mohler, H.J., A.S. Rood, H.A. Grogan, **E.A. Caffrey**, and J.E. Till. 2021. Analysis of Environmental Data to Support Quantification of Historical Releases from a Former Uranium Processing Facility in Apollo, Pennsylvania. *Health Physics*, 120 (5), 495-509.
- Rood, A.S., H.A. Grogan, H.J. Mohler, J.R. Rocco, **E.A. Caffrey**, C. Mangini, J. Cartwright, T. Mathews, C. Shaw, M.E. Packard, and J.E. Till, 2019. Use of Routine Environmental Monitoring Data to Establish A Dose-Based Compliance System for a Low-Level Radioactive Waste Disposal Site. *Health Physics*, Jan;118(1):1-17. DOI: 10.1097/HP.0000000000001116.
- Caffrey, E.A.**, Mangini, C.D., Rood, A.S., Grogan, H.A., Mohler, J.H., Rocco, J.R., Till, J.E., Cartwright, J., Shaw, C., and Matthews, T. 2019. Implementation of a Dose-based Compliance System for WCS. *Waste Management Symposia 2019*. Phoenix, AZ. 3–7 March.
- Shore, R., Beck, H., Boice Jr, J.D., **Caffrey, E.A.**, Davis, S., Grogan, H., Mettler, F.A., Preston, R.J., Till, J., Wakeford, R., Walsh, L., and Dauer, L.T. 2019. Response to Letter by Moghissi and Calderone. *Health Phys.* 117(2):224-225. doi: 10.1097/HP.0000000000001107.
- Shore, R., Beck, H., Boice Jr, J.D., **Caffrey, E.A.**, Davis, S., Grogan, H., Mettler, F.A., Preston, R.J., Till, J., Wakeford, R. Walsh, L. and Dauer, L.T. 2019. Reply to Comment on 'Implications of Recent Epidemiologic Studies for the Linear Nonthreshold Model and Radiation Protection'. *J Radiol Prot.* 39(2):655-659. doi: 10.1088/1361-6498/ab077f. Epub 2019 May 24.
- Shore R., Beck H., Boice, Jr J.D., **Caffrey, E.A.**, Davis, S., Grogan, H.A., Mettler, F.A., Preston, R.J., Till, J.E., Wakeford, R., Walsh, L., Dauer, L.T. 2019. Recent Epidemiologic Studies and the Linear No-Threshold Model for Radiation Protection-Considerations Regarding NCRP Commentary 27. *Health Physics*, Feb;116(2):235-246.

- Shore R., Beck H., Boice, Jr J.D., **Caffrey, E.A.**, Davis, S., Grogan, H.A., Mettler, F.A., Preston, R.J., Till, J.E., Wakeford, R., Walsh, L., Dauer, L.T. 2018. Implications of Recent Epidemiologic Studies for the Linear Nonthreshold Model and Radiation Protection. *J. Radiological Protection*, Sept;38(3):1217-1233.
- National Council on Radiation Protection and Measurements. 2018. Implications of Recent Epidemiologic Studies for the Linear-Nonthreshold Model and Radiation Protection. NCRP Commentary No. 27. National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Suite 400, Bethesda, Maryland. R.E. Shore (Chair), L.T. Dauer (Co-Chair), H.L. Beck, **E.A. Caffrey**, S. Davis, H.A. Grogan, R.N. Hyer, F.A. Mettler Jr., R.J. Preston, J.E. Till, R. Wakeford, L. Walsh.
- Till, J. E., Beck, H. L., Grogan, H. A., & **Caffrey, E.A.**, 2017. A review of dosimetry used in epidemiological studies considered to evaluate the linear no-threshold (LNT) dose-response model for radiation protection. *International Journal of Radiation Biology*, 93:10:1128-1144.
- Caffrey, E.A.**, Johansen, M.P., Caffrey, J.A., & Higley, K.A., 2017. Comparison of Homogeneous and Particulate Lung Dose Rates for Small Mammals. *Health Physics*. 112:6:526-532.
- Caffrey, E.A.**, 2016. Development and Application of Voxelized Dosimetric Models for Biota: Characterization of the Uncertainty in the International Commission on Radiological Protection's Wildlife Dosimetry System. *Oregon State University Doctoral Dissertation*. Oregon State University. Available at: <http://hdl.handle.net/1957/58187>.
- Caffrey E.A.**, Johansen MP, & Higley KA., 2015. Organ Dose Rate Calculations for Small Mammals at Maralinga, the Nevada Test Site, Hanford, and Fukushima: A Comparison of Ellipsoidal and Voxelized Dosimetric Methodologies. *Radiation Research*. 184:433–41.
- Higley, K., Ruedig, E., **Caffrey, E.**, Jia, J., Comolli, M., & Hess, C., 2015. Creation and application of voxelised dosimetric models, and a comparison with the current methodology as used for the International Commission on Radiological Protection's Reference Animals and Plants. *Annals of the ICRP*. 44:s2.
- Caffrey E.A.**, Johansen MP, & Higley KA., 2016. Voxel Modeling of Rabbits for Use in Radiological Dose Rate Calculations. *J Environ Radioact*. 151(2):480–6. doi:10.1016/j.jenvrad.2015.04.008.
- Johansen, M.P., Child, D. P., **Caffrey, E.A.**, Davis, E., Harrison, J.J., Hotchkis, M.A.C., & Beresford, N.A. 2016. Accumulation of plutonium in mammalian wildlife tissues following dispersal by accidental-release tests. *J Environ Radioact*. 151(2):387-94. doi:10.1016/j.jenvrad.2015.03.031.
- Ruedig, E., **Caffrey, E.A.**, Hess, C., & Higley, K.A., 2014. Monte Carlo Derived Absorbed Fractions for a Voxelized Model of *Oncorhynchus Mykiss*, a Rainbow Trout. *Radiation and Environmental Biophysics*. 53:3:581-7.
- Caffrey, E.A.**, Leonard, M.A., Napier, J.B., Neville, D.R. and Higley, K.A. 2014. Radioecology: Why Bother? *Journal of Environmental Protection*. 5:3,181-192. doi: 10.4236/jep.2014.53022.
- Caffrey, E.A.** & Higley, K.A., 2013. Creation of a voxel phantom of the ICRP reference crab. *J Environ Radioact*. 120:14–18.
- Cardarelli, R., Wendland, B., Higley, K.A., Paulenova, A., **Caffrey, E.A.**, Ruirui, L. 2013. Assessment of Tritium Removal Technologies. Electric Power Research Institute Interim Report #3002000608.
- Cardarelli, R., Oliver, G., Hood, D., **Caffrey, E.A.**, Higley, K.A. 2013. Carbon-14 Background, Pathway, and Dose Calculation Analysis for Nuclear Power Plants: A Sourcebook for Accurate Carbon-14 Dose Calculations. Electric Power Research Institute Report #3002000545, Palo Alto, CA.
- Caffrey, E.A.**, 2012. Improvements in the Dosimetric Models of Selected Benthic Organisms. *Oregon State University Master's Thesis*. Oregon State University. Available at: <http://ir.library.oregonstate.edu/xmlui/handle/1957/34305>.