

Sandra L. Carroll, Ph.D.

Principal Scientist

EXPERIENCE SUMMARY

Dr. Sandra Carroll is an environmental scientist with advanced training and experience in environmental toxicology, air quality analysis, chemical accident prevention programs, human health and ecological risk assessment, and environmental studies. She has extensive experience implementing facility and chemical specific process hazard analyses and risk management plans. Field and laboratory experience includes soil, surface water and groundwater sampling, toxicity determination with bioassays for phototoxicity and photolysis, and analytical chemistry including gas chromatography-mass spectrometry (GC-MS) and high performance liquid chromatography (HPLC).

Dr. Carroll has conducted environmental, health and safety audits for private and public sector clients. She has served as chemical safety audit team leader for the U. S. Environmental Protection Agency (EPA), including an assignment during which she collaborated with EPA and the Occupational Safety & Health Administration (OSHA) for chemical accident prevention program development under the Clean Air Act.

Dr. Carroll has participated in a wide range of projects that required inter-agency coordination with federal, state, local, and Tribal governments, technical support for industrial facilities, workshops, public meetings, and training development. She has contributed to technical, policy development, and regulatory negotiations, including consensus building, group facilitation, and risk communication for environmental projects.

PROFESSIONAL RECORD

2014-Present	Sandra L. Carroll, LLC, Principal Scientist
2006-2014	Tetra Tech Inc., Reno, Nevada, Senior Toxicologist
2002-2006	University of Nevada, Reno, Research Scientist
1985-2002	U.S. Environmental Protection Agency, San Francisco, CA, Program Manager for Chemical Accident Prevention, Risk Management Planning, Emergency Planning and Community Right to Know Act (EPCRA) Programs

TOXICOLOGY AND AIR QUALITY

- **Toxicity, Health Hazard, Environmental and Safety Assessments.** Conducted toxicity and health hazard assessments of organic, synthetic organic and inorganic compounds for industrial process materials and product lines in the manufacturing industry. Assessments included research and analysis of toxicology data, regulations, manufacturers' safety data sheets, published literature, technical reports, process flow diagrams, chemical use rates, chemical mass balance calculations, and other reference materials concerning worker safety, public health, and environmental hazards. Results of assessments were used for safe manufacture, use, disposal, and end of life disposal of manufactured products. (2009 to 2014).

Education:

Ph.D. Environmental Toxicology, 2005, University of Nevada, Reno

B.S., Environmental Science and Policy, 1984, University of California, Davis

Certifications & Training:

- OSHA 40-Hour Hazardous Waste Operations and Emergency Response (HAZWOPER) Training.
- OSHA 8-Hour HAZWOPER Refresher Training, current; Respirator Fit-Test, current.
- OSHA 8-Hour HAZWOPER Supervisor Training, current
- MSHA 24-Hour Safety Training for Surface, Metal and Nonmetal Mining, and Refresher Training, current.
- National Safety Council First Aid and CPR Training, current.
- Site Safety Coordinator Training, current.
- Tetra Tech, Inc. Project Management (Level 1 and Level 2) Training.
- U.S. Environmental Protection Agency Chemical Safety Audit Basic and Advanced Training.
- U.S. Department of Homeland Security Training and Authorized User of Chemical Vulnerability Information, Authorized User Number CVI-20080121-1006388.
- Process Hazard Analysis (PHA) General and Advanced Training, utilizing PHA-Pro® 8 software developed by Dyadem International Ltd.

Areas of Expertise:

Toxicology
EH&S Audits
Risk Assessment
Air Quality Analysis
Environmental Studies
Chemical Accident Prevention

- **Clean Air Act Title V Operating Permit Applications.** Preparation of air quality operating permit applications, working with multi-disciplinary project teams. Experience with all aspects of permit application and regulatory support for clients, including air quality assessments to support National Environmental Policy Act (NEPA)/ Environmental Impact Statements (EIS). Dr. Carroll has extensive experience in data collection, emissions inventories, data analysis, impact analysis, document preparation, and regulatory negotiations. Projects include data interpretation and use of model outputs in the permitting and NEPA/EIS process (2006 to Present).
- **Science Advisor for Water and Air Quality Issues in the Lake Tahoe Basin, Tahoe Regional Planning Agency, California and Nevada.** Serves as a member of the Motorized Watercraft Technical Advisory Group convened by the Tahoe Regional Planning Agency (TRPA) ad hoc to provide scientific support to the TRPA Governing Board. Provides support for specific issues related to proposed or ongoing projects in the Tahoe Basin to assess potential water and air quality impacts and mitigation measures related to environmental concerns. The technical advisory group has been tasked to consider issues such as the impacts of watercraft engine emissions and the installation of piers and buoys within the Tahoe Basin. Dr. Carroll provides support for data collection and analysis, technical meetings, public forums, and outreach efforts. (2002 to Present).
- **Toxicological Review and Assessment of Pit Lake Water Quality, Sandra L. Carroll, LLC.** Providing technical evaluations for Screening Level Ecological Risk Assessment (SLERA) and Ecological Risk Assessment (ERA). This project includes research of pit lake water chemistry data and water quality parameters. Data analysis involves comparisons of existing pit lake water quality data with predicted concentrations from geochemical modeling of pit lake water quality. Findings and recommendations were provided for further analysis to satisfy requirements for development of a new mining project in Nevada. (2014 to Present).
- **Environmental Impact Studies.** Experience includes: Environmental Impact Reports (EIR) for the City of Fresno for a biosolids project, Initial Study and Mitigated Negative Declaration for a new California Judicial Council San Bernardino Courthouse, and EIR for a new Stockton Courthouse. Screening Level Ecological Risk Assessments (SLERA) for clients as part of the Environmental Assessment process under the National Environmental Policy Act (NEPA). Prepared Air Quality and Climatology Baseline Studies for NEPA analyses. (2007 to Present).
- **Impact Assessments for Organic Compounds, University of Nevada and Collaborator Desert Research Institute, Reno, Nevada.** Investigated the phototoxicity and photolysis of polycyclic aromatic hydrocarbons (PAH) from watercraft engine emissions and their effects on aquatic organisms. Analytical methods included surface water sampling, determination of PAH concentrations with gas chromatography-mass spectrometry, bioassays with *Ceriodaphnia dubia*, and statistical analysis in SAS. The results of this investigation were included in an environmental assessment and ecological risk assessment of PAH in Lake Tahoe, CA/NV. Dr. Carroll also investigated the ecological and human health risks of applying polyacrylamide (PAM) to unlined earthen canals for reducing seepage in agricultural fields. These experiments investigated the photolysis of acrylamide and polyacrylamide in natural sunlight under controlled conditions. Analytical methods involved surface water sampling and determining PAM concentrations with high performance liquid chromatography. These results were included in a human health and ecological risk assessment. (2002 to 2006).

CHEMICAL ACCIDENT PREVENTION

- **Chemical Safety Audit Team Leader, Environmental Health and Safety Audits.** Conduct audits, provide professional services to clients being audited. Provided program management for Tetra Tech, Inc., Cameco Corporation, GE Oil & Gas, Adidas, U.S. Department of Agriculture, U.S. Environmental Protection Agency, Defense Logistics Agency - Strategic Materials, Hawthorne Army Depot, SOC Nevada, LLC and other public and private sector clients. Audits include scoping, data collection, site visits, inspections, and development and completion of audit protocols. Completed audits fulfill corporate and regulatory requirements: 1) determine compliance with codes and regulations, emphasizing those that address the greatest safety and health risk to employees; 2) review programs, procedures, training records, permits, and other documents; 3) meet with site management and key personnel and review audit protocols and documents, identify and research data gaps, areas of strength, and opportunities for improvement; 4) assess regulatory compliance status based on a review of records and meetings with personnel; and 5) prepare findings to resolve issues and establish the basis of the protocol framework for future audits. (1989 to Present).
- **Process Hazard Analyses and Chemical Accident Prevention Program, Defense Logistics Agency, Hawthorne Army Depot/SOC Nevada LLC, Hawthorne, Nevada.** Completed process hazard analysis projects in accordance with federal and state laws [EPA RMP, OSHA Process Safety Management (PSM), and State of Nevada Chemical Accident Prevention Program (CAPP)]. As project manager, Dr. Carroll managed all aspects of process hazard analyses and chemical accident prevention programs for transport, consolidation, safe receipt and long-term storage of the U.S. Defense Logistics Agency's strategic stockpile (~5,000 tons) of elemental mercury at Hawthorne Army Depot, NV. Allowed the dispersed national stockpile of elemental mercury to be transported, received, and stored in one location without incident to control access and support safe and environmentally sound management. Project included analysis of the movement and transfer of material, review of regulations and guidance, and application of professional experience and judgment to develop best management and chemical accident prevention practices. Performed "What if" analyses, HAZOP, and human factors evaluations for all aspects of process review to identify best management practices. Project team identified over 200 hazard mitigation recommendations. All were implemented. (2007 to 2014).

ENVIRONMENTAL MANAGEMENT

- **Program Manager, Chemical Accident Prevention Program, EPA, San Francisco, California.** Managed EPA chemical accident prevention program under the CAA §112(r) and chemical emergency preparedness and prevention under the Emergency Planning and Community Right-to-Know Act (EPCRA). This work included serving as team leader for chemical safety audits and accident investigations. For these efforts, Dr. Carroll directed a multi-agency and consultant-supported audit team, inspecting facilities that handled hazardous materials or that had experienced hazardous material releases. Root-cause analysis approaches were applied to assess releases and support approaches to reduce future releases. Audits involved working with audit team and facility personnel to identify findings and recommendations for hazard communication and accident prevention. Other responsibilities included hazardous materials response training, tabletop, functional and field exercises, computer modeling (CAMEO), outreach and public education. Dr. Carroll was also responsible for contracts and grants management and the preparation of hazardous materials response guidelines for responding to incidents involving natural hazards. (1989 to 2002).

- ***Development of National Standards for Chemical Accident Prevention and Risk Management Planning (RMP) Program Development, EPA, Washington, DC and San Francisco, California.*** Participated in a multi-agency workgroup that developed national standards for chemical accident prevention and risk management planning [Clean Air Act (CAA) §112(r) and 40 CFR Part 68]. Provided expertise as chemical safety audit team leader, sharing experience gained through facility-specific chemical safety audits and based on the investigation of hazardous materials releases. For this effort, Dr. Carroll received a commendable service award from EPA. During this time, she also provided technical support to EPA Headquarters during a detail to the Chemical Emergency Preparedness and Prevention Office for development of RMP standards. Tasks included regulatory and program development, workshops, coordination with other agencies, industry, nonprofit organizations, and public representatives. (1994 to 2000).
- ***Clean Air Act Program Development, Nevada Division of Environmental Protection and EPA, Carson City, Nevada.*** Responsibilities included developing the Clean Air Act (CAA) Title V Operating Permit Program for the State of Nevada, providing technical assistance to stakeholders, and developing seminars and workshops for affected regulated facilities and agencies. Worked with EPA and the State of Nevada as the CAA Coordinator for state implementation plan, operating permit, hazardous air pollutants and stratospheric ozone protection programs. Based on research of the CAA Amendments of 1990, Nevada Revised Statutes and Nevada Administrative Code, Dr. Carroll drafted air quality regulations for fine particulates (PM₁₀) and operating permits (Title V) and prepared a legislative package that was enacted by the Nevada Legislature. She supported all aspects of program implementation and regulatory development. (1991 to 1994).
- ***Emergency Communications, EPA, San Francisco, California and Phoenix, Arizona.*** Environmental scientist and project leader for an emergency communications planning initiative. In this role, Dr. Carroll collaborated with the Arizona State Emergency Response Commission (SERC) and City of Phoenix Fire Department in designing an emergency response communication program for first responders and industrial facilities in this area. She supported multi-stakeholder interaction and project conceptualization, which focused on taking chemical information required from facilities through various regulations, streamlining and integrating that data, and providing the data to appropriate parties within each facility and to local fire departments and other responder agencies. The project was initiated in Maricopa County, AZ and included industry, SERC, Local Emergency Planning Committee, State, and federal representatives. The project team developed a database structure that accommodated multiple data requirements and supported real-time tracking as inventory levels changed over time. The project was tested at select facilities within one county and then expanded to other areas. For this work, Dr. Carroll and the project team were presented a Hammer Award for leading the development of new approaches for communicating chemical hazards during emergencies. (1998 to 2000).
- ***Federal Response and Mitigation Planning, EPA, San Francisco, California.*** As planning team member, participated in federal response planning and mitigation for hazardous materials, including the Hazard Mitigation Survey Team for the Loma Prieta, California earthquake. In this role, she contributed to the development of the Federal Response Plan related to Emergency Support Function 10 – Hazardous Materials. She also participated as a member of the inter-agency steering committee, collaborating with federal agencies including the Federal Emergency Management Agency (FEMA), Department of Defense (DoD), US Forest Service, National Oceanographic and Atmospheric Administration (NOAA), US Geological Survey and OSHA. In support of plan implementation, Dr. Carroll developed and conducted training and exercises related to the plan, interacting with a wide range of federal, state and local agencies in training and exercises that included functional, tabletop, and full-scale. (1989 to 2002).