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Pieter N. Booth
Principal

Professional Profile

Mr. Pieter Booth is a Principal in Exponent's EcoSciences practice. He has 28 years of experience as an environmental scientist and program manager specializing in ecotoxicology and risk assessment, natural resource damage assessment (NRDA), and restoration of natural systems. Mr. Booth has directed many complex multidisciplinary projects to assess ecological risks and impacts from releases of hazardous substances, including oil. He has directed and participated in environmental and social due diligence audits as required by multilateral banks for a variety of projects in the energy, transportation, and natural resources sectors. He has also served as consulting expert for issues related to exposure and ecological effects and developed expert reports for review by the International Court of Justice. He is also nationally recognized for his NRDA work, particularly his role providing technical support to industry clients during restoration-based settlement negotiations. He has fulfilled this role for several of the largest NRDA cases in the country, including Saginaw River and Bay, Lake Hartwell/Twelvemile Creek, St. Lawrence River, and Tittabawassee River . In these roles, he has provided technical support to legal teams in the development of case strategy and in the supervision and preparation of materials for litigation support under CERCLA, RCRA, the Clean Water Act, and the regulatory programs of various states.

Mr. Booth has a particularly strong background in managing and directing evaluations of the potential impacts of PCBs and metals on fish, birds, and mammals; ecological risks posed by sediment contamination; and options for sediment management. Mr. Booth has developed and managed a corporate program for a Fortune 500 manufacturing company, to implement risk assessment guidance for program managers in the remediation group and provide site-specific ecological risk assessments at numerous sites nationwide.

For other industrial clients, Mr. Booth has assisted in developing overall strategies for environmental issues, designing site-specific assessments, and negotiating risk-based response actions with state and federal agencies. In addition, he has supervised the study design, collection, and analysis of environmental data and the development of PC- and web-based data management, analysis, and visualization tools. Mr. Booth has led numerous projects directed at the characterization and remediation of contaminated sediments in the United States and South America, and he has helped to create guidance and policy for regional sediment management programs in Puget Sound and San Francisco Bay.

Academic Credentials and Professional Honors

M.M.A., Marine Affairs, University of Washington, 1984
I.P.A. Certificate, Integrative Program in Administration, University of Washington Graduate School of Business, 1983
B.A., Biology, University of the Pacific, 1977

Licenses and Certifications

Hazardous Waste Operations and Emergency Response 40-hour training program; Hazardous Waste Operations Management and Supervisor 8-hour training program

SSI Advanced Open Water Scuba certification, 2009

Publications

Booth PN, Salatas JH, Jawetz S. Restoring the Great Lakes: The Great Lakes Legacy Act, Great Lakes Restoration Initiative, and NRDA. ABA Newsletter on Superfund and Natural Resource Damages Litigation 2010 Nov; 6(1).

Salatas JH, Booth PN. Considerations for early restoration and cooperative assessments in the NRDA process. Environmental Perspectives Newsletter – Emerging Trends in Natural Resource Damage Assessment 2010 Fall.

Booth PN, Salatas, JH, Kaetzel RS, Gard NW, Yost LJ, O'Boyle RA, Mackay CE. Risk assessment as a decision-making tool for treatment of emissions at a new aluminum smelter in Iceland: 1. Background and introduction. J Hum Ecol Risk Assess 2009, in press.

Salatas JH, Booth PN, Gard NW, O'Boyle RA, Mackay CE. Risk assessment as a decision-making tool for treatment of emissions at a new aluminum smelter in Iceland: 3. Ecological assessment. J Hum Ecol Risk Assess, 2009; 15(3):469–502.

Kaetzel RS, Yost LJ, O'Boyle RA, Booth PN. Risk assessment as a decision-making tool for treatment of emissions at a new aluminum smelter in Iceland: 2. Human health risk assessment. J Hum Ecol Risk Assess, 2009; 15(3):442–468.

Menzie CA, Booth P, Law SA, von Stackelberg K. Use of decision support systems to address contaminated coastal sediments: Experience in the United States. In: Decision Support Systems for Risk-Based Management of Contaminated Sites. Marcomini A, Suter II GW, Critto A (eds), Springer Verlag, 439 p, 2009.

Booth P, Gard N, Law S, Davis R. Sustainability: Considerations for including eco-assets in a company's bottom line. American Bar Association Climate Change, Sustainable Development, and Ecosystems Committtee Newsletter 2007; 11(1):7–11.

Booth P, Gribben K. A review of the formation, environmental fate, and forensic methods for PAHs from aluminum smelting processes. Environ Forens 2005; 6(2):133–142.

Booth PN, Bigham G, Gasch, Jr. M. Natural resource damage looms as major liability issue. Environ Corp Counsel Report 1994; 1(2):5–8.

Booth PN, Jacobson MA. Development of cleanup standards at Superfund sites: an evaluation of consistency. J. Air Waste Manage Assoc 1992; 42:762–766.

Booth PN, Becker DS, Pastorok RA, Sampson JR, Graham WJ. Evaluation of restoration alternatives for natural resources injured by oil spills. Prepared for the American Petroleum Institute, Washington, DC, API Publication No. 304, 1991.

Jacobson MA, Booth PN. A review and evaluation of hazardous waste cleanup standards implemented after the enactment of the Superfund Amendments and Reauthorization Act. In: Proc. Haztech International '90. Institute for International Research, Inc., New York, NY, 1990.

Booth PN, Becker DS, Barrick RC, et al. A screening-level approach to estimating natural resource damages from contaminated marine sediments. In: Proc. Sixth Symposium on Coastal and Ocean Management. American Society of Civil Engineers, New York, NY, 1989.

Pastorok RA, Booth PN, Williams LG. Estimating potential health risks of chemically contaminated seafood. Puget Sound Notes, U.S. Environmental Protection Agency Region 10, Seattle, WA, May 1986.

Presentations

Booth PN, Salatas JH. The Great Lakes Legacy Act, Great Lakes Restoration Initiative, and NRDA: The potential for synergy. Poster presented at SETAC North America 30th Annual Meeting, Portland, OR, November 7–11, 2010.

Booth P, Law S. EcoAIM: Application to the San Pedro Watershed. Roundtable Discussion of Emerging Ecosystem Service Tools, BSR Environmental Services, Tools, and Markets Working Group, Phoenix, AZ, October 5, 2010.

Booth P. Corporate land management and ecosystem services: How does it all come together? Presented at the Wildlife Habitat Council Ecosystem Services Conference: A New Generation in Restoration: Strategies for Managing Corporate and Public Land, June 23, 2010.

Booth P, Law S, Ma J. Ecosystem service considerations for corporate land management: Emerging ecosystem service tools and a case study of comparative tool application. Poster presented at SETAC North America 30th Annual Meeting, Portland, OR, November 7–11, 2010.

Booth P, Law S, Ma J. Case study of comparative tool application and considerations for corporate land management. Presented at ACES: A Community on Ecosystem Services, Gila River Indian Community, Phoenix, AZ, December 6–9, 2010.

Booth P, McArdle M, Kane Driscoll S. Application of ecological risk-based approach to sediment remediation at a former manufacturing plant site. Annual Conference on Soils, Sediments, Water and Energy, Amherst, MA, October 19–22, 2009.

Law S, Booth P, Gard N, Ma J, von Stackelberg K. Ecological Asset Inventory and Management (EcoAIM) tool: A screening approach for identifying and managing ecological

assets. Society of Environmental Toxicology and Chemistry North America, 29th Annual Meeting, Tampa, FL, November 16–20, 2008.

Booth P, Salatas J, Gard N, Mackay C, O'Boyle, R. A predictive ecological risk assessment for evaluating treatment options for aerial emissions at an aluminum smelter is Reyðarfjörður East Iceland. Presented at Society of Toxicology, Charlotte, NC, March 25–29, 2007.

Salatas JH, Booth P, Gard N, Mackay C, O'Boyle R. Using predictive risk assessment to evaluate aluminum smelter treatment options for protection of mammalian communities in Iceland. Presented at Society of Environmental Toxicology and Chemistry 27th Annual Meeting, Montreal, Quebec, November 5–9, 2006.

Salatas JH, Booth P, Gard N, Mackay C, O'Boyle R. Using predictive risk assessment to evaluate treatment options for aluminum smelter emissions. Session: Challenges and Innovations in the Evaluation of Birds in Ecological Risk Assessments. Presented at Society of Environmental Toxicology and Chemistry 27th Annual Meeting, Montreal, Quebec, November 5–9, 2006.

Booth P, Harman W, Kirchof C. Dam removal as out-of-kind compensatory restoration for CERCLA Releases: The case of Twelvemile Creek/Lake Hartwell, SC. SETAC, Interactive Poster Presentation, Abstract Reference No. BOO-1117-819783, November 16, 2005.

Booth P, Gard N, Bodishbaugh R. Tools for Streamlining Ecological Risk Assessments at RCRA Corrective Action Facilities. SETAC, Poster Session, Abstract Reference No: BOO-1117-829805, TP20 Ecological Risk Assessment, November 15, 2004.

Booth P, Edwards M, Nielsen DL. Spatial and temporal trends of PCBs in fish in response to natural recovery in sediments. 4th SETAC World Congress 25th Annual Meeting in North America, Portland, OR, November 14–18, 2004.

Booth PN, Medved JB, Williams L. Wetland restoration under the Saginaw River and Bay NRD settlement. Presented at SETAC 24th Annual Meeting, Austin, TX, November 9–13, 2003.

Mackay CE, Becker S, Law S, Booth P. Probabilistic assessment of the risk to terrestrial birds and mammals in a small urban lake; Harris Lake, MI. Presented at the 23rd Annual Society of Environmental Toxicology and Chemistry Meeting, Austin, TX, November 9–13, 2003.

Medved JB, Booth PN, Moore M, Nielsen D, Goode D. Use of GIS with dynamically linked database tools in quantitative ecological assessment—A case study. Interactive poster presentation at the Society of Toxicology and Environmental Chemistry Annual Meeting and Conference, Philadelphia, PA, November 14–18, 1999.

Booth P, Medved J, Moore M, Mackay C, et al. Estimated vs. measured dietary exposure of terrestrial wildlife to contaminants in soil. Presented at the 15th Annual Conference on Contaminated Soils, Amherst, MA, October 18–21, 1999.

Booth PN, Ecological risk assessment and management: updating the tools to provide more value. General Motors Corporation Global Environmental Conference, Dearborn, MI, October 1999.

Booth PN, Henson KA. Multiuser sites for contaminated sediment disposal. In: Proc. ASCE Specialty Conference, Water Forum '92, Baltimore, MD, August 22–24, 1992.

Project Experience

Natural Resource Damage Assessment (NRDA)

Consulting restoration expert on behalf of Dow Chemical Company in the Tittabawasse River and Saginaw River and Bay NRDA matter. Responsible for developing and negotiating technical approaches for this cooperative NRDA and harmonizing these approaches with injury quantification efforts. Focus is on identifying and scaling restoration projects to compensate the public for alleged interim losses resulting from releases of dioxins, furans, and potentially other substances.

Project manager and consulting expert on behalf of industry for restoration-based settlement discussions in the Ottawa River NRDA matter. Primary issues include evaluation of alleged injury due to releases of PCBs, PAH, and metals relative to general ecological degradation due to baseline conditions, and identification and scaling of potential restoration projects to foster cooperative, restoration-based settlement.

Managing and providing technical support as consulting expert to Alcoa and General Motors in settlement negotiations in the St. Lawrence River environmental natural resource damage matter. Technical issues center on PCBs and polycyclic aromatic hydrocarbons in sediment of the Grasse, Raquette, and St. Lawrence rivers. Overseeing development and negotiation of all technical aspects of the matter, including potential injury and service reductions to benthic macroinvertebrates, fish, piscivorous and insectivorous birds, mammals, aquatic plants, and herptiles. Have a lead role in identification, scaling, and development of compensatory restoration projects for ecological services. Developed and presented technical positions and exhibits during negotiations with the New York State Department of Environmental Conservation, New York Attorney General's office, U.S. Department of the Interior, National Oceanic and Atmospheric Administration, and St. Regis Mohawk Indian Tribe.

Project manager on behalf of General Motors for all aspects of technical support on the Saginaw River and Bay NRDA matter. Played a key role in the development and implementation of technical strategies during settlement negotiations in this landmark natural resource damage case. The underlying technical issues were related to developing realistic baseline conditions for allegedly injured resources, counter-positions to the injuries alleged by the trustees, and an innovative and cost-effective restoration package. Provided detailed evaluations of causation on a variety of injuries, including bioaccumulation of PCBs by fish and reproductive effects of PCBs on fish and birds. General Motors recognized the contribution by bestowing a Worldwide Facilities Group 1998 Crew Award.

Managed and was lead consulting expert for Schlumberger in support of settlement negotiations in the Lake Hartwell natural resource damage case. Key technical issues revolved around allegations of fisheries-related impacts due to bioaccumulation of PCBs, and putative impacts of PCBs on benthic macroinvertebrate communities, fish, insectivorous birds, and piscivorous birds and mammals. Another key issue was the rate of recovery from alleged PCB-mediated injury, given EPA's remedy of monitored natural recovery. Directed the development of technical positions regarding the likely extent of injury and reductions in ecological services, if any, that were likely to have resulted from injuries. Presented technical positions during negotiation sessions with federal trustees and trustees from the states of Georgia and South Carolina, and provided technical assistance for selecting and determining the scale of the preferred compensatory restoration projects. Was co-author and technical editor of the Lake Hartwell restoration and compensation determination plan.

Managed a natural resource injury assessment for ARCO in support of settlement negotiations in the Clark Fork River natural resource damage case. The injury assessment included modeling past, present, and future water quality based on sediment/water interactions and provided critical comments on the trustee's case regarding sediment injury. The critique included a detailed evaluation of available sediment quality criteria and an evaluation of ecological risks posed by sediments with elevated concentrations of metals.

Managed tasks to quantify baseline injuries and project cumulative future injury for groundwater, geologic, and surface-water resources at the Anaconda mining complex in the Clark Fork River natural resource damage case. The analyses of injury provided the basis for litigation support and support during settlement negotiations in a natural resource damage claim.

Managed technical support activities for a national-level NRDA program. Determined contaminant transport and fate, habitat degradation, bioaccumulation, and resource injury. Responsible for studies at more than 100 Superfund sites. Studies characterized risks to natural resources, assessed injury and potential damages to natural resources, and offered recommendations for future investigations, including restoration.

Managed a task to characterize historical activities at a large industrial site and evaluate regional waste management activities in terms of potential effects to a lake environment. Regional waste management activities were characterized to aid in apportioning injury and damages in preparation for an NRDA. Developed materials balance calculations for more than 100 years of activities at a soda ash plant and more than 50 years of activities at two chlor-alkali plants and a chlorinated benzene plant.

Managed tasks to develop technical memoranda describing economic theory for NRDAs, the applications of the theory, and approaches to assessing damages to groundwater from hazardous waste sites. Memoranda were used by the Washington State Department of Ecology to develop a state program for NRDAs.

Managed NRDAs at five hazardous waste sites. Activities included biological and economic assessment of damages to recreational fisheries and benthic infauna and strategic evaluation of use and nonuse damage estimates. Developed an approach for assessing the decrease in economic value associated with benthic community effects.

Ecological Risk Assessment

Managed novel comparative human health and ecological risk assessments for air emissions of sulfur dioxide, hydrogen fluoride, PAH, and particulate material from a proposed aluminum smelter in Reyðarfjörður, Fjarðabyggð, Iceland. The primary objective of this predictive risk assessment was to determine whether there would be consequential differences in the level of risk posed by air emissions from the smelter operation with and without seawater scrubbers. A matrix of air modeling data was obtained for more than 10,000 receptor points under 99 discrete simulation scenarios to support the risk assessments. Spatially and temporally explicit exposure modeling was used in a probabilistic framework to evaluate risks to plants, birds, and mammals. The risk assessment resulted in a decision by the government of Iceland which granted the facility a permit without having to install costly seawater scrubbers.

Managing and providing corporate support on all site-specific ecological risk assessments for General Motors. Also developing corporate guidance for ecological risk assessment for General Motors project and program managers. Responsibilities for this $7 million program include overseeing development of corporate strategy on ecological risk assessment; participating in negotiations with state and federal regulatory agencies on policy and regulatory issues, as well as scope and direction of site-specific assessments; and ensuring consistency among all ongoing site ecological risk assessments. Managed over 30 risk assessments under this program, ranging from habitat characterization to multimillion dollar and multi-year investigations.

Managing a quantitative risk assessment to develop an ecologically based site remediation strategy for a stream, associated wetlands, and abandoned stormwater detention basin in Framingham, Massachusetts. This multi-phase risk assessment includes design and implementation of a state-of-the-science, site-specific bioavailability study of PAH in conjunction with 42-day *Hyallela azteca* sediment toxicity testing. Results of this novel approach indicate that sediment toxicity is driven by metals (lead and zinc) rather than PAH, despite PAH concentrations in the many hundreds of parts per million. Remedial design based on the results of the risk assessment represents a cost savings of more than $2 million over a remedy based on default cleanup levels.

Managed a quantitative probabilistic risk assessment to develop an ecologically based remediation strategy for an urban lake and associated wetlands and uplands in Pontiac, Michigan. Results of the risk assessment indicated that that no further action was needed to address ecological risk from PCBs and metals in wetland and upland soils or to address risk to piscivorous wildlife feeding in the lake. Surveys of benthic macroinvertebrates indicated significant population and community effects in the lake; however, a detailed limnological study indicated that the major stressor was related to seasonal stratification and low dissolved oxygen. These findings were used to negotiate and implement a limited sediment capping project saving the client over $12 million compared to sediment removal.

Managed and conducted an ecological risk assessment to meet Michigan Part 201 requirements at a site involved in settlement negotiations for a major natural resource damage case. Developed innovative strategic approaches to ecological risk assessment and extensive negotiation of technical and procedural issues with Michigan State agency representatives and

the federal trustee. Demonstrated low bioavailability of elevated concentrations of metals in soil.

Provided technical support to an industry client in negotiating the ecological risk assessment and sediment assessment components of the Ohio Voluntary Action Program rule. Participated in several negotiation meetings, and developed solid scientific positions on issues such as toxicity testing, bioindicators, and use of reference area comparisons.

Contaminated Sediment Management

Managed a project investigating sediment contamination in access channels to the Port of Buenos Aires, Argentina, in support of a navigation dredging project. Evaluated the applicability of international sediment standards and contaminated-sediment management practices to develop a suitable and economically viable disposal option. Designed, implemented, and concluded a sediment sampling program within a 3-week period. Geochemical analysis of metals contamination demonstrated no significant environmental impacts, allowing the project to go forward in a timely and cost-effective manner using open-water unconfined disposal for the majority of dredged material.

Managed a sediment investigation in the lower Hudson River at Sleepy Hollow, New York. This work was performed in anticipation of the demolition of a manufacturing complex and the multimillion dollar redevelopment of waterfront property. The sediment investigation focused on identifying spatial patterns of distribution of metals in sediment and the association of the metals contamination with local point and nonpoint sources.

Managed a project providing technical assistance and oversight for field activities, data evaluation and validation, community relations, enforcement support, and RI/FS support at a naval installation. This complex site presented a wide range of contamination problems in soils, groundwater, surface water, biota, and sediments.

Managed a project that evaluated the feasibility of implementing a multiuser disposal site program for contaminated sediments in Puget Sound, Washington. Results indicated that a lack of disposal capacity was threatening the Puget Sound sediment cleanup program, as well as navigation maintenance and improvement projects. The greatest challenges to program implementation were site selection (upland, nearshore, and aquatic sites) and liability management. Document was used by the client to formulate recommendations for implementing a regional program that was presented to state and federal agencies and the state legislature.

Managed a project evaluating disposal alternatives for dredged material in San Francisco Bay. Alternatives were evaluated for aquatic disposal in dispersive and nondispersive sites with material rehandling, disposal in diked baylands and other nearshore areas, and disposal in upland sites.

Analyzed regulations and guidelines and documented the decision-making framework for open-water unconfined disposal of dredged material in Puget Sound, Washington.

Evaluated mitigation actions and coordinated the preparation of an EIS on developing and implementing numerical sediment quality standards. Standards focused on establishing sediment impact and recovery zones and a sediment cleanup decision process for Puget Sound, Washington. Evaluation included quantifying disproportionate effects to small business enterprises.

Managed a project to assess the long-term bacteriological effects on freshwater sediments from a spill of untreated sewage and storm water. Sediments were sampled from three combined sewer overflows to compare indicators of human fecal contamination. Results of the $17,000 study were successfully used to save the client more than $250,000 in cleanup and restoration costs.

Participated in developing numerical criteria based on sediment chemistry; amphipod, Microtox®, and oyster larvae bioassay; and benthic community structure for guiding sediment remedial action at a Superfund site in Washington.

Environmental Impact Assessment and Policy Analysis

Conducted lender environmental due diligence for the 300 MW Jaguar Energy petcoke fired power plant in Guatemala. Principal issues included potential thermal imacts from the discharge of cooling water to a river, risks to endemic species due to habitat loss, evaluation of treatment and stack design to minimize air impacts, potential social impacts to nearby communities from influx of foreign workers during construction, potential impacts to aquifer use in nearby communities due to water extraction, and evaluation of management practices to minimize airborne dust.

Conducted lender environmental and social due diligence audit for Phase 1-B of the Highway 2000 Project in Jamaica. Project involved close coordination between the environmental and social programs of the builder, operator, and Government of Jamaica, all of whom had key roles in project management. Principal issues included the working with the responsible entities to ensure that the resettlement program met lender requirements, drainage control to ensure risk of flooding would not be increased, the potential for ecosystem effects due to habitat loss and fragmentation in the Portland Bight Protected Area, adequacy of a program for mangrove habitat restoration, and numerous aspects of project environmental and social management programs.

Conducted lender environmental and social due diligence audit for Ardan International submerged timber harvesting in Panamá. Principal issues included social issues associated with joint venture agreement with the indigenous peoples of the Kuna de Mandugandi, contracting instruments for timber removal from Lake Gatún and Lake Bayano, potential water quality impacts, transportation and social impacts associated with milling sites, and worker health and safety programs.

On behalf of builder, conducted rapid bioassessment and habitat assessment and developed a short- and long-term monitoring program for 80 MW Palomino hydroelectric project in the Dominican Republic. Principal issues were associated with altered flows of the Río Yaque del Sur and Río Grande del medio. Environmental issues received heightened care due to the

project's location within the boundaries of the José del Carmen Ramirez national park. Issues of special concern included the potential for the presence of endemic and endangered invertebrates, fish, and amphibians, and the potential for loss of terrestrial habitat.

Managed the visual and avian impacts components of an environmental impact assessment for a 500-kV power line project in the Esteros del Iberá wetland area of northern Argentina. The World Bank used this work as the standard for projects of this type in Latin America. The conclusions and recommendations developed by Exponent on these highly controversial issues allowed the project to be completed ahead of schedule and below previously projected costs for mitigation.

Managed and supervised the development of multijurisdictional action plans to control toxic contaminant loading from point and nonpoint sources to five urban bays of Puget Sound, Washington. Action plans represented the culmination of lengthy and complex negotiations among source control programs of numerous federal, state, and local agencies and citizen groups. In some cases, negotiations spanned 2 years.

Developed and implemented a conceptual model for performing marginal analyses to determine optimal degrees of restoration following oil spills. Marginal analysis was designed to assess natural resource damages based on restoration costs and residual damages in an economically efficient manner. Results were used as an industry policy document for developing federal oil spill damage assessment regulations.

Managed the review of more than 200 record of decision documents to compile information on cleanup standards, remedial actions, and applicable regulations in support of Washington State Department of Ecology efforts to develop cleanup standards for uncontrolled hazardous waste sites. Project was the first analytical documentation of cleanup standard development at federal sites following the enactment of SARA.

Analyzed local, state, and federal government programs and policies to recommend institutional mechanisms for managing a comprehensive environmental monitoring program for Puget Sound, Washington.

Served as project manager for the compilation and synthesis of all existing Puget Sound data relating to toxic and bacterial contamination, environmental impacts, and human health risks for inclusion in a document for public distribution.

Editorial Board

- Environmental Toxicology and Chemistry (ET&C), 2012

Professional Affiliations

- Society for Environmental Toxicology and Chemistry
- Ecological Society of America
- Society for Ecological Restoration