Elizabeth Rand
Consultant

Education and Credentials

B.A., Biology, Middlebury College, Middlebury, Vermont, 1984

Continuing Education and Training

Hazardous Waste Operations and Emergency Response 40-Hour Certification (2011; annual refreshers through 2017)

Bloodborne Pathogens Training (2016)

OSHA Globally Harmonized System of Classification and Labeling of Chemicals Training (2013)

Roadside Erosion Control Certification, Cumberland County Soil and Water Conservation District, Gorham, Maine (1999)

Watershed Stewardship Training, University of Maine Cooperative Extension Service, Portland, Maine (1997)

OSHA 8-Hour Health and Safety Supervisor Training (1993)

State of Maine Provisional Teaching Certification in Secondary Education, University of Southern Maine, Gorham, Maine (1988)

Professional Profile

Ms. Elizabeth Rand is an environmental consultant with more than 20 years of experience in risk assessment, environmental regulation, and hazardous waste management. She has managed and supported complex human and environmental health risk assessments, critiques of state and federal environmental regulations and toxicological criteria, development of site-specific water quality criteria, development of risk management strategies for feasibility studies of hazardous waste sites, and preparation of testimony and rebuttals in support of environmental litigation. In addition to her toxicology and risk assessment experience, Ms. Rand has organized and supervised floodplain soil and sediment sampling, water quality and effluent sampling, environmental reconnaissance exercises, and watershed restoration projects.

Ms. Rand's experience comprises projects that elucidate the transport and potential exposures and risks associated with dioxins, PCBs, metals, asbestos, hydrocarbons, and pesticides in various commercial and environmental media. Her projects have included evaluations related to land application of wastewater sludge and ash, effluent discharge to publicly owned treatment works and/or viable waterways, consumer use of pulp and paper products, and potential exposures at contaminated manufacturing and disposal sites. Ms. Rand has quantified health risks related to atmospheric loads of mercury to major river watersheds; the potential relationships between house-dust contamination and industrial site activities; and the disposition of, and environmental risks associated with, dioxin contamination of a floodplain and wetland. In addition, Ms. Rand has managed, designed, and implemented watershed surveys and nonpoint source pollution studies for several municipalities and soil and water conservation districts.

Relevant Experience

Toxicology and Risk Assessment

Remedial Risk Management Strategy Model Development at CERCLA Site, Montana—As project manager, directed an interdisciplinary team that developed a unique exposure apportionment model and risk management tool for application in the feasibility study for a large and complex CERCLA site. The risk management tool applies EPA risk assessment results along with

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multiple landscape attributes to identify the areas of higher- and lower-potential human exposures and risk across an operable unit comprising thousands of acres. The resulting spatial models allow for the assessment of risk-based remedial action outcomes. The risk management strategy also captures hard-won consensus among three federal and two state stakeholder agencies and their contractors on the particulars of the remedial management strategy framework.

Development of Site-Specific Ambient Water Quality Criteria for Aluminum, Cadmium, and Copper in Freshwater, Androscoggin River, Maine—Teamed with the project director and ecotoxicologist to develop water effects ratios (WERs) for three metals in support of the application of site-specific water quality criteria for effluent discharge permit limits. On behalf of multiple paper industry clients and their outside counsel, successfully implemented a work plan to conduct a series of site-specific water quality toxicity tests and developed scientifically defensible WERs for aluminum, cadmium, and copper. These WERs were approved by state and federal regulators and now support the application of metal-specific and site-specific ambient water quality criteria to the mill discharge permits.

Development of Site-Specific Ambient Water Quality Criteria for Cadmium, Copper, Lead, and Zinc in Freshwater, St. Croix River, Maine—Assisted in the development of WERs for cadmium, copper, lead, and zinc in support of establishing site-specific water quality criteria for the St. Croix River. On behalf of the client, and in negotiation with state and federal agencies, developed and implemented a work plan to generate defensible WERs for the four metals. Data derived from the ongoing study will be used to develop site-specific water quality criteria for cadmium, copper, lead, and zinc, which will inform mill discharge license limits.

Assessment of Risks Associated with the Presence of Chemicals in Combustion Fuels, Confidential Location—Evaluated hypothetical occupational and consumer risks associated with the presence of chemicals in combustion fuel systems. Conducted an assessment of the possible occupational health risks associated with maintenance and food process operations using these fuels. Also assessed potential consumer risks from ingestion of food baked in ovens fired with the fuel. All hypothetical risks were determined to be *de minimis*.

Human Health and Ecological Risk Assessments, Supplemental Investigation, Centredale Manor Restoration Superfund Site, Rhode Island—Conducted supplemental floodplain soil and sediment sampling campaigns and drafted human health and ecological risk assessments in support of the remedial investigation of this Superfund site in EPA Region 1. The site is associated with human health and ecological concerns from the presence of dioxins, furans, PCBs, pesticides, herbicides, and volatile organic compounds.

Pre-Design Investigation, Centredale Manor Restoration Project Superfund Site, North Providence, Rhode Island—Developing the quality assurance and field sampling plans for the assessments of baseline conditions of the aquatic, floodplain, and upland flora and fauna that may be impacted by remediation of contaminated soil and sediment. These ecological evaluations will provide information to assist with restoration activities and set the baseline from which remedial efficacy will be determined.

Study of Mercury Sources to the Penobscot River and Comparative Assessment of Human Health Risk from Mercury Discharged from a Former Chlor-alkali Facility, Maine—On behalf of outside counsel, worked with project team to estimate mercury loading to the Penobscot River from all sources, including wet and dry atmospheric deposition, point source discharge, and groundwater flux from landfills associated with a former chlor-alkali facility. Assessed comparative human health risks associated with pre-remedial and potential post-remedial conditions of the landfills, the conclusions of which were that the vast majority of mercury to the lower Penobscot River is from global sources, global sources of mercury are not likely to diminish in the future, and selection of a remedial alternative should not be based on human health risk reduction because post-remedial risks are not discernible when compared to pre-remedial risks.

Risk Assessments of Coated Paper Products for Regulatory Compliance, Maine—Assessed human health risks associated with the use of coated paper products manufactured with compounds listed on California's Proposition 65 list of chemicals "known to the state to cause cancer or reproductive toxicity." The assessment included exposure and health risk assessments to multiple end users of the coated papers and concluded that the potential health risks were below *de minimis* levels. As a result of these assessments, the client concluded that Proposition 65 product labeling was not warranted.

Human and Ecological Risks Associated with Soil Amendment, Kentucky—Estimated the environmental and human health impacts potentially associated with the use of a pulp and paper industry by-product as a component of a soil amendment product or as a component of fertilizer. Evaluation and comparison of sampling data with background levels and with human and ecological health soil screening concentrations indicated that none of the constituents is present at high enough concentrations to present a risk of harm to either human health or the environment.

Air Sampling Work Plan, Former Manufactured Gas Plant, Indiana—Assisted in the preparation of an indoor sampling plan for a municipal administrative building located adjacent to a former manufactured gas plant in Indiana. Analyzed the bases of the health-based action levels for benzene, toluene, ethylbenzene, and xylene and naphthalene, and their applicability to the present project.

Public Health and Environmental Risk Evaluation, RCRA Facility, Maine—Managed the public health and environmental risk evaluation at a large RCRA facility in EPA Region 1. Assessed current and future human and ecological health risks associated with approximately 20 chemicals present in 13 solid waste management units. Based on the results of the risk assessment, developed and proposed health-based media protection standards.

Ecological Risk Assessment, RCRA Facility, Portsmouth, New Hampshire—Provided support and technical review of an ecological evaluation of potential impacts to fish, aquatic vegetation, benthic species, rodents, and plants resulting from historical disposal practices at the Portsmouth Naval Shipyard RCRA facility.

Risk Assessment in Support of Proposed Rulemaking, Augusta, Maine—Managed the development of a comprehensive multipathway assessment of the risks to wildlife and humans associated with the application of paper mill sludge and ash to agricultural and silvicultural land in Maine. The results of this assessment were incorporated into a proposed rule for regulation of land application of wastewater residuals in Maine.

Toxicity Assessment, PCBs, Confidential Location—Evaluated and summarized noncancer effects of PCBs in humans and animals. Addressed the implications and conclusions that could be drawn from this review in regard to the noncarcinogenic effects of PCBs in humans.

Toxicokinetic Assessment of Lead, Confidential Location—Researched and evaluated data on the toxicokinetics of lead in human adults and children. Compiled results of epidemiological and clinical studies of the uptake and distribution of lead to blood, bone, fetus, and breast milk to determine rates of absorption and to estimate exposures to fetuses and breast-feeding infants.

Environmental Fate Analysis of PCBs in Terrestrial Plants, Confidential Location—Researched and evaluated studies on the uptake from contaminated soils of PCBs in terrestrial plants. Developed quantitative estimates, on an Aroclor-specific basis, of parameters such as root plant uptake, foliar dust deposition, and soil volatilization and subsequent foliar uptake.

Testimony and Litigation Support

Litigation Support and Expert Witness Preparation, Dioxins, Confidential Location—Analyzed toxic tort litigations centered around the determination of dioxin contamination of house dusts in residences located in the vicinity of wood treatment plants.

Litigation Support and Expert Witness Preparation, Mercury, Maine—In preparation of expert testimony, analyzed and compared data on anthropogenic inputs, including atmospheric deposition, of mercury compounds to a major riverine watershed to estimated mercury inputs from a post-remedial former chlor-alkali facility. Expert testimony delivered to the State Board of Environmental Protection supported the plaintiff's remedial option proposal, which was significantly less expensive and hazardous than the state's Department of Environmental Protection proposed remediation alternative, which would require the removal and disposal of five landfills in a Canadian disposal facility located 400 miles from the site.

Litigation Support and Expert Witness Preparation, Dioxins, Confidential Location—Critically evaluated written and oral testimony of plaintiff expert witnesses in regard to potential personal and property damages associated with dioxin contamination of residential soil and house dusts in the vicinity of a former wood treatment facility.

Testimony, Maine Board of Pesticides Control, Ellsworth, Maine—Prepared and delivered testimony to the Maine Board of Pesticides Control on the potential human and ecological impacts associated with the application of the herbicide hexazinone (Velpar®) to blueberry fields in Maine. Testimony was delivered on behalf of the state-funded Maine Blueberry Commission in support of the petition process for the use of the herbicide.

Development of Water Quality Standard for Dioxin, Maryland—Assessed the risks to humans from consumption of fish impacted by the discharge of dioxin-contaminated effluent to a tributary of Chesapeake Bay. The assessment was developed for the defense of a feasible water quality standard for dioxin.

Sampling and Remediation Plan, Mercury Contamination, Vermont—Managed the development of sampling and remediation plans for a manufacturing facility that had discharged mercury into a publicly owned treatment works. Prepared testimony on toxicological, human health, and environmental issues for use in settlement negotiations with the state legal representatives.

Comments on Proposed Ecological Cleanup Criteria, New Jersey—Provided critical comments on New Jersey Department of Environmental Protection and Energy proposed regulations for the derivation of ecologically-based cleanup criteria for hazardous waste sites.

Comments on EPA-Proposed Land Application Rule—Evaluated and critiqued the exposure and environmental fate models and assumptions used by EPA to support its Proposed Regulation of Land Application of Pulp and Paper Mill Sludge. Assessed the applicability of models and parameters used by EPA to estimate the erosion potential of soils amended with sludges containing dioxin. Provided technical review of comments on other aspects of EPA's proposed rule.

Environmental Sampling

Supplemental Floodplain and Wetland Investigation, Rhode Island—Participated in the reconnaissance, collection and processing of floodplain soil and wetland sediment sampling in watershed, stream, and emergent wetland areas associated with a Rhode Island Superfund site. Field exercises required several modifications to sample locations and sampling techniques, in coordination with EPA oversight and contracted teaming partners, to accommodate challenging soil, sediment, vegetation, and seasonal conditions. Participated in the synthesis of the sampling results and the drafting of the sampling report.

Nonpoint Source Pollution Assessments and Abatements

Lake Watershed 319 Project, Raymond, Maine—Partnered with the Cumberland County Soil and Water Conservation District to implement the Raymond Pond and Crescent Lake Watersheds 319 Grant Project. Directed and assisted with the organization and installation of Best Management Practices demonstrations, landowner contacts, publicity, and the coordination of municipal entities.

Watershed Survey, Raymond, Maine—Directed the 1999 watershed survey of Crescent Lake in Raymond, Maine. Wrote the grant application to the Maine Department of Environmental Protection for Maine Nonpoint Source Program funding to conduct the survey; managed the administrative, technical, and volunteer components of the study; and authored and compiled the state-of-the-art survey report.

Watershed Survey, Raymond, Maine—Co-managed the watershed survey of Raymond Pond. Organized meetings, wrote informational letters and public service articles, conducted volunteer

training, and assisted the Maine Department of Environmental Protection with follow-up surveys and report preparation.

Publications

(E. Rand also published as E.R. Algeo)

Keenan, R.E., E.R. Algeo [Rand], E.S. Ebert, and D.J. Paustenbach. 1993. Taking a risk assessment approach to RCRA corrective action. In: *How Clean Is Clean? Developing Cleanup Standards for Contaminated Soil, Sediment, & Groundwater*. Water Environment Federation, Specialty Conference Series Proceedings, Alexandria, VA. pp. 255–275.

Maritato, M.C., E.R. Algeo [Rand], and R.E. Keenan. 1992. Potential human health concerns from composting: The *Aspergillus fumigatus* debate. *Biocycle* 33(12):70–72.

Keenan, R.E., E.R. Algeo [Rand], E.S. Ebert, and D.J. Paustenbach. 1992. Taking a risk assessment approach to RCRA corrective action. *Proceedings of Water Environment Federation RCRA Corrective Action Seminar*, New Orleans, LA. September 20. pp. 101–121.

Parsons, A.H., S.L. Huntley, E.S. Ebert, E.R. Algeo [Rand], R.E. Keenan. 1991. Risk assessment for dioxin in Columbia River fish. *Chemosphere* 23:1709–1717.

Keenan, R.E., E.R. Algeo [Rand], and E.S. Ebert. 1991. A critical review of the EPA risk assessment of use and disposal options for pulp and paper mill sludge. Proceedings of the 1991 TAPPI Environmental Conference, pp. 1077–1087.

Keenan, R.E., E.R. Rand, E.S. Ebert, J.W. Knight, M.M. Sauer, and R.E. Kross. 1990. A critical review of the recent EPA assessment of risks from dioxins and furans in land-applied pulp and paper mill sludges. Proceedings of the 1990 TAPPI Environmental Conference.

Keenan, R.E., J.W. Knight, E.R. Rand, and M.M. Sauer. 1990. Assessing potential risks to wildlife and sportsmen from exposure to dioxin in pulp and paper mill sludge spread on managed woodlands. *Chemosphere* 20(10-12):1763–1769.

Keenan, R.E., M.M. Sauer, F.H. Lawrence, E.R. Rand, and D.W. Crawford. 1989. Examination of potential risks from exposure to dioxin in sludge used to reclaim abandoned strip mines. Chapter 20. In: *The Risk Assessment of Environmental and Human Health Hazards: A Textbook of Case Studies*. D.J. Paustenbach (ed.). J. Wiley & Sons, NY. 1,200 pp.

Lawrence, F.H., R.E. Keenan, E.R. Rand, M.M. Sauer, and J.W. Knight. 1989. Uncertainties and conservatism in risk assessment of dioxin in paper mill sludge used for mineland reclamation. Proceedings of the 1989 TAPPI Environmental Conference, pp. 393–396.

Keenan, R.E., M.M. Sauer, F.H. Lawrence, R.S. Gordon, and E.R. Rand. 1987. Assessment of potential health risks from dermal exposure to dioxin in paper products. NCASI Technical Bulletin No. 534. New York. 105 pp.

Invited Presentations / Panels / Peer Reviews

Characterizing and interpreting fish consumption rates for developing human health water quality criteria. NCASI West Coast Regional Meeting. Copresented with R.E. Keenan and P.D. Anderson. September 26, 2007.

Crescent Lake and Raymond Pond watershed surveys. Raymond Select Board Public Hearing, ME. April 18, 2000.

Watershed surveys: A tool for identifying phosphorous sources in Lake Watersheds. Sebago Lake Association Annual Meeting, St. Josephs College, Standish, ME. July 31, 1999.

Assessment of health risks associated with the presence of hexazinone in drinking water. Delivered on behalf of the Maine Blueberry Commission to the Maine Board of Pesticides Control, Ellsworth, ME. July 7, 1994.

Ecological risk assessment in the 1990's. Presented to Sidley and Austin, New York, NY. Copresented with C.R. Harman and M.A. Barbara. August 27, 1992.

Risk assessment and industrial hygiene. Invited Speaker at the Meeting of the American Industrial Hygiene Association, Iroquois Chapter. Albany, NY. November 20, 1990.

Presentations / Posters

Gwinn, P.O., J. Samuelian, and E. Rand. 2017. Application of the biotic ligand model to derive acute and chronic site-specific water quality criteria for copper in the Little Androscoggin River. AEHS 33rd Annual International Conference on Soils, Sediments, Water, and Energy, Amherst, MA. October.

Gwinn, P.O., E. Rand, and J. Samuelian. 2016. Androscoggin River water-effect ratios and proposed site-specific criteria – Determinations for aluminum, copper, and cadmium. New England Water Environment Association (NEWEA) Annual Meeting, Boston, MA. January.

Gwinn, P.O., J. Samuelian, and E. Rand. 2016. Application of the biotic ligand model to derive acute and chronic site-specific water quality criteria for copper in the Little Androscoggin River, Maine. NEWEA Annual Meeting, Boston, MA. January.

Gwinn, P.O., E. Rand, and J. Samuelian. 2015. Is it appropriate to compare pore water concentrations to ambient water quality criteria? Sediment Management Working Group, Arlington, VA. December 2.

Keenan, R.E., P.O. Gwinn, E.R. Algeo [Rand], and P.D. Anderson. 2008. Characterizing and interpreting fish consumption rates for developing human health water quality criteria. (Abstract) Fifth Annual Conference on Integrating Water Resources Management, University of Massachusetts. April 8.

Shear, N.M., M.H. Henning, and E.R. Algeo [Rand]. 1994. Development of a Screening Criterion for Ecological Risk Assessment Based on Home Range Size. Twentieth Annual Maine Biological and Medical Sciences Symposium, Lewiston, ME. May 20.

Algeo [Rand], E.R., M.J. Sullivan, and F.J. Dombrowski. 1993. Applying ecological risk assessment strategies to address environmental problems. Presentation at the Fourth Annual West Coast Conference on Hydrocarbon Contaminated Soils and Groundwater, Long Beach, CA. March.

Keenan, R.E., E.R. Algeo [Rand], and J.W. Knight. 1992. Applying ecological risk assessment strategies to address environmental problems. Presentation at the Seventh Annual Hydrocarbon Contaminated Soils Conference, Amherst, MA. September 22.

Rand, E.R., A.H. Parsons, E.S. Ebert, R.J. Wenning, and R.E. Keenan. 1990. TCDD concentrations in resident and migratory fish from the Columbia River. Society of Environmental Toxicology and Chemistry, Eleventh Annual Meeting, Crystal City, VA. November 11–15.

Rand, E.R., M.M. Sauer, and R.E. Keenan. 1990. Estimates of TCDD uptake in cattle and TCDD contamination in vegetables from soils amended with paper mill sludge in Maine. Poster presentation at the Eleventh Annual Meeting of the Society of Environmental Toxicology and Chemistry, Crystal City, VA. November 11–15.

Sauer, M.M., J.W. Knight, R.E. Keenan, and E.R. Rand (presenter). 1990. Examination of potential risks to American robins exposed to dioxin in Maine soils amended with sludge. Poster presentation at the Eleventh Annual Meeting of the Society of Environmental Toxicology and Chemistry, Crystal City, VA. November 11–15.

Rand, E.R., M.M. Sauer, and R.E. Keenan. 1990. Assessment of potential human exposure to dioxin present in the agricultural food chain as a result of landspreading of paper mill sludge in Maine. Maine Biological and Medical Sciences Symposium, Bar Harbor, ME.

Paustenbach, D.J., C.A. Kasunic, and E.R. Rand (presenter). 1989. Estimating removal efficiency of dioxins and furans in the air pollution train of a sulfuric acid regeneration combustor during waste incineration. Poster presentation at the Ninth International Symposium on Chlorinated Dioxins and Related Compounds, Toronto, Ontario. September 17–22.

Rand, E.R., and M.C. Maritato. 1987. Assessment of human health risks and analysis of potential impacts on terrestrial wildlife related to exposure to dioxin from land application of waste water sludge in Maine. Poster presentation at the Maine Biological and Medical Sciences Symposium, Brunswick, ME.