

# Julia L. Tims

Senior Ecologist



Ms. Tims has more than nineteen years of experience in terrestrial ecology and natural resource management and environmental impact assessment. Ms. Tims is a professional ornithologist and has conducted environmental impact assessment and natural resources studies throughout the United States, South America, Africa, and Europe involving biodiversity assessment and management, wildlife and vegetation management, endangered species survey and management, and stakeholder engagement related to biodiversity and the interactions between biological and social issues. Ms. Tims has particular expertise in projects that combine technical ecological issues with project design, land management, and conservation planning for protected areas, sensitive species, and habitats. Mrs. Tims excels in coordinating diverse, large-scale projects throughout the United States and globally.

## Fields of Competence

- Environmental impact assessment
- Conservation planning
- Biodiversity assessment, management, and monitoring
- Biodiversity offsets
- World Bank/IFC standards and guidelines
- Project permitting and documentation
- Ecological baseline studies
- Environmental management and monitoring
- Stakeholder engagement related to biodiversity and biological/social interactions
- Interaction with environmental NGOs
- Habitat restoration and enhancement
- Endangered Species Act Section 7 Consultation
- Taxonomy of vegetation, birds, mammals, reptiles, and amphibians
- Project planning/design to address ecological issues
- Alternatives analysis
- Cumulative impact assessment

## Professional Affiliations

- American Ornithologist's Union
- Society of Wetland Scientists
- The Wildlife Society
- Waterbird Society

## Credentials

- M.Sc., Natural Resources Management/Ecology, Cornell University, 1999, With Distinction
- B.Sc., Entomology and Applied Ecology/Wildlife Conservation, University of Delaware, 1990
- Habitat Suitability Index Modeling, United States Fish and Wildlife Service
- Environmental Impact Assessment, Inter-American Development Bank
- Monitoring and Evaluation of Projects, Inter-American Development Bank
- OSHA 40-hr Hazardous Materials Handling and Safety Training

## Key Industry Sectors

- Energy
- Infrastructure (transportation and pipelines)
- Oil and gas development
- Government (National and local)

## Papers and Publications

- Tims, J.L., I.C.T Nisbet, J. Hatch, and C. Mostello. 2004. Characteristics and performance of Common Terns in Old and Newly-established colonies: implications for long term conservation. *Waterbirds*. 27(2):134-143.
- Tims, J.L. and K.M. Brown. 2001. Food Items Obtained by Gulls at and Around JFK International Airport: Relevance to Airport Management. *Waterbirds*. 24(1): 44-52.
- Tims, J.L. and K.M. Brown. 2001. Changes in the Nesting Populations of Colonial Waterbirds in Jamaica Bay Wildlife Refuge, New York, 1974-1998. *Northeastern Naturalist*. 45:17-28.

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## Key Projects

**Avian Protection Plan, PSE&G Susquehanna-Roseland Transmission Line, New Jersey.** Prepared the Avian Protection Plan (APP) for PSE&G's 45-mile Susquehanna-Roseland Transmission Line located in the Highlands Region of northern New Jersey. The APP included a detailed assessment of the bird species composition and habitat quality in the transmission line right-of-way, identification of enhancement opportunities for avian species including several rare species and species undergoing regional population declines, and identification of ways to reduce and minimize the direct and indirect impacts on birds from the construction and operation of the project. The APP was developed in accordance with the *Avian Protection Plan Guidelines*, a guidance document jointly prepared by the Avian Power Line Interaction Committee and the U.S. Fish and Wildlife Service (USFWS). The APP was reviewed and approved by the USFWS and will be implemented by PSE&G upon commencement of project construction.

**Avian Protection Plan, Verizon Wireless, Nationwide US.** Prepared the APP for Verizon Wireless (VZW) that provided the basis for their current nationwide avian management program. The Plan address the challenges of operating and maintaining VZW's nationwide network of cell sites in relation to perching, roosting, and nesting locations of protected avian species. The Plan is currently used by VZW to facilitate awareness of avian issues within the telecommunications industry and to identify the actions that are necessary to comply with applicable avian protection laws. The Plan is designed to reduce the operational and avian risks that result from avian interactions with telecommunication tower structures and their associated facilities.

**Crown Landing LNG Environmental Studies and Permitting, Logan Township, NJ.** Technical lead for terrestrial ecological issues associated with a proposed liquified natural gas (LNG) import terminal located on the Delaware River in New Jersey. Conducted terrestrial investigations at the site including wetland delineation, vegetation community characterization, wildlife habitat assessment, and threatened and endangered species investigations. Prepared FERC resource reports and worked closely with client to address ecological issues associated with the project and provided guidance for

potential avoidance and mitigation measures to offset potential impacts of the project. Primary ecological issues with the project included impacts to wetlands and bald eagles. Addressed ecological issues with the regulatory agencies and prepared state and federal permit applications for the project.

**Massachusetts Division of Fisheries and Wildlife Tern Restoration Project, Buzzards Bay, MA.** Lead scientist and project manager for developing a management plan for several islands in Buzzards Bay, MA that support nesting populations of state and federally-listed tern species. The islands are protected by the state as part of the Wildlife Management Area system, which allows some recreational use of selected sites. As part of management plan development, Ms. Tims conducted an assessment of the potential effects of recreational use of the islands on the nesting birds and their habitats. The study determined that recreational use was incompatible with the waterbird nesting and recommended that the island and surrounding buffer zone be protected from any human use during the bird breeding season from April through August. The recommendation was adopted and incorporated in the management plan. The project also evaluated several habitat restoration and shoreline stabilization options, of which several were adopted.

**U.S. Army Yakima Firing Center Habitat and Threatened and Endangered Species Studies, Yakima, WA.** Lead scientist and project manager for U.S. Army project involving large-scale impact assessment of Army activities at the Yakima Firing Center, WA. Conducted a detailed habitat inventory and led breeding bird studies in areas potentially used by two federally-listed threatened bird species. Prepared impact assessment of Army training activities and land management practices and developed INRMP for the site. Evaluated the installation's land and resource management policies and recommended policy modification to enhance natural resource protection and stewardship.

**Teknor Apex Wetland Delineation and Ecological Monitoring, Norton, MA.** Technical leader for a wetland delineation and ecological characterization of a chemical manufacturing site and associated undeveloped properties. Conducted wetland delineation and vegetation and wildlife assessment, including bird and amphibian surveys. Advised client

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on wetland issues associated with an ongoing remediation project at the site and designed and implemented a wetland mitigation plan wetlands that were degraded during remedial activities. Worked closely with local regulators to obtain wetland permits and negotiate wetland mitigation requirements.

**Shpack Superfund Site Wetland Delineation and Ecological Characterization, Attleboro, MA.** Technical leader on wetland delineation and ecological characterization of a superfund site to support preparation of ecological and human health risk assessments for the site. Conducted wetland delineation and vegetation and wildlife inventory including surveys for rare plants, breeding birds, amphibians, macroinvertebrates, and fish. Evaluated ecological data in the context of contaminant patterns and recommended remedial actions for the site based on sensitive habitats and wildlife use. Collaborated with EPA and USACE regarding remedial actions and wetland delineation and functional assessment.

**Portland Air National Guard Ecological Risk Assessment and Wetland Evaluation, Portland, OR.** Project Manager and Senior Ecologist for Phase I Ecological Risk Assessment and Phase II Screening Assessment involving extensive site investigation and ecological risk analysis associated with a contaminated drainage ditch. The risk analysis focused on the extent of contamination and a migration pathway analysis to evaluate the potential for site-related contaminants to reach the Columbia Slough, a critical habitat for endangered salmonids. The site characterization included a wetland functions and values assessment and detailed ecological characterization of the site and adjacent water bodies to determine the appropriate remedial action(s) for the site. Consulted with ODEQ on ecological risk issues and USACE and ODSL regarding wetland impacts and mitigation.

**Atofina Ecological Risk Assessment, Portland, OR.** Project Manager and senior ecologist on Phase 1 ecological risk assessment for Atofina property located along the Willamette River in downtown Portland. Work included an ecological inventory of the site, delineation of shoreline wetlands, a wetland functions and values assessment, and threatened and endangered species evaluation. Currently involved in ongoing consultation with state and federal agencies regarding potential remedial actions at the site, wetland and

shoreline impacts, wetland mitigation, and potential effects of the remedial action on threatened and endangered species, particularly salmonids in the Willamette River.

**Union Pacific Rail Road Ecological Risk Assessment, Eugene Rail Yard, Eugene, OR.** Project Manager and Senior Ecologist on Ecological Risk Assessment for the Eugene Rail Yard, Eugene, Oregon. Conducted a detailed ecological investigation of on-site and adjacent ecological communities for contaminant-receptor analysis. Evaluated soil, sediment, and surface water data for contaminants of concern. Specific issues included the potential for contaminants of interest to effect several State-listed threatened and endangered species, including Western pond turtle. Coordinated with ODEQ and ODFW on ecological risk and threatened and endangered species issues, respectively.

**Cape Vincent Wind Power Project, NY.** Conducted wetlands and threatened and endangered species field assessment and contributed to the state-level Environmental Impact Statement (EIS) pursuant to the New York State Environmental Quality Review Act (SEQRA) for a potential wind farm in northern New York. Provided senior oversight on the ecological sections of the EIS including vegetation, wildlife, wetlands and waterbodies, and threatened and endangered species. Worked with local herpetile expert on an assessment of the Project's potential effects on Blanding's turtle, a state-listed threatened species, and developed recommendations to avoid or mitigate potential impacts from the Project on Blanding's turtles and their habitat.

**NiSource Gas Pipeline Wetland Delineation and Rare Plant Surveys, MD.** Technical lead for wetland delineations and rare plant surveys along an existing natural gas pipeline spanning four counties in central Maryland. Coordinated with state and federal agencies and prepared permit applications to secure authorizations to test and repair the pipeline in specific locations. Also surveyed wetland and riparian habitats in need of restoration along the pipeline and provided specific recommendations regarding restoration of degraded areas.

# Philip E. Goodrum, Ph.D.

Senior Project Manager



Philip Goodrum has over 20 years experience in quantitative risk assessment and environmental modeling, specializing in applications to human health and ecological risk assessment, sediment remediation, groundwater compliance monitoring, and natural resources damages assessment. He has served as a technical team leader and project manager, responsible for coordinating more than 20 major client deliverables per year to address CERCLA, RCRA, TSCA, FIFRA, and other federal and state obligations. Dr. Goodrum brings a broad understanding of the use and effective communication of data evaluation, visualization, and statistical analysis techniques to support human health and ecological risk assessment as well as sample design optimization for clients engaged in long-term monitoring programs. He has extensive experience applying geospatial analysis to high-profile contaminated sediment and floodplain sites that require technical innovation and creative solutions. He provides expert peer review of regulatory guidance and conducts negotiations with state and federal regulators on issues related to data interpretation, statistical analysis, modeling, risk characterization, and remedy selection.

Dr. Goodrum is a recognized national expert in both probabilistic modeling and lead risk assessment, which were the subject areas of his Ph.D. He has directed multi-year support contracts on probabilistic risk assessment (PRA) for USEPA's Office of Pesticide Programs (Environmental Fate and Effects Division) and Superfund office. Dr. Goodrum currently serves on USEPA's Science Advisory Board for lead and also serves on the Interstate Technology and Regulatory Council workgroup on Incremental Sampling Methodology, for which he received the 2010 Industry Recognition Award. He teaches professional short courses on statistics and most recently taught a 1-day short course on geostatistics at the Battelle Sediments conference in New Orleans.

## Professional Affiliations & Registrations

- Member Interstate Technology and Regulatory Council (ITRC) workgroup on Incremental Sampling Methodology, 2009 – date
- Member Society for Environmental Toxicology and Chemistry, 2001 – date
- Member Sigma Xi, 2000 – date
- Adjunct Visiting Professor, SUNY College of Environmental Science and Forestry, Graduate Course on Statistics and Environmental Modeling, 1999 – date
- Co-Chair Syracuse Regional Lead Task Force, Syracuse, NY, 1999 – 2002

## National Advisory Committees

- U.S. EPA Science Advisory Board for Lead, 2010 - date
- U.S. EPA Clean Air Scientific Advisory Committee (CASAC) Lead Review Panel (current activity is a three-year appointment) 2010 – 2013, 2006 – 2007
- U.S. EPA National Center for Exposure Assessment (NCEA), Research Triangle Park (RTP). Invited speaker to National Air Quality Criteria for Lead Workshop. Chapel Hill, NC, 2005
- U.S. EPA NCEA, RTP. Peer review panel for All Ages Risk Model for Lead, 2000

## Fields of Competence

- Quantitative risk assessment
- Probabilistic modeling
- CERCLA RI/FS and removal actions
- Soil, groundwater, and sediment investigations
- FIFRA (ecological risk assessment of pesticides)
- Statistics, including geostatistics
- Toxicology, including dose-response modeling and species sensitivity distributions
- Lead exposure and bioavailability

## Education

- Ph.D., Engineering, SUNY College of Environmental Science and Forestry, 1999
- M.S., Water Resources, SUNY College of Environmental Science and Forestry, 1995
- B.S., Environmental Technology, Cornell University, Ithaca, NY, 1989

## Honors & Awards

- Interstate Technology and Regulatory Council (ITRC) Industry Recognition Award for contributions to workgroup on Incremental Sampling Methodology, 2010
- Syracuse Research Corporation graduate student fellowship, 2005

## Key Projects

### **Probabilistic Dose-Response Analysis, U.S. Environmental Protection Agency**

Currently assisting USEPA with the development of a technical manual to accompany a new probabilistic model for ecological risk assessments of aquatic receptors. The model will implement novel approaches for combining data across species and genus classifications. The model improves upon the current practice of evaluating species sensitivity distributions by explicitly quantifying variability and uncertainty in dose response relationships consistent with the full range of data available.

### **Probabilistic Modeling with MicroExposure Event Simulation, U.S. Environmental Protection Agency**

Conducted two-dimensional Monte Carlo Analysis to develop risk-based soil action levels for TCDD-TEQ. Implemented a Microexposure Event modeling technique to quantifying long-term average daily dose as a series of short-term (daily) exposure events.

### **Oil Refinery Site with Inorganics and Organics, Confidential Client**

Conducted a baseline human health risk assessment for a former oil refinery site with inorganics and organics. Responsibilities include developing the conceptual model for numerous worker, recreational, and residential exposure scenarios. Delineated exposure units and calculated exposure point concentrations using current statistical techniques for handling left-censored data. Conducted exposure assessments, toxicity assessments, and the risk characterization for numerous chemical classes including metals, PAHs, and organic VOCs.

Evaluated risks to construction workers using the VDEQ trench model and evaluated risks to residents using USEPA showering and bathing models.

### **Dioxin Fingerprinting in Surface Soil, Confidential Client**

Assisted with application of multivariate statistics to dioxin congener data expressed as proportions. Conducted principal components analysis and developed methods to rank unclassified samples based on proximity to 95% ellipsoids representing unique sources. Results were used to establish upper bound background screening levels for dioxin TEQs.

### **Multivariate Statistical Analysis of Sediment Systems, Confidential Clients**

Conducted a statistical analysis for multiple high profile sites to determine if near site sediment conditions are similar to upriver conditions in major urban river systems. Data included in situ toxicity testing, benthic community indices, and concentrations of metals and water quality parameters. Techniques included hierarchical cluster analysis, ANOVA, and principal components analysis. Represented clients in negotiations with state regulatory agencies to assist with interpretation of results of statistical analysis.

### **Background Screening Levels in Groundwater, Confidential Client**

Conducted statistical analysis of extensive data base of groundwater monitoring data to develop background screening levels for approximately 30 constituents. Statistical methods included outlier analysis, time series analysis including seasonal trend analysis, graphical evaluation with probability plots, and calculation of upper tolerance limits. Developed alternative methods to account for unequal sample sizes in wells.

### **Exploratory Data Analysis - Dietary Exposures, U.S. Environmental Protection Agency**

Assisted with exploratory data analysis of NHANES and Continuing Survey of Food Intake by Individuals (CSFII) data sets to generate estimates of dietary patterns among adults in the United States. Food groups were combined with Food and Drug Administration (FDA) data on average concentrations of cadmium in foods. Assisted in the development of the Cadmium Dietary Exposure Model (CDEM) to synthesis estimates of food-ingestion rates and cadmium concentrations, resulting in estimate of the variability in cadmium exposure from food among the general U.S. population.

**Lead - Large Area Superfund Sites, U.S. Environmental Protection Agency**

Conducted human health risk assessments (HHRA) at large area Superfund sites in Region 3 and Region 8. Applied the USEPA's IEUBK Model for Lead in Children and a probabilistic model (developed as part of Ph.D. research) called the Integrated Stochastic Exposure model for lead. Conducted sensitivity analysis using both one-dimensional (1-D) and two-dimensional (2-D) Monte Carlo analysis. Developed risk-based cleanup levels for lead in soil.

**Exposure Assessment - Drinking Water, U.S. Environmental Protection Agency**

Managed a project to develop a tool for calculating time-weighted average concentrations of multiple constituents in drinking water from large data sets generated by national surface water and groundwater monitoring programs. Developed alternative approaches using USEPA and U.S. Geological Survey (USGS) methodologies for evaluating time series data. Assisted in the preparation of a final technical report for a case study of acetochlor.

**Exposure Assessment - Birds, U.S. Environmental Protection Agency**

Managed a team to develop a software tool that implements a spatially explicit approach to ecological risk assessment that provides greater flexibility in defining habitat ranges overlaid with site-specific data on concentrations in exposure media. Applied the tool (GeoSEM) to several hypothetical exposure scenarios for birds exposed in agro-environments in Florida. Implemented several random walk routines published by Bruce Hope (Oregon Department of Environmental Quality). Applied a first-order kinetics assumption to simulate bioaccumulation of chemicals over time in terrestrial receptors (both prey and predator species).

**Exposure Assessment - Soil Ingestion Rate, U.S. Environmental Protection Agency**

Conducted a comprehensive peer review of all available studies to support estimates of soil ingestion in children and adults. Developed a series of alternative probability distributions for soil-ingestion rate, supported primarily by daily estimates reported by Stanek and Calabrese from the Amherst and Anaconda cohorts. Provided peer reviews for the USEPA and state agencies on proposed deviations from the Standard Default Point Estimates for children (200 mg/day) and adults. Proposed additional data-analysis steps to reduce source of uncertainty in the

existing data, including incorporating more recent data on age-specific hand-to-mouth activity.

**Exposure Assessment - Birds, U.S. Environmental Protection Agency**

Conducted a literature review to identify and summarize the field data available to support estimates of activity patterns of birds in agro-environments. Developed estimates of habitat use patterns for a variety of species observed in orchards and field crops. Assisted the USEPA in utilizing the available data to support the development of a new probabilistic terrestrial exposure model for pesticides.

**Exposure Assessment - Fish Ingestion Rate, Confidential Client, Various Locations**

Conducted HHRA's at Superfund sites in New York, Massachusetts, and Maine involving PCB exposures to anglers via fish ingestion. Developed estimates of fish-ingestion rates based on site-specific creel surveys, including concurrent helicopter flyovers. Assisted in reviewing and summarizing literature on the reduction in PCBs in fish filets associated with different cooking practices. Developed a spreadsheet-based tool for conducting Monte Carlo analysis, including Microexposure event simulation.

**Dose Response Data Analysis, Confidential Client**

Conducted statistical analysis of dose response data on copper toxicity in birds. Evaluated both regression analysis and probit analysis for multiple studies, accounting for differences in study design that may correlate with observed responses. Assisted with the development of a PBPK model for copper in birds to evaluate the probability of adverse effects associated with alternative acute exposure scenarios.

**Sampling Design, Confidential Clients**

Assisted with sampling designs for numerous data collection efforts including nature and extent evaluations of abiotic media (sediment, soil, surface water, and groundwater). Assisted with designing surveys to estimate fish ingestion rates for anglers residing near sites with a wide range of potential fishing locations. Calculated sample sizes needed to achieve desired Type I and Type II error rates.

**Comparison of XRF and Laboratory Measurements of Metals in Soil, Confidential Client**

Conducted statistical analysis to evaluate the performance of XRF measurements of metals

concentrations in soil. Conducted parametric paired t-tests and Wilcoxon Matched Pairs Test and evaluated the uncertainty in summary statistics on data sets with non-detects. Participated in negotiations with statisticians representing a regulatory agency.

**Peer Review of Terrestrial Exposure Models for Pesticides, U.S. Environmental Protection Agency**

Served as independent peer reviewer of a probabilistic risk assessment submitted to the USEPA's Office of Pesticides in support of rodenticides. Evaluated the modeling assumptions including estimates of dietary patterns of predatory mammals and birds. Demonstrated alternative modeling assumptions to simulate exposures over time to provide a more informative sensitivity analysis.

**Peer Review of Probabilistic Risk Assessment, U.S. Environmental Protection Agency Region 1**

Served as independent peer reviewer of a probabilistic risk assessment conducted by USEPA Region 1 on a major waterway. Evaluated selection of exposure factors, exploratory data analysis methods and results, and probabilistic modeling approaches. Provided peer-review comments and participated in discussion with the Agency's team of consultants.

**Peer Review of Fish Ingestion Rate, Florida Department of Environmental Protection, Florida**

Evaluated a proposed probability distribution for fish-ingestion rates used in a probabilistic baseline risk assessment for the Florida Department of Environmental Protection (FDEP).

**Product Registration of Pesticides, Cheminova**

Managed the data development on toxicity as well as fate and transport of ethyl and methyl parathion in support of state and federal pesticide registration, Special Reviews, and other data requirements under USEPA FIFRA Guidelines. Served as primary point of contact for a major European agro-chemical company, coordinated studies with contract laboratories, submitted data packages to state and federal agencies, and communicated with agencies on all scientific and regulatory compliance issues.

**Product Registration of Pesticides, Confidential Client**

Managed a project to conduct groundwater and surface water modeling of a pesticide applied to turf. Developed a conceptual site model, evaluated alternative modeling approaches for quantifying fate and transport in

unsaturated and saturated zones, and estimated physical/chemical properties of degradates. Model calibration was conducted using results of prospective groundwater studies.

**Inhalation Modeling of VOCs via Showering, U.S. Environmental Protection Agency**

Evaluated alternative modeling approaches for calculating exposures to VOCs from showering, including Foster and Christowski's Integrated Human Exposure Model (IHEM), Schaum and Andleman, CalTOX, and others. Developed hypothetical case studies to demonstrate the similarities and differences in modeling approaches. Extended modeling approaches to accommodate probabilistic risk assessment and conducted sensitivity analysis to illustrate the role of model uncertainty in risk assessments of VOCs.

**Dose Response Modeling of Pesticides - Refined Aquatic Risk Assessment Model, U.S. Environmental Protection Agency**

Managed and participated in the development of a probabilistic risk assessment model for the USEPA's Office of Pesticide Programs, Environmental Fate and Effects Division. Responsibilities included coordinating software development, developing statistical methods to quantify variability and uncertainty in dose-response, and initiating technical documentation and a user's guide. Assisted the USEPA in prioritizing model development activities and in testing initial versions of the software.

**Fate and Transport Modeling - Stochastic Weather Models, U.S. Environmental Protection Agency**

Managed a team of hydrologists, computer programmers, and environmental modelers to develop a new software tool, GemPRO, which generates a long-term stochastic time series of weather based on a short-term record from national weather stations. GemPRO is designed to generate data files that are compatible with both GLEAMS and PRZM/EXAMS.

**Fate and Transport Modeling - Watershed Scale Models, U.S. Forest Service**

Managed a team of hydrologists and modelers to evaluate alternative modeling approaches that could be applied to fate and transport modeling of pesticides in forested catchments. Provided a critical peer review of GLEAMS and outlined a series of enhancements including the use of a watershed scale approach.

**Aquatic and Terrestrial Ecological Risk Assessment, U.S. Environmental Protection Agency**

Managed and participated in more than 40 ecological risk assessments for the USEPA's Office of Pesticide Programs, Environmental Fate and Effects Division. Responsibilities included preparation of problem formulation and conceptual models, literature search and review, evaluation of pesticide-use patterns throughout the United States, application of fate and transport models, and characterization of risks to both aquatic and terrestrial receptors, including threatened and endangered species. Conducted both Tier 1 point estimate calculations and Tier 2 probabilistic calculations for non-target receptors in both aquatic and terrestrial ecosystems.

**Disinfection Byproducts - Wet Weather Flows, Water Environment Research Foundation (WERF)**

Developed a tiered screening level risk assessment methodology to evaluate risks associated with disinfection byproducts following the treatment of wet-weather flows. Summarized all toxicity reference values available for chemicals measured in effluent following the application of alternative treatment technologies (e.g., ozone, chlorine, chlorine dioxide). Assisted in the preparation of a report for the Water Environment Research Foundation (WERF) published in 2005 titled, "Identifying Technologies and Communicating Benefits and Risks of Disinfecting Wet Weather Flows."

**Risk Assessment Guidance for Superfund (RAGS), U.S. Environmental Protection Agency**

Co-authored the USEPA's 2001 Risk Assessment Guidance for Superfund (Volume 3), <http://www.epa.gov/oswer/riskassessment/rags3a dt/index.htm>, which provides guidance on the use of PRA in human and ecological risk assessment. Conducted research on alternative probabilistic approaches, assisted the USEPA in the development of a three-tiered approach to PRA, and developed case studies to demonstrate the applications of PRA to both human health and ecological risk assessment. Also responsible for reviewing PRAs submitted to and conducted by the USEPA's Superfund program (OSRTI).

**Metals Bioavailability, Confidential Client**

Assisted in the review of site-specific estimates of arsenic bioavailability, comparing estimates from in vitro assays and in vivo measurements. Prepared a summary of the range of bioaccessibility and bioavailability that would be expected under different pH conditions comparable to

the range of conditions in the human gastrointestinal (GI) tract. Assisted in the development of preliminary remediation goals for arsenic.

**Metals Bioavailability, U.S. Environmental Protection Agency**

Assisted in development of new estimates of bioavailability of lead in adults based on variability in absorption under fed and fasted conditions. Conducted data analysis of primary experimental study data with adults exposed to radio-labeled lead in controlled diets. Developed SAS scripts to evaluate meal patterns of adults from the National Health and Nutrition Examination Survey (NHANES) data. Developed a spreadsheet-based tool to quantify inter- and intra-individual variability in daily average absorption via the gastrointestinal tract, considering alternative assumptions for auto-correlation over time. Assisted in the application of the same methodology to calculate bioavailability of nickel following exposures via drinking water.

**Occupational and Transportation Risk Assessment, Confidential Client**

Conducted an occupational and transportation risk assessment for workers that would implement alternative proposed remedies of site with PCBs in sediment. Obtained national data sets on the frequency of injuries and worker fatalities for a range of occupations associated with each remedy. Conducted a sensitivity analysis to evaluate risks associated with alternative sediment dredging and capping technologies and alternative disposal sites.

**Radionuclides - Probabilistic Backcalculation of Risk-Based Action Levels, U.S. Environmental Protection Agency**

Applied the first probabilistic risk assessment with the USEPA's Risk Assessment Guidance for Superfund (RAGS) approach to develop risk-based action levels (RALs) in soil for the Rocky Flats Superfund site contaminated with radionuclides (americium, plutonium, uranium). Developed probability distributions for inputs for multiple exposure pathways (soil ingestion, home-grown vegetable ingestion, inhalation, and external exposure), conducted Monte Carlo analysis including sensitivity analysis, developed the technical report, and participated in multiple stakeholder meetings with federal and state regulatory agencies and the public community action group.

## Publications

Osborn, E., P.E. Goodrum, S. Huntley, L. Harrington, B. DeShields, R. Hilarides, and S. Holm. 2010. Determination of Site-Specific PCDD/PCDF Ambient Soil Concentrations at a Former Sawmill Site. Submitted to Integrated Environmental Assessment and Management.

Swarts, S.G., V.B. Houck, M.M. Stephenson, M.R. Osier, and P.E. Goodrum. 2006. A Web Database Providing Ready Availability to Measured Indoor Air Pollutant Concentrations and Supporting Information. Proceedings of the 99th Annual Conference and Exhibition of the Air Waste Manag. Assoc. Paper #442. June 20.

Maddaloni, M., M. Ballew, G. Diamond, M. Follansbee, D. Gefell, P. Goodrum, M. Johnson, K. Koporec, G. Khoury, J. Luey, M. Odin, R. Troast, P. Van Leeuwen, and L. Zaragoza. 2005. Assessing Lead Risks at Non-Residential Hazardous Waste Sites. *Hum Ecol Risk Assess* 11: 967-1003.

Thayer, W.C., D.A. Griffith, P.E. Goodrum, G.L. Diamond, and J.M. Hassett. 2003. Application of Geostatistics to Risk Assessment. *Risk Anal.* 23(5): 945-960.

Choudhury, H., T. Harvey, W.C. Thayer, T.F. Lockwood, W.M. Stiteler, P.E. Goodrum, J.M. Hassett, and G.L. Diamond. 2000. Use of a Modified Cadmium Pharmacokinetics Model to Validate Urinary Cadmium Elimination as a Biomarker of Exposure. In: *Metal Ions in Biology and Medicine*. Centeno, J.A., P. Collery, G. Vernet, R.B. Finkelman, H. Gibb, J.C. Etienne, Eds. John Libbey, Eurotext, Paris. p. 313-315.

Griffin, S., P.E. Goodrum, G.L. Diamond, W. Meylan, W.J. Brattin, and J.M. Hassett. 1999. Application of a Probabilistic Risk Assessment Methodology to a Lead Smelter Site. *Hum Ecol Risk Assess* 5(4):845-868.

Lockwood, T.F., H. Choudhury, G.L. Diamond, P.E. Goodrum, J.M. Hassett, and W.M. Stiteler. 1998. A cadmium dietary exposure model (CDEM) for use in risk assessment. *Toxicol Sci* (48): 382.

Diamond, G.L., P.E. Goodrum, S.P. Felter, and W.L. Ruoff. 1997. Gastrointestinal Absorption of Metals. *Drug Chem Toxicol* 20:345-368.

Goodrum, P.E., G.L. Diamond, J.M. Hassett, and D.L. Johnson. 1996. Monte Carlo Modeling of Childhood Lead Exposure: Development of a Probabilistic Methodology for Use with the U.S. EPA IEUBK Model for Lead in Children. *Hum Ecol Risk Assess* 2:68 1-708.

Price, P.S., C.L. Curry, P.E. Goodrum, M.N. Gray, J.I. McCrodden, N.W. Harrington, H. Carlson-Lynch, R.E. Keenan. 1996. Monte Carlo Modeling of Time-dependent Exposures Using a Microexposure Event Approach. *Risk Anal* 16 (3):39 -348.

## Presentations

“Incremental Sampling Method -- Retrospective Study of the Potential Utility for Decision-Making”. Goodrum, P. 2011. Paper presented at Sixth International Conference on Remediation of Contaminated Sediments, New Orleans, LA.

“Regulatory Initiatives to Assess Risks to Populations – Case Study of California’s Delta Blood Lead Metric”. Nedoff, J., Goodrum, P.E., Lee, D.K. and Meyer, C. Poster presented at Society for Environmental Toxicology and Chemistry (SETAC) 2010 Annual Meeting, Portland, OR.

“PRZM Ground Water Modeling Predictions for a Modified Acetochlor Soil Restriction on Corn, Cotton, and Soybeans.” Negley, T.L., Goodrum, P.E., Newcombe, A.C., Gustafson, D.I., and I. van Wesenbeeck. 2010. Presented at the 239th Annual Meeting of the American Chemical Society. San Francisco, California.

“Tailoring LTM Optimization Strategies for Large and Small Groundwater Sampling Networks.” Goodrum, P.E., T.L. Negley, K. Peterburs, and G. Reeder. 2010. Paper presented at Battelle Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA.

“Use of Historic Groundwater Data in Developing Long-Term Monitoring Strategies.” Sueker, J., M. Gefell, J. Holden, B. Thompson, and P. Goodrum. 2010. Paper presented at Battelle Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA.

“A Comparison of Three Different Methods for Estimating Children’s Soil and Dust Ingestion Rates.” Simon, T.W. and P.E. Goodrum. 2010. Poster presented at Society of Toxicology (SOT) 49th Annual Meeting, Salt Lake City, UT.

“Performance of Incremental Sampling Techniques for Estimation of Exposure Point Concentrations.” Goodrum, P.E., K. Tolson, S. Roberts, L. Stuchal, C. Saranko, A. Singh, J. Hathaway, K. Black, and L. Mora-Applegate. 2010. Poster presented at ARCADIS Sediment Management Seminar, Ft. Lauderdale, FL.

“Applying Long-term Groundwater Optimization (LTMO) Strategies to Reduce Life-Cycle Costs.” Peterburs, K., T.L.

Negley, P.E. Goodrum, M.S. Jones, and G. Reeder. 2009. Poster presented at Railroad Environmental Conference, University of Illinois at Urbana-Champaign, IL.

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