Deborah French-McCay, Ph.D., Director of Research & Model Development Pollutant Fates & Effects, Modeling

Ph.D. Oceanography - Graduate School of Oceanography, University of Rhode Island
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Areas of Expertise:

Dr. French-McCay (formerly Dr. French) specializes in quantitative assessments and modeling of oil and chemical releases for impact, risk, and natural resource damage assessments (NRDA); evaluating transport and fates, exposure, and effects of pollutants on individual organisms, populations and aquatic ecosystems. Dr. French McCay leads development of RPS ASA's oil and chemical spill models (SIMAP and CHEMMAP) and manages numerous projects utilizing these models to evaluate oil/chemical trajectory and fate, impacts and ecological risks. Her population modeling work includes models for plankton, benthic invertebrates, fisheries, birds and mammals. She has developed water quality, food web and ecosystem models for freshwater, marine and wetland ecosystems. She has been principal investigator and primary author of more than one hundred technical reports and papers and is an internationally recognized expert in oil spill fate and effects modeling. She has provided expert testimony in hearings regarding environmental risk and impact assessments. Dr. French McCay is the Director of Research and Model Development at RPS.

EXPERIENCE RELATED TO OIL/CHEMICAL SPILL AND IMPACT ASSESSMENTS:

Applied Science Associates, Inc. and RPS **1984-present**

Oil and Chemical Spill Fate, Impact and Natural Resource Damage Assessment

- Principal investigator/project manager for the Natural Resource Damage Assessment Model for Coastal and Marine Environments (NRDAM/CME) and the Natural Resource Damage Assessment Model for Great Lakes Environments (NRDAM/GLE) which are used in "Type A" assessments of damages due to spills of toxic substances under US regulations (Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and of oils under the Oil Pollution Act of 1990 (OPA)).
- Developed biological effects model components of the NRDAM/CME, NRDAM/GLE, and ASA's derivative model SIMAP, which estimate pollutant-induced losses in productivity, fisheries yield and wildlife.
- Developed aquatic toxicity model and supporting toxicological database such that mortality is a function of concentration, time and temperature of exposure; this toxicity model forms part of the NRDAM/CME, NRDAM/GLE and other model systems (e.g., SIMAP, CHEMMAP) developed by Applied Science Associates, Inc.
- Principal developer of the physical fates model component of the NRDAM/CME, NRDAM/GLE, and ASA's derivative models SIMAP and CHEMMAP, which estimate oil and chemical distribution and concentrations over time after a spill.
- Developed the restoration model components of the NRDAM/CME and NRDAM/GLE, which determine appropriate restoration actions and approximates costs.
- Principal Investigator in the development of biological databases for fishery species and wildlife by habitat and season for 77 coastal, 11 Great Lakes and 10 inland freshwater biological provinces of the United States. These data support the NRDA models.
- Principal Investigator in the development of a Primary Restoration Guidance Manual which evaluates feasibility, effectiveness and success, and costs of restoration of wetland and aquatic natural resources. This supports NOAA's OPA NRDA regulations.
- Provided technical support and modeling to federal and state trustees to estimate fates, injuries and natural resource

damages resulting from spills:

- World Prodigy oil spill in Narragansett Bay, June 1989 (modeled fates, injuries, damages); the damage assessment was used by the R.I. Attorney General's office to successfully negotiate a settlement with the responsible party.
- Vista Bella Oil Spill of 6 March 1991 in Caribbean Sea (modeled fates and injuries to water column, habitats and birds)
- Bouchard oil spill, August 1993, at the entrance to Tampa Bay. Provided technical support to federal public trustees in developing a natural resource damages claim (modeled fates and injuries)
- Caustic soda spill, Barge Cynthia M, March 1994 (modeled fates and water column injuries)
- Morris J. Berman No.6 fuel oil spill, January 1994, in San Juan, Puerto Rico.
- North Cape oil spill, January 1996, in Rhode Island – provided technical support, modeling of fates and injuries, restoration scaling, Chair of Technical Working Group assessing injuries and restoration alternatives for marine resources
- May 1997 Lake Barre, Louisiana, oil pipeline break (modeled fates, injuries; restoration scaling)
- September 1997 Platform Irene, California, oil pipeline break (modeled fates and injuries)
- November 1997 Kure spill in Humboldt Bay, California for State Natural Resource Trustees (modeled trajectory and fate)
- Alafia River phosphoric acid spill of December 1997 (injury quantification and restoration scaling)
- September 1998 Command spill off San Francisco, California for State Natural Resource Trustees (modeled trajectory and fate)
- February 1999 New Carissa spill in Oregon (modeled oil exposure and injuries)
- Chalk Point (Pepco) oil spill in the Patuxent River, MD, April 2000 (injury quantification and restoration scaling)
- Penn oil spill in Narragansett Bay, July 2000 (modeled oil exposure and injuries)
- November 2000 Westchester oil spill in the Mississippi River (modeled oil exposure and injuries)
- 23 oil spill cases in Florida (injury quantification and restoration scaling); for State Natural Resource Trustees who successfully submitted claims to the National Pollution Fund Center (USCG OPA fund)
- Ever Reach Spill of 30 September 2002 in Charleston Harbor, SC
- April 2003 Bouchard 120 oil spill in Buzzards Bay, Massachusetts
- Mosaic acidic process water release of September 2004 in Hillsborough Bay, FL
- Three oil spills that occurred in the Galveston Bay area (1999, 2000, 2004) (modelled oil exposure and injuries)
- Citgo Refinery Spill of 21 June 2006 in the Calcasieu River, Louisiana, modelled oil exposure and water column injuries; provided an assessment of the physical fate and transport of the oil, exposure concentrations, and injury (as direct injury and production foregone) to aquatic organisms and habitats
- Deepwater Horizon oil spill of April-July 2010 in the Gulf of Mexico

- Deepwater Horizon oil spill of April-July 2010 in the Gulf of Mexico; Expert for US Government/NOAA of Water Column Technical Working Group, which evaluated impacts to marine fish and invertebrates. Performed modeling analyses of spill fates and biological effects for quantification of injuries. Dr. French McCay was lead of the Offshore Water Column, Plankton and Fish Technical Working Group in development of over 40 work plans for cruises each involving one or more vessels in the Gulf of Mexico that collected physical, chemical and biological data for use in the NRDA. She led the effort of conducting oil transport, fate and exposure modeling using the SIMAP model to evaluate injuries for water column organisms. She collaborated with hydrodynamic modelers, evaluating their hydrodynamic model output as input to the SIMAP model. Dr. French McCay also oversaw the development of biological density and life history data for use in

modeling baseline biological densities and production foregone due to the spill. She developed and implemented population models, using published fish life history models and vital rates, to extrapolate from instantaneous direct injuries to additional production lost to the ecosystem due to injured organisms being removed from the environment. Technical reports are available at: [https://www.doi.gov/deepwaterhorizon/adminrecord].

- Hawaiian Molasses Spill NRDA (State of Hawaii) – Dr. French McCay managed an analysis quantifying natural resource injuries to fish and invertebrates caused by spilled molasses in Honolulu Harbor and Ke'ehi Lagoon. Due to a pipeline burst, approximately 233,000 tons of molasses spilled into the marine system resulting in prolonged hypoxic conditions. Quantified production foregone and gained by various restoration options.
- Provides technical support to NOAA's Office of Response & Restoration / Assessment & Restoration Division and state trustees in on-going natural resource damage assessment cases.
- Provided training to federal and state trustees, industry, and private parties on use of modeling for NRDA, impact and risk assessment.

Modeling and Analysis of Pollutant Fates and Effects, Ecological Risk Assessment

- Project Manager and model developer for ASA's spill fates and biological effects model systems: SIMAP for oil spills and CHEMMAP for chemical spills. These models are used for impact and risk assessment, as well as natural resource damage assessment.
- CHEMMAP Model Development – Dr. French McCay designed and managed the development of RPS ASA's CHEMMAP model system, which evaluates fate and biological effects of chemical releases in fresh and saltwater environments, accounting for transport, dispersion, volatilization, dissolution, acid-base reactions, and adsorption of chemicals in aquatic environments.
- Developer of Orimulsion fates model in ASA's SIMAP model system. Used this model to perform an ecological risk assessment for the importation of the bitumen product Orimulsion into Tampa Bay, Florida, as compared to the present risk using No. 6 fuel oil, and testified in permit hearings (client: Florida Power and Light). Model also used for an ecological risk assessment for permit applications by a power plant in New Brunswick Canada for conversion from No. 6 fuel oil to Orimulsion.
- Principal investigator for modeling oil spill fate and environmental exposures resulting from deepwater blowouts in the Gulf of Mexico assuming various response alternatives, including subsea dispersant injection. Developed Comparative Risk Assessment model for evaluating trade-offs of dispersant use.
- Used modeling to estimate impacts resulting from hypothetical spills of the cargo of a ship carrying hazardous wastes to be incinerated at sea; applied to several coastal areas (Gulf of Mexico and North Atlantic) and 10 possible wastes; analyzed worst case and most likely scenarios and performed sensitivity analysis.
- Project Manager for oil modeling analysis as part of the development of the Environmental Impact Assessment for the El Segundo Marine Technical Lease Renewal.
- Assessment of potential oil spill impacts and natural resource damages for oil platform spills off the coast of Florida, involving conditional probability (trajectory) modeling and worst-case analysis. Testified in permit hearings for Coastal Petroleum.
- Principal investigator for modeling fates and ecological risks of discharges associated with the use of chemical products used in deep water oil and gas operations in the Gulf of Mexico (MMS project, as subcontractor to A.D. Little).
- Principal investigator for modeling analysis of potential spills resulting from groundings in San Francisco Bay in an ecological risk assessment and cost analysis for natural resource damages, response costs and socioeconomic costs (client: Army Corps of Engineers, San Francisco District).
- Principal investigator for modeling analysis of potential spill impacts and costs in Washington state waters as part of a cost-benefit analysis for the Washington Department of Ecology's rulemaking regarding spill response requirements
- Principal investigator for modeling of spills in US waters with and without dispersant use, for use in an Programmatic

Environmental Impact Statement, US Coast Guard rulemaking on response equipment regulations

- Principal investigator for preparation of an Environmental Assessment of hazardous material spill response equipment regulations, a US Coast Guard rulemaking under OPA90, where modelling was used to evaluate chemical fate and potential environmental consequences.
- Principal investigator for an analysis and review identifying the qualitative and relative risk of oil spills to the navigable waters and inland areas of Washington State to inform policy regarding resource allocation for oil spill prevention, preparedness, and response activities; client: JLARC Oil Spill Analysis and Review (Washington State Joint Legislative Audit and Review Committee).
- Brazilian River Oil Spill Assessment (Petrobras Brazil) – Dr. French McCay was the principal investigator for the modeling analysis of the fates and effects of an oil spill in the Meio and Sagrado River systems in a mountainous region of Brazil. She quantified water column concentrations of dissolved components of the oil and measured the range of exposure to fish, insect larvae, and benthic invertebrates. Brazilian natural resource agency freshwater and estuarine fish and invertebrate data were obtained and synthesized to generate a survey catch per unit effort index for oil spill injury assessment.

Modeling of Wildlife Population Dynamics and Movements for Impact Assessment

- Developed a population model and a seasonal migration model for the northern fur seal; differences by age and sex were incorporated in the models; analyzed the impact of entanglement in discarded plastics on the northern fur seal population.
- Utilized northern fur seal population and migration models along with an oil spill trajectory model to estimate impacts on the northern fur seal population.
- Bioenergetics modeling to evaluate fish consumption by cormorants and its impact on fish populations in the Narragansett Bay estuary

Fish and Invertebrate Population Modeling and Impact Assessment

- Developed population and fisheries model with spatial resolution for eggs, larvae, juvenile and adults; an associated transport model used to distribute eggs and larvae.
- Applied the spatially resolved population and fisheries model to sea scallops and Atlantic cod on Georges Bank; used this model to estimate potential impacts of off shore oil development on the populations and fisheries.
- Developed a model system LARVMAP, which simulates active (directional swimming or sinking) and passive (by currents) movements of eggs, larvae, ichthyoplankton and other life stages of aquatic biota; used for evaluating potential impacts of spills, development, entrainment and impingement
- Assessed potential impacts of the entrainment of ichthyoplankton as a result of seawater heating from regasification facilities and impacts from pipeline and LNG terminal construction and operation, for Environmental Impact Statements for proposed LNG projects: two off the coast of Louisiana in the Gulf of Mexico, one in Mount Hope Bay, Massachusetts.
- Missouri Fish Kill Calculator (Missouri Department of Conservation) - Dr. French McCay managed the development of a resource equivalency analysis model calculator for estimating injuries and damages associated with small-scale spill induced fish kills. The calculator translated injuries into fish restocking restoration measures using Resource Equivalency Analysis based on population modeling. Extensive fish life history data libraries for freshwater species occurring in the mid-west were compiled. A user interface to the fish kill calculator tool was also developed.

Ecological Evaluations for Marine Spatial Planning and Alternative Energy Siting Assessments

- Developed framework for modeling ecological values of marine biological resources, applied to the marine offshore area considered by the Rhode Island Ocean Special Area Management Plan (RI Ocean SAMP). The definition of “ecological value” was based on that used in other recent marine spatial planning valuation efforts, i.e., the intrinsic value of biodiversity without reference to anthropogenic use. Synthesized spatial distribution data were gathered from various studies performed by University of Rhode Island (URI) researchers as input to the Ecological Value Map (EVM) modeling effort. Weighting schemes were applied to normalized mapped data and the modified results summed to compute EVMs

that reflect protection status, global importance of the resources, uncertainty of the data and potential impacts of developments.

- Under funding from Bureau of Ocean Energy, Management, Regulation and Enforcement (BOEMRE), and in partnership with the University of Rhode Island, developed a conceptual framework and approach for cumulative environmental impact evaluation of offshore renewable energy development, as part of a larger framework for a site evaluation tool for decision makers. This extends the work on the RI Ocean SAMP to include consideration of cumulative impacts and a framework for application to offshore waters of the US. Socioeconomic uses and values are also included in the framework.

Expert Testimony and Hearing Experience (Oil Spill Related)

- Provided technical reports and expert opinion to NOAA Damage Assessment Center and other federal and state trustees in numerous natural damage assessment cases.
- Testified in Florida permit hearings for Florida Power and Light as an expert in oil spill modeling, regarding the modeling of the fates and effects of potential oil and Orimulsion spills.
- Testified in Florida permit hearings for Coastal Petroleum as an expert in oil modeling and natural resource damage assessment, on the assessment of potential oil spill natural resource damages resulting from oil platform spills off the coast of Florida.
- Estimated potential impacts on marine biota of once-through cooling and of stack emissions of a resource recovery facility at Quonset Point, RI on marine, freshwater and wetland biota; provided expert testimony at state government hearings for permitting the project, 1985-1990.
- Assessed potential impacts of water withdrawals and emissions from the proposed Newbay Power Plant on aquatic and terrestrial biota; testified in hearings to RI Department of Environmental Management and RI Coastal Resources Management Council in 1993 as an expert in Ecology and Environmental Impact Assessment.
- Assessed potential marine biological impacts of marina expansion and shore facility development on a small estuary (Fiddlers Cove) in Falmouth, MA; testified in town and state hearings in 1987.
- Assessed the extent and value of fresh and saltwater wetlands which might be impacted by development projects; provided information to be used in applications to Rhode Island Department of Environmental Management and Rhode Island Coastal Resources Management Council. Provided expert testimony in hearings.
- Assessed the potential water quality impacts of development projects; provided information to be used in applications to Rhode Island Department of Environmental Management and Rhode Island Coastal Resources Management Council. Provided expert testimony in hearings.

National Academy of Sciences, National Research Council

- 2017 Provided technical information on oil spill exposure analyses and comparative risk assessments related to dispersant use to the Committee on Evaluation of the Use of Chemical Dispersants in Oil Spill Response
- 2013 Member of Committee for Review of Genwest Effective Daily Recovery Capacity (EDRC) Project Final Report, requested by Bureau of Safety and Environmental Enforcement (BSEE)
- 2008 Provided technical information on oil spill consequence analysis to the Committee on Risk of Oil Spills in the Aleutian Islands: A Study to Design a Comprehensive Risk Assessment
- 2002 Member of Committee to Review the Oil Spill Recovery Institute's Arctic and Subarctic Research Programs
- 2001 Provided technical information and text inserts on oil spill modeling to the Committee on Oil in the Sea III
- 2001 Provided technical information and model simulations to the Committee on Spills of Emulsified Fuels: Risk and Response
- 1999 Provided technical information and model simulations to the Committee on Environmental Performance of Tanker

Designs in Collision and Grounding

SELECTED PUBLICATIONS

Articles in Journals and Books

French-McCay, D., D. Crowley, and L. McStay. 2019. Sensitivity of Modeled Oil Fate and Exposure from a Subsea Blowout to Oil Droplet Sizes, Depth, Dispersant Use, and Degradation Rates. Mar. Pollut. Bull (in press).

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French-McCay, D., M. Horn, Z. Li, K. Jayko, M. Spaulding, D. Crowley, and D. Mendelsohn, 2018. Modeling Distribution Fate and Concentrations of Deepwater Horizon Oil in Subsurface Waters of the Gulf of Mexico. Chapter 31 in: Oil Spill Environmental Forensics Case Studies, S. Stout and Z. Wang (eds.), Elsevier, ISBN: 978-O-12-804434-6, pp. 683-736.

Spaulding, M. Z. Li, D. Mendelsohn, D. Crowley, D. French-McCay, and A. Bird, 2017. Application of an Integrated Blowout Model System, OILMAP DEEP, to the Deepwater Horizon (DWH) Spill. Marine Pollution Bulletin 120: 37-50. DOI information: 10.1016/j.marpolbul.2017.04.043

Li, Z., M. Spaulding, and D. French McCay, 2017. An algorithm for modeling entrainment and naturally and chemically dispersed oil droplet size distribution under surface breaking wave conditions. Mar. Poll. Bull. 119:145-152.

Li, Z., M. Spaulding, D. French McCay, D. Crowley, J. R. Payne, 2017. Development of a unified oil droplet size distribution model with application to surface breaking waves and subsea blowout releases considering dispersant effects. Mar. Poll. Bull. 114: 247-257.

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Response: A Global Perspective. Book Series: NATO Science for Peace and Security Series C - Environmental Security, pp. 297-320.

French McCay, D., N. Whittier, M. Ward, and C. Santos, 2006. Spill hazard evaluation for chemicals shipped in bulk using modeling. Environmental Modelling & Software 21(2):158-171.

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French McCay, D. P. and T. Isaji, 2004. Evaluation of the consequences of chemical spills using modeling: Chemicals used in deepwater oil and gas operations. Environmental Modelling & Software 19(7-8):629-644.

French McCay, D., N. Whittier, S. Sankaranarayanan, J. Jennings, and D. S. Etkin, 2004. Estimation of potential impacts and natural resource damages of oil. J. Hazardous Materials 107/1-2:11-25.

Sankaranarayanan, S. and D. French McCay. 2003a. Application of a Two- dimensional Depth-averaged Hydrodynamic Tidal Model. Journal of Ocean Engineering 30(14): 1807-1832.

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Environment Canada, Ottawa, ON, Canada, pp. 253-271.

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Gretchen Greene, PhD

PRINCIPAL ECONOMIST/MANAGING PARTNER

Dr. Gretchen Greene has over 25 years of diverse economics experience in natural resource, energy, and community economics. Dr. Greene has expertise in ecosystem service valuation, natural resource damage assessment (NRDA), recreation, water demand and management, and public infrastructure investment. She also brings expertise in endangered species economics; land conservation and sustainable economic development; cost-benefit analysis; demographics, socioeconomics, and environmental justice; decision analysis with uncertainty; and survey design and data analysis. An experienced facilitator, Dr. Greene has developed focus groups and surveys covering a variety of environmental topics. She has worked in dozens of different cultural environments, from southern Africa to Mongolia to Native American communities. She has worked with numerous federal, state, tribal, and municipal agencies as well as private industrial clients and law firms.

Qualifications

- PhD, Food and Resource Economics: University of Florida, Gainesville, FL
- MS, Food and Resource Economics: University of Florida, Gainesville, FL
- BA, Religion Studies: Wellesley College, MA

Professional Associations

- American Water Research Association (AWRA)
- Water Environment Federation (WEF)
- Population Association of America (PAA)
- Western International Economic Association (WIEA)
- American Agricultural Economic Association (AAEA)

Key Skills

- Benefit Cost Analysis
- Economics of Recreation
- Public Infrastructure Investment
- Economic Decision Making Under Climate Uncertainty

Selected Projects

Natural Resource Damage Assessments and Other Litigation

Development of Baseline Information System Related to Gulf Oil Spill, Arnold and Porter – Washington DC

Dr. Greene led the human-use side of developing a Web-based information management system that compiles, evaluates, and facilitates access to publicly available data, reports, articles, and geospatial information related to baseline ecological and human-use services provided within the Gulf of Mexico. The system was used to aid in determining the public loss related to the spill.

Economic Value of Tropical Rainforest Land in Latin America, Confidential Oil and Gas Client – Ecuador

Dr. Greene led a team providing litigation support to a confidential client on potential damage to tropical rainforest land in Latin America as a result of oil and gas exploration and extraction. The project involved literature reviews on the total economic value of the land, including direct use values, indirect or ecological use values, and passive or nonuse values.

Human Use Impacts Resulting from Petroleum Corporation Oil Spill, CITGO – Louisiana

Dr. Greene assessed the human use impacts resulting from a CITGO oil spill in the Calcasieu River Estuary in Louisiana. A series of site visits and helicopter overflights was conducted to investigate the recreational sites and types of activities potentially affected by the spill and the level of recreational activity in the spill impact zone. Dr. Greene designed and implemented a recreational use survey and analyzed survey data and other information to estimate the economic value of lost and diminished recreational use.

Settlement Support, Natural Resource Damage Case, Briggs and Morgan – Albemarle Sound, North Carolina

Dr. Greene reviewed the analysis of recreational fishing values in the Roanoke River and Albemarle Sound in support of a confidential client of Briggs and Morgan. In response to the review, Dr. Greene led a team that conducted an alternative valuation of the economic damages resulting from historic releases to the sound and a series of fish consumption advisories. Dr. Greene worked with the client to develop strategies and presentation materials for the on-going settlement negotiations.

Settlement Support, Tribal Natural Resource Damage Case, Arcadis Consulting – New York

Dr. Greene provided background information about different approaches to valuing the cultural component of natural resource damages in a case between an Indian tribe and a confidential client of Arcadis Consulting. Relevant previous settlements were reviewed and a strategy for negotiations was developed.

Fish-Consumption and Recreation Survey, Upper Columbia River Remedial Investigation/Feasibility Study and Human Health Risk Assessment, Teck Cominco – Spokane, Washington

Dr. Greene worked with the U.S. Environmental Protection Agency and the National Park Service in the RI/FS process of assessing risk to human health. She oversaw and reviewed the Upper Columbia River recreation and fish-consumption surveys. She reviewed and developed the data quality objectives, survey sample design, survey instrument, enumeration, and data analysis steps of the process.

Traditional Ecological Knowledge Study, First Nation and Ministry of Transportation, Ontario, Canada

Dr. Greene worked with a First Nation and the Ministry of Transportation of Ontario to provide estimates of damages to lands occupied by the highway traversing reserve lands. Estimates for foregone market losses such as timber stumpage fees, as well as non-market value estimates for subsistence and traditional and community values, are being developed.

Tool for Selection of Sustainable Remediation Strategies for the Great Lakes Region, Confidential Client – Northeast United States

Dr. Greene developed a decision-making tool for selection of alternative remediation strategies based on principles of green remediation consistent with U.S. Environmental Protection Agency and U.S. Navy guidance documents. Metrics used in the decision framework include water quality, water quantity, sediment quality and quantity, air quality, recreation and other human uses, and ecological or habitat services.

Settlement Support for Soboba Tunnel Damages Natural Resource Damages Case, Soboba Band of Luiseno Indians – Hemet, California

Dr. Greene supported Luebben, Johnson, and Barnhouse in estimating the value of foregone water to the Soboba Tribe over a period of 70 years. The foregone water resulted from damages related to the leakage into a tunnel built by the federal government. Damages were estimated for a variety of different legal strategies. The settlement involved three water districts and federal, local, and state entities.

Damages Related to Mining Lease Dispute, Wilson Elser Moskowitz Edelman & Dicker – Dallas, Texas

Dr. Greene provided expert testimony in deposition regarding alleged damages related to a mineral lease and water permitting procedures. The case was heard in the District Court of Tulsa County, State of Oklahoma.

Recreation Economics and Ecosystem Services

Expert Testimony on Economic Value of Hunting and Fishing in Missouri

Dr. Greene provided expert testimony in court and in deposition for a case involving a ban on imports and exports of deer in the state of Missouri. Testimony covered the economic stimulus provided by, and the economic value of, deer hunting, and was based on a study completed for the Missouri Department of Conservation by Ramboll Environ on the economic value of hunting and fishing in Missouri.

Recreational Benefits of Proposed Water-Storage Facility, Fort Apache Indian Reservation - Arizona

Dr. Greene estimated the economic benefits of a proposed water-storage facility on future tourism visitation and related tourist expenditures to the Fort Apache Indian Reservation. Benefits were measured in terms of increased value of improved fish habitat, increased value of recreation for Tribal members and tourists, benefits to the Tribal fish hatchery program. The study also included a discussion of cultural values. A regional economic impact analysis was also completed, quantifying profits to local and Tribal businesses and income and employment increases. Visitors from within Arizona and from other states were estimated separately. The results of this analysis were used in negotiations related to Salt River Project basin-wide water rights adjudications and Gila River basin adjudications.

Economic Benefits of Improved Instream Flow in the Upper Yakima Basin, Bureau of Reclamation - Yakima, Washington

Dr. Greene conducted an evaluation of the recreational benefits associated with the acquisition of water rights to enhance stream flows in the Taneum Creek basin. The study included a direct survey of recreational anglers to determine their willingness to pay for increased stream flows to benefit fish. Recreation participation rates and demand, as well as the benefits of various levels of improved fishing quality, were estimated using a random utility model. Regional economic impacts were also developed to describe the impact from recreational anglers' expenditures on the economies of the Yakima Basin.

Social and Economic Impact Analysis for the Timber Mountain/John's Peak Off-Highway Vehicle Management Plan and Environmental Impact Statement, Bureau of Land Management - Medford, Oregon

Dr. Greene drafted an EIS that evaluated management alternatives for an OHV recreation area. Her work focused on the social and economic impacts of the management alternatives, including issues concerning property values, noise, and law enforcement near the recreation area. Future demand for OHV recreation in the management area was also estimated.

Recreational Needs Assessment, Enloe Dam Hydroelectric License Application Process - Okanogan County, Washington

Dr. Greene conducted a recreational needs assessment for the Enloe Dam relicensing process. The work involved projecting recreational needs for the next 30 years and evaluating the capacity of the project to mitigate recreational demand. Trends in recreational participation, based on national, state, and county research, were developed for the County. Local stakeholders were interviewed to validate the results.

Floodplain Ecosystem Services Valuation for Carson River Valley, Carson River Water Subconservancy District – Carson, Nevada

Dr. Greene estimated the value of floodplain ecosystem services provided by farmlands that flood in winter. Facing population and development pressures, the water management district was interested in exploring appropriate monetary values to pay farmers for ecosystem services provided by the undeveloped land. Based on actual flood flow data, a model was designed to simulate, first, the actual event, and then the same event, but with a developed floodplain. Results demonstrated changes in peak flow speed, volume, and warning time under the two scenarios.

Economic Considerations for Land Preservation as a Strategy for Watershed Protection in the Cahaba River Basin, EDAW – Atlanta, Georgia

Dr. Greene prepared a report which provided an overview of the economic benefits and costs of preserving and conserving land in the rapidly developing Cahaba Watershed and included an evaluation of different preservation mechanisms. A summary of the strengths and weaknesses of preservation mechanisms included a review of land leases, donations, transferable development rights, product contracts, conservation easements, and fee purchases. Benefits of watershed protection that were evaluated included values for protecting water quality and water supply; enhancing recreation; preserving habitat; reducing erosion; and enhancing property values and tax revenues. Costs included payments for land purchase, management, and enforcement; foregone tax revenues; and the opportunity cost of development.

Analysis of Benefits and Costs of Proposed Regulatory Changes in Offshore Oil and Gas Exploration in the Arctic, Oil and Gas Industry

Dr. Greene analyzed the benefits and costs of offshore oil and gas exploration in the U.S. Arctic. Analysis included all benefits and costs covering royalties, income, fiscal impacts, regional economic impacts, and environmental benefits and costs. Detailed financial data were developed from public sources and from the client (under a nondisclosure agreement). Analysis was conducted prior to rulemaking on oil and gas operations in the arctic and covered risks of oil spills, safety, and health impacts. Results were presented to the White House Office of Management and Budget. Analysis was also presented in testimony to the U.S. Senate Energy Committee.

Analysis of the Economic Impacts of Complying with Regulations Implementing Laws on Endangered Species, EDAW and California Department of Fish and Game – Sacramento, California

Dr. Greene analyzed the impacts of regulations implementing California laws relating to threatened or endangered species. The laws modify conditions under which incidental or accidental take of species is penalized, as well as changing reporting requirements for individuals and other state agencies. Dr. Greene was responsible for analyzing the economic impacts of the new regulation on the development community as well as the natural environment.

Conservation Tools: An Evaluation and Comparison of the Use of Certain Land Preservation Mechanisms, Washington State Recreation and Conservation Office – Washington

Dr. Greene developed a spreadsheet-based tool for analyzing how different land conservation and preservation mechanisms affect the achievement of stated goals of the Recreation and Conservation Office. The report was part of a required element of State House Bill 1957 that required the office to explore the effect of different land preservation mechanisms on cost and the ability to respond to future ecological and economic changes and shocks. .

Quarry Valuation Based on Water Storage Potential, Confidential Client – Indiana

Dr. Greene's appraisal of a quarry in Indiana focused on three different capacities: water storage potential, any remaining mineral resources, and any other uses (e.g., as a landfill).

Expert Witness on Conservation and Urban Water Demand – New York City, New York

Dr. Greene provided expert witness support on the effects of conservation on urban water demand. Literature was reviewed and water demand forecasts were evaluated and reproduced.

Evaluation of the Economic Impact of Designating Critical Habitat for the Cook Inlet Beluga Whale, National Marine Fisheries Service – Anchorage, Alaska

Dr. Greene evaluated the economic impacts of designating critical habitat for the Cook Inlet beluga whale. She analyzed the potential benefits of critical habitat designation and the designation's potential impacts to subsistence and commercial fishing. The work was part of the Regulatory Impact Review Section 4(b)(2) Analysis/Initial Regulatory Flexibility Act Analysis for the designation.

Ecosystem Services Analysis for Pesticide Reregistration, Dow Chemical – London, England

Dr. Greene is currently working with Dow Chemical to explore the ecosystem service levels associated with a potential reregistration of the chemical chlorpyrifos, or dursban. The pesticide is used in Spain to control red scale in citrus production. Spain is the largest citrus exporter in the world, and the economic analysis explores the economic impacts in terms of jobs, regional impacts, and aesthetic value under a scenario in which chlorpyrifos is banned. The environmental effects considered in the assessment include impacts on water, greenhouse-gas levels, and habitat for over 25 species. Preliminary results suggest that, although environmental impacts may be minimal, economic impacts would be considerable.

Selected Papers and Presentations

Remediation and water resource protection under changing climatic conditions. With D. Rowe, S. Warner, and K. Gimre. Environmental Technology & Innovation 8:291-298, 2017.

Panel Discussion: Integrated Planning for Coastal Restoration: A Net Ecosystem Services Approach. CNREP 2016, New Orleans, Louisiana, March 22, 2016.

Making Decisions about Climate Change Adaptation. San Diego Climate Action Plan Panel Discussion. Lambda Alpha International, San Diego, California, January 5, 2016.

Economic Analysis of Climate Change Adaptation in Ventura County, CA. With G. Reub, F. Kristanovich, R. Battalio, D. Revell, S. Newkirk, L. Verdone, and E. Vandebroek. CERF Annual Meeting, Coastal Inundation and Its Impacts in a Changing Climate, Session SCI 188B, Portland, Oregon, November 12, 2015.

Climate Change and Water Management: Fear of Uncertainty. Session 3: Economic Considerations. 2015 AWRA Washington State Conference—Water Management Strategies in the Face of Climate Change, Seattle, Washington, October 22, 2015.

Net Ecosystem Services Analysis as a Floodplain Restoration and Management Tool. With G. Reub and S. Mathies. Fish Passage 2015, Groningen, The Netherlands, June 22–24, 2015.

Economic Approaches to Using Ecosystem Services in Floodplain Management Decisions. With S. Burr. American Water Resources Association Annual Meeting, Portland, Oregon, November 7, 2013.

Measuring the Social and Economic Outputs from Ecosystem Services Provided by Shellfish Used in Restoration and Aquaculture. With G. Reub, J. Fisher, and W. Dewey. EcoSummit 2012, Columbus, Ohio, October 4, 2012.

An Ecosystem Services Framework in Practice: An Assessment of Fruit Production in Southern Europe. With G. Reub, S. Deacon, J. Nicolette, and S. Norman. 6th SETAC World Congress/SETAC Europe 22nd Annual Meeting, Berlin, Germany, May 20–24, 2012.

Optimal Ecosystem Services Provided through Shellfish Aquaculture: The Role of Property Rights. With J. Fisher, G. Reub, and W. Dewey. Coastal and Estuarine Research Federation 21st Biennial Conference, Societies, Estuaries, and Coasts: Adapting to Change, Daytona Beach, Florida, November 6–10, 2011.

Cultural Differences in Economic Values for Ecosystem Service Restoration. Society for Ecological Restoration 4th World Conference, Merida, Mexico, August 21–25, 2011.

Overview of Social and Economic Service Quantification, Evolution and Valuation of Ecosystem Services Workshop. ACES Conference, Phoenix, Arizona, December 6, 2010.

Understanding and Evaluating Watershed Assets as Part of a Water Stewardship Program. American Business Conferences Sustainable Agricultural Partnerships 2010, San Francisco, California, August 10, 2010.

Conservation Tools: An Evaluation and Comparison of Certain Land Preservation Mechanisms. With D. Greene, T. C. Richmond, and T. Greenwalt. Washington State Office of Recreation and Conservation, Dec. 23, 2009, available at: http://www.rco.wa.gov/documents/rco/ConservationTools.pdf

Socioeconomic Conditions in an Oil-Producing Region of Ecuador. With B. Wyse, S. Onisko, and S. Jenniges. 2009 ESRI International User Conference Map Gallery Exhibition, San Diego, California, July 2009.

Estimation of Recreation Anglers' Value of Reef Fish in the Gulf of Mexico. With C. B. Moss and E. Thunberg. Southern Agricultural Economics Association Annual Meetings, North Carolina, February 1996 (Abstract: Journal of Agricultural and Applied Economics, 28:1(1996):216).

The Demand for Recreational Fishing in Tampa Bay, Florida: A Random Utility Approach. With C. B. Moss and T. H. Spreen. Marine Resource Economics, 12:293-305, 1997.

ENVIRONMENTAL RESEARCH CONSULTING

Dagmar Schmidt Etkin, PhD

Curriculum Vitae

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Dr. Dagmar Schmidt Etkin has 47 years of experience in environmental analysis–14 years investigating issues and analyzing data related to population biology and ecological systems, and 33 years specializing in risk analysis (probability and consequences) related to energy production and transport. Since 1999, she has been president of Environmental Research Consulting (ERC). ERC's work focuses on providing regulatory agencies and industry with sound scientific data and perspectives for responsible environmental decision-making and risk assessment.

Education

- **PhD Harvard University**, Organismic/Evolutionary Biology (ecology, statistics, modeling) 1982
- **MA Harvard University**, Biology 1980
- **BA University of Rochester**, Biology 1977

Professional Analytical Experience

With an academic background in biology, ecology and population modeling, biostatistics, and general sciences (chemistry, physic, mathematics), Dr. Etkin moved into more applied fields of environmental science related primarily to energy production and transport issues. She has applied statistical analytical methods to a variety of environmental risk assessment studies, conducted fault-tree and other probability analyses, and developed mathematical models to evaluate vessel traffic and casualties and estimate spill costs, oil well blowout probabilities, frequency analyses of spills, offshore wind project impacts, and other topics to meet the needs of government regulators and industry. She has also provided expert witness support and testimony in oil spill-related cases.

Risk Analysis: General Oil Spill

Hudson River Oil Spill Risk Assessment
Scenic Hudson, Inc. (2017–2018)
Comprehensive oil spill risk assessment of Hudson River, including probabilities of spills from vessels, crude-by-rail transport, pipeline, and facilities for current and potential future oil transport scenarios, as well as trajectory, fate, and effects modeling of worst-case discharge scenarios in the New York Harbor through Troy, New York, corridor. Assessment of spill response plans and preparedness. Developed and conducted workshops for federal and state response officials, stakeholders, and community groups.

Alaska/Arctic Oil Spill Risk Analysis
National Oceanic and Atmospheric Administration (2012–2014)
Analysis of future probabilities of spills and environmental and socioeconomic impacts associated with oil exploration, production, transportation, and storage activities in the Alaskan Arctic for the purpose of strategic planning for NOAA practitioners in spill response and damage assessment.

Cook Inlet Maritime Risk Assessment
Cook Inlet Regional Citizens Advisory Council/Alaska Dept. Env. Cons./US Coast Guard (2011–2012)
Risk analysis for spills and vessel casualties from 330 GT+ marine vessels in Cook Inlet, Alaska. Leading workshop on environmental consequences of spills in Cook Inlet.

Oil Spill Risk Analysis for BOEMRE for Offshore Environmental Cost Model (OECM)
Bureau of Ocean Energy Management Regulation Enforcement (2010)
Provided probability distribution functions of spill volumes for offshore production activities and alternative tanker oil imports for use in modeling of spill impacts in OECM.

Oil Spill Risk Analysis for State Funding Mechanism
Washington Joint Legislative Audit and Review Committee (2008–2009)
Analysis of oil spill risk (probability and consequences) from all sectors and geographic zones in Washington state waters based on current and future trends for both actual and projected worst-case discharge spillage.

Risk Analysis for Industry Regulated by Washington for Spill Prevention/Preparedness
Washington Department of Ecology (2008–2009)
Analysis of spill risk (probability/consequences) from industry sectors regulated by Washington Department of Ecology Spills Program for prevention and preparedness based on current and future worst-case discharge scenarios.

Arctic Spill Risk Assessment
ExxonMobil Upstream Research (2008–2009)
Analysis of US and Canadian arctic spillage rates and spill risk studies for arctic spill risk assessment.

Oil Spill Risk Analysis Based on Oil Transport Mode
Pipeline & Hazardous Material Safety Administration (2005–2006)
Comparative risk analysis of oil spillage from pipelines, tank vessels, and tanker trucks for states of Washington, Oregon, California, Alaska, and Hawaii.

Risk Analysis: Offshore Exploration & Production

Development of Response Information for Offshore Oil Spills in Area Contingency Plans
Bureau of Safety and Environmental Enforcement (2019–2023)
Development of updates to Area Contingency Plans and Regional Contingency Plans to incorporate spill response measures for worst-case discharges related to offshore oil and gas operations in the Gulf of Mexico, California/Pacific, and Alaska.

Chemical Products Inventory in the Gulf of Mexico Related to Offshore Activities
Bureau of Ocean Energy Management (2016–2017)
Analysis of risks from chemical products used in offshore oil and gas exploration and production activities.

Offshore Worst-Case Discharge Analysis: Oil Spill Response Capabilities
Bureau of Safety and Environmental Enforcement (2014–2016)
Analysis of worst-case blowout scenarios for Gulf of Mexico, US Pacific, and US Arctic offshore exploration and production–probabilities, benchmarking, and spill response/mitigation (intervention) capabilities for development of response capability regulations for offshore industry.

Spill Risk Analyses for Environmental Impact Assessment of Canadian Offshore E & P
Equinor/ExxonMobil/Suncor/Chevron/BHP (2016–present)
Analysis of spill risk (probability of blowouts and spills with volumes) as part of overall risk analysis for environmental impact assessment for offshore Newfoundland wells.

Analysis of Probabilities of Arctic Well Blowouts and Intervention Methods
Shell Oil (2014)
Development of fault tree analysis to determine likelihood of exploratory well blowouts and durations based on various intervention methods.

Analysis of Potential Blowouts and Spills from Offshore Wells and Activities
Shell Canada Limited (2013–2014)
Analysis of exploratory well blowouts and mobile offshore drilling unit spill scenarios with respect to relative probability of occurrence and probability distribution of spill volumes, flow rates, and duration for environmental assessment of proposed exploratory drilling project. Analysis of other oil inputs and natural seeps in relation to potential spillage from wells.

Analysis of Probability of Discharge Scenarios from Potentially Leaking Oil Well
US Coast Guard/Bureau of Safety and Environmental Enforcement/Taylor Energy (2013–present)
Analysis of potential discharge scenarios and probabilities of incidents from abandoned oil wells associated with platform toppled during Hurricane Ivan (2004).

Analysis of Spill Scenarios from Proposed Oil & Gas Development in the Canadian Beaufort Sea
World Wildlife Federation Canada (2013)
Analysis of spill scenarios and probabilities, including worst-case discharge well blowouts for proposed oil and gas development in the Canadian Beaufort Sea for incorporation into trajectory, fate, and effects modeling of hypothetical spill impacts.

Analysis of Spill Scenarios from Proposed Oil & Gas Development in Greenland/Arctic Canada
World Wildlife Federation Canada (2015–2016)
Analysis of spill scenarios and probabilities, including worst-case discharge well blowouts for proposed oil and gas development off western Greenland and in the Baffin Sea of Arctic Canada for incorporation into trajectory, fate, and effects modeling of hypothetical spill impacts.

Risk Analysis: Offshore Ports

Oil Spill Risk (Probability) Assessment for Proposed Offshore Gulf of Mexico Port
EXP Energy/Blue Marlin Offshore Port LLC (2020)
Analysis of the probabilities of oil spills from the proposed Blue Marlin Offshore Port (BMOP) Project, including onshore and offshore pipelines, platforms, and single-point mooring systems.

Comparative Oil Spill Risk Assessment for Proposed Texas Offshore Port System
US Coast Guard (2009)
Analysis of oil spill risk and vessel collision/allision study for environmental impact assessment for proposed Texas Offshore Port System (including associated pipelines).

Risk Analysis: Rail Oil Transport

Rail Oil Transportation Safety
Washington Dept. of Ecology/Utilities and Transportation Commission (2018–2019)
Analysis of rail transportation safety for oil and other hazardous cargoes based on recent technological developments, industry initiatives, and regulatory measures with specific applications to Washington State.

Rail and Pipeline Spill Probability and Volume Analysis for Oil Spill Response for Inland Areas
ExxonMobil Upstream Research Company (2016–2017)
Analysis of crude-by-rail spill probability and volumes for planning for inland oil spill response operations.

Environmental Impact Statement: Shell Eastgate Crude-by-Rail Unloading Facility
Skagit County/Washington Department of Ecology (2015–2017)
Analysis of risk (probability and consequences) of crude-by-rail traffic through Skagit County to facility, including analysis of spill scenarios, geographic analysis of spill locations, and potential impacts of spills, fires, and explosions.

Risk Analysis of Crude Oil Rail Transport Related to Facility Environmental Impact Statement
Washington State Energy Facility Site Evaluation Council (2014–2017)
Analysis of risk for oil spillage and fire/explosion for Bakken and other crude oil transport by rail through Washington State to proposed facility in Columbia River.

Rail Oil Transport Risk
Washington Dept. of Ecology (2014–2015)
Analysis of risks of oil transport by rail in Washington inland areas for evaluation of state-wide policies and risk mitigation.

Risk Analysis: Pipelines

Enbridge Line 5/Wisconsin–Bad River Reservation Oil Spill Probability Analysis
Enbridge Energy (2021–present)
Conducting independent oil spill probability analysis for pipeline running through Bad River Reservation.

Dakota Access Pipe Line Environmental Impact Assessment
Energy Transfer (2021–present)
Conducting independent probability analyses of pipeline spill scenarios for Dakota Access Pipe Line. Reviewing previously-conducted probability assessment reports.

Enbridge Line 3 Pipeline Environmental Impact Statement
Minnesota Department of Commerce/Dept. of Natural Resources (2017–2019)
Review of oil spill impact modeling and analysis in draft environmental impact statement (EIS) and preparation of final EIS for major pipeline project. Expert witness testimony at state hearings.

Rail and Pipeline Spill Probability and Volume Analysis for Oil Spill Response for Inland Areas
ExxonMobil Upstream Research Company (2016–2017)
Analysis of inland pipeline spill probability and volumes for planning for inland oil spill response operations.

Risk of Crude/Bitumen Pipeline Spills in the US: Analyses of Historical Data
American Petroleum Institute (2013)
Analysis of rates of crude (including diluted bitumen) pipeline spillage in the US from 1968–2012.

Canadian-US Pipeline Risk Analysis Project
Pipeline Research Council International, Inc. (2010–2011)
Develop oil spill cost and impact model for use in risk analysis project for Canadian-US pipeline systems.

Risk Analysis: Vessel Traffic/Ports

US Coast Guard Hudson River Ports & Waterways Safety Assessment Workshop Participation
US Coast Guard Sector New York (2017)
Invited participation in Hudson River Ports and Waterways Safety Assessment (PAWSA) Workshop in Albany, New York, to evaluate safety and environmental issues related to Hudson River usage by commercial, public, and recreational vessels.

Hudson River Ports and Waterways Safety Assessment Technical Assistance
Scenic Hudson, Inc. (2017)
Technical expert assistance for the Hudson River Ports and Waterways Safety Assessment (PAWSA) to evaluate vessel traffic issues, including the proposal for anchorages, and the development of risk mitigation measures.

Salish Sea Workshop: Trans-Boundary Vessel Oil Spill Risk Assessment and Management
Washington Dept. of Ecology/Puget Sound Partnership (2015)
Development and facilitation of workshop of US and Canadian regulatory agencies, US and Canadian Coast Guards, First Nations, Tribal Nations, maritime industry, pilot associations, maritime exchanges, and environmental advocacy organizations to analyze risk of vessel-related oil spills and to develop risk reduction measures.

Risk Analysis of Crude Oil Vessel Transport for Facility Environmental Impact Statement
Washington State Energy Facility Site Evaluation Council (2014–2017)
Analysis of risk for oil spillage and accidents for Bakken and other crude oil transport by vessel through in Columbia River for proposed facility.

Quantitative Risk Assessment for Roberts Bank Terminal 2 Project (Vancouver)
***Hemmera/Port of Metro Vancouver* (2013–2014)**
Analysis of the probability and nature of vessel-related casualty and spill incidents for proposed container ship terminal expansion; analysis of oil and chemical impacts of spill scenarios.

Vessel Traffic and Risk Assessment Study for Environmental Impact of Refinery
US Army Corps of Engineers/Washington Dept. of Ecology (2012–2014)
Risk analysis of vessel accident probability statistics, characterization of likely casualties, and characterization of casualty consequences for existing BP Cherry Point refinery as part of environmental impact assessment of addition of second dock.

Gateway Pacific Terminal Vessel Traffic and Risk Assessment Study
Washington Department of Ecology (2011–2014)
Analysis of vessel accident probability statistics, characterization of likely casualties, and characterization of casualty consequences for proposed bulk carrier terminal with dry cargo commodities in Puget Sound.

Spill Analysis Cherry Point Refinery North Dock Environmental Impact Statement
US Army Corps of Engineers (2006–2014)
Environmental impact study of vessel traffic and potential oil spills related to BP Cherry Point Refinery in Washington.

Study of Tug Escorts in Puget Sound
Washington Dept. of Ecology (2004)
Analysis of socioeconomic and environmental benefits of use of tug escorts for oil tankers in Puget Sound, as part of engineering study to evaluate application of tug escort rules to different oil tanker types.

Spill Risk Assessment/Response, Socioeconomic/Environmental Damage Analysis
US Army Corps of Engineers, San Francisco (2001–2003)
Oil spill/vessel accident risk analysis for the US ACE project of rock removal in San Francisco Bay. Teamed with Applied Science Associates in estimating response and socioeconomic damage costs associated with hypothetical oil spill scenarios as modeled by ASA's SIMAP oil spill trajectory and natural resource damage modeling program.

Risk Analysis: Maritime Shipping

High-Consequence Risk Management of Global Tanker Trade
SeaRiver Maritime (2019)
Development of an oil spill cost and consequences model for incorporation into a global marine shipping operations high-consequence risk management model; incorporation of high-consequence vessel casualty analysis into risk management model.

Update of Environmental and Economic Benefits of Marine Transport of Hazardous Substances
US Coast Guard/Department of Homeland Security (2010–2017)
Analysis of frequency and volumes of spills of hazardous substances (chemicals) during marine transport and facility storage and transfer operations.

Marine Oil Transport Risk
Washington Dept. of Ecology (2014–2015)
Analysis of risks of oil transport in Washington marine and estuarine waters for evaluation of state-wide policies and risk mitigation.

Risk Modeling for Maritime Transportation of Petroleum and Chemicals (RAMMS)
British Petroleum Shipping, UK (2007–present)
Development and continuing maintenance of model to determine marine transportation risk for petroleum/chemicals from databases of casualty incidents and modeling of oil and chemical spill costs.

Analysis of Washington Vessel Spillage/Casualty Rates Relative to Other States, US
Washington Dept. of Ecology (2001)
Analysis of oil spillage and vessel casualties in Washington compared to US as whole and three other key coastal states in to assess impact of state spill prevention regulations

Environmental Impacts of Dry Cargo Discharges into the Great Lakes
US Coast Guard Strategic Planning and Analysis (2001–2003)
Analysis of environmental impacts of dry bulk cargo discharges from commercial cargo carriers in Great Lakes to identify and quantify impacts of cargo residue discharges into affected areas, assess current program's effectiveness, and make recommendations for regulatory action.

Risk Analysis: Offshore Wind Energy

Environmental Sensitivity and Associated Risk with Offshore Floating Wind Technologies
Bureau of Ocean Energy Management (2016–2017)
Analysis of spill scenarios from potential offshore floating wind technologies on Pacific West Coast and Hawaii, including vessel collision/allision modeling, to update BOEM's Relative Environmental Sensitivity Assessment (RESA) model.

Environmental Risks, Fate, and Effects of Chemicals Associated with Wind Turbines
Bureau of Safety and Environmental Enforcement (2012–2013)
Analysis of the probabilities of leakages of chemicals and oils from wind turbines, impacts of spills, and likely spill scenarios.

Oil Spill Probability Analysis for the Cape Wind Energy Project in Nantucket Sound
Cape Wind Associates (2006)
Probability analysis for oil spills associated with the presence of offshore Cape Wind Energy Project with regard to earthquakes, vessel accidents, tsunamis, hurricanes, and storms, as requested by Minerals Management Service.

Vessel Collision/Allision Analysis for the Cape Wind Energy Project in Nantucket Sound
Cape Wind Associates (2006–2008)
Probability analysis for vessel collisions and allisions, and associated oil spills associated with the presence of the offshore Cape Wind Energy Project.

Oil Spill Ecological Impact Analysis

Oil Spill Consequence and Impact Risk Model Development
ExxonMobil Upstream Research (2011–2012)
Review of over 1,200 research studies and spill case with analysis of environmental and socioeconomic impacts of oil spills and development of a spill risk model.

Arctic Spill Damage Assessment Initiative
NOAA Office of Restoration & Response (2009)
Review of studies and data on arctic spill risks for recommendations for damage assessment and restoration planning in Alaska and the Arctic.

Review of Studies on Interactions between Spilled Oil and Shorelines
Minerals Management Service (2006–2007)
Literature review of previous studies on oil-shoreline interactions and analysis of data on shoreline oil impact to develop algorithms for modeling of shoreline oiling.

Analysis of Methods to Determine and Classify Oil Persistence
US EPA, Oil Program (2003)
Analysis of different methodologies for determining persistence in oil as applied by USCG, international authorities, non-US governments, and industry.

Oil Spill Cost Analysis

Analysis of US Oil Spill Cost Trends Relative to Oil Industry Spillage (1968–2018)
ExxonMobil Upstream Research (2019–2020)
Analysis of oil industry spill rates in comparison to oil industry costs for response and natural resource damage assessments (NRDA).

Analysis of High-Consequence Spills for Risk Management of Global Tanker Trade
SeaRiver Maritime (2019)
Development of an oil spill cost and consequences model for incorporation into a global marine shipping operations high-consequence risk management model; incorporation of high-consequence vessel casualty analysis into risk management model.

Oil Spill Cost Model for California
California Dept. Fish & Wildlife Office of Spill Prevention &Response (2018–2019)
Development of oil spill cost model for application in determining required levels of financial responsibility for operators in California.

Model for Oil Spill Cost Risk Associated with Offshore Operations
Woodside Energy, Australia (2018)
Development of oil spill cost risk model for offshore operations in Australia and other locations worldwide. Model includes response costs, damage costs, and fines/penalties.

Estimation of Oil Spill Costs for Floating Production, Storage, and Offloading Vessels
Mitsubishi Tanker (2017)
Analysis of potential response costs and natural resource damages for worst-case discharge scenarios from FPSOs; analysis of probability of accidents and spills.

Estimation of Oil Spill Impacts and Costs from Potentially Leaking Oil Well
US Coast Guard Sector New Orleans/Taylor Energy (2013–present)
Analysis of potential response costs and natural resource damages for worst-case discharge scenarios from plugged and abandoned oil wells associated with platform toppled during Hurricane Ivan (2004) for the purposes of providing an estimate of costs for development of a consent decree with responsible party.

Analysis of Potential Marine Oil Spill Costs for Enbridge Northern Gateway Project
Enbridge Northern Gateway Pipelines (2010–2011)
Determine potential costs associated with oil spills that might occur in marine waters as part of the operations associated with the operation of tankers.

Cost Analysis for Vessel-Sourced Oil Spills
US Government Accountability Office (2006–2007)
Analysis of the costs of response and damages for vessel spills in the US to determine appropriateness of existing spill liability limits.

Development of Oil Spill Cost Model for Global Shipping Operations
BP Shipping, UK (2007–present)
Development of algorithms and model design for oil spill cost model for application to global tanker and tank barge shipping operations. Continuous updating and maintenance.

Development of Model to Estimate Costs and Damages from Oil Spills
US EPA Oil Program (2002–2007)
Development of basic model (Basic Oil Spill Cost Estimation Model) to estimate costs (response, natural resource, socioeconomic) by oil type, spill volume, and location factors.

Oil Spill Response Cost Modeling for National Defense Reserve Fleet
US Maritime Administration (2001–2002)
Oil spill response cost modeling for hypothetical oil spill scenarios related to the dismantling of the National Defense Reserve Fleet in the James River, Virginia.

Response Cost Estimation Modeling for USCG Evaluation of Tanker Designs
National Academy of Sciences/Transportation/Marine Boards (1999–2000)
Development of methodology for USCG to estimate cost of mechanical recovery/shoreline cleanup for various oil spill scenarios; model used in evaluating cost consequences of spills of various sizes from alternative tanker designs.

Spill Response Analysis

Development of Response Information for Offshore Oil Spills in Area Contingency Plans
Bureau of Safety and Environmental Enforcement (2019–2021)
Updating of existing oil and gas infrastructure in US Outer Continental Shelf (OCS); development of worst-case discharge (WCD) scenarios; analysis and evaluation of mechanical containment and recovery, dispersant, and in situ burning capabilities; modeling of WCD scenarios; and development of best response strategies and concepts of operations under different conditions.

Development of Inland Environmental Effective Recovery System Potential Calculator
US Coast Guard Research & Development Center (2018–2020)
Design of the model concept and development of algorithms for an Effective Recovery System Potential (ERSP) calculator for application to inland environments.

Analysis of Mechanical Recovery Effectiveness for Offshore Spills
ExxonMobil Upstream Research (2019–2020)
Analysis of the factors that affect effectiveness of mechanical recovery operations in open-water, offshore spills and estimation of potential range of recovery values.

Analysis of Decontamination Processes
ExxonMobil Emergency Preparedness and Response (2017–present)
Analysis of oil spill decontamination processes with respect to costs, cost-effectiveness, injuries and health impacts for responders, and waste stream minimization.

Long-Term Shoreline Monitoring/Cleanup Program after Macondo MC252 Spill
Grand Isle, Jefferson Parish, Louisiana (2012–2015)
Analysis of shoreline and nearshore impacts from Macondo MC252 spill and advisory services for the development of a long-term monitoring and residual oil cleanup program for Grand Isle.

Development of Macondo MC252 Spill Long-Term Shoreline Monitoring Program
Plaquemines Parish, Louisiana (2012–2015)
Analysis of shoreline and nearshore impacts from Macondo MC252 spill and advisory services for the development of a long-term monitoring program for Plaquemines Parish.

Technical Support Macondo MC252 Spill: Impact Study/Protective Strategy
Mobile County Commission (Alabama) (2010)
Provide technical support to the County Commission on issues related to spill response, protective strategies, environmental and socioeconomic impact analyses, modeling of spill responses

Technical Support Macondo MC252 Spill: Protective Strategy/Response Evaluation
Louisiana Office Coastal Protection and Restoration (2010)
Provide technical support by evaluating spill response and protective measure proposals; modeling of protective booming strategies for sensitive marsh areas of Louisiana

Hydrodynamics/Current Analysis: Washington Oil Transfer Regulation Effectiveness
Washington Dept. of Ecology (2003–2006)
Hydrodynamics and currents analysis in Puget Sound/Columbia River for pre-booming measures for oil transfers.

Cost-Benefit Analysis of Shoreline Booming Options–Modeling Impacts and Costs
California Fish/Game, Oil Spill Prevention & Response (2007–2009)
Application of previously-developed models and data to evaluate quantitatively the benefits of various response strategies for representative spills and impacted resources in terms of impact reductions and cost implications.

Oil Spill Response Vessel Capabilities in State of Washington
Washington Dept. of Ecology (2005)
Analysis of impacts of oil spills in Washington waters to determine types of incidents for which vessel of opportunity skimming systems and other uses of vessels could augment spill response.

Laser Fluorosensor Heavy Oil Detection Cost-Benefit Analysis
US Coast Guard Research & Development Center (2005–2006)
Cost-benefit analysis laser fluorosensor technology for improving spill response; development of database of oil spills that may have provided opportunities for employing fluorosensor technology; modeling of environmental impacts and response costs for spills.

Cost-Benefit Analysis of USCG Oil Spill Research & Development Program
US Coast Guard Research & Development Center (2002)
Cost-benefit analysis of improvements in spill response technology to determine response, socioeconomic, and environmental cost reductions by alternative response technologies and improvements in mechanical recovery.

Oil Spill Response Modeling Tool Development

Development of Initial Oil Spill Response Tool for Emergency Responders (ADIOS3)
National Oceanic and Atmospheric Administration (2011–2013)
Develop algorithms for ADIOS3 (response tool to aid Incident Command in response decisions during drills or actual events) to incorporate socioeconomic and environmental impacts evaluation of resource risk in quasi-quantitative manner based on experience with past spills and state-of-the-art research on impacts of spilled oil and spill response measures, and response mitigation effectiveness.

Oil Spill Modeling Working Group Study–Modeling of Spill Response
UNH/NOAA Coastal Response Research Center (2008–2011)
Evaluation of state-of-the art in spill modeling with emphasis on spill response modeling for conceptual development of the next generation of oil spill models.

Development of Oil Spill Response Cost-Effectiveness Analytical Tool
NOAA/UNH Cooperative Inst. Coastal/Estuarine Environmental Tech. (2002–2004)
Two-year grant to develop decision-making tools for determining cost-effectiveness of various oil spill cleanup response options in order to better facilitate short- and long-term environmental recovery of oil-impacted areas.

Oil Spill Policy Analysis

Oil Spill Response, Socioeconomic, Environmental Cost-Benefit Analysis for Washington
Washington Dept. of Ecology (2003–2006)
Cost-benefit analysis of proposed spill response preparedness regulations, development of survey of response contractors and plan-holders to determine regulatory compliance cost; detailed modeling of response, socioeconomic, and environmental costs for comparison of response methods

Washington State Oil Transfer Rule Benefit Analysis
Washington Dept. of Ecology (2003–2006)
Analysis of potential benefits of proposed oil transfer rule for spill prevention/mitigation.

Analysis of Discharge Scenarios for Washington Contingency Planning Standards
Washington Dept. of Ecology (2001)
Analysis of potential spills; development of oil spill scenario probability distribution functions to determine most likely/worst-case discharges for contingency planning.

Cost-Benefit Analysis of US EPA Oil Program
US EPA Oil Program (2002–2007)
Analysis of US EPA Oil Program benefits of spill prevention and increasing spill response effectiveness; examination of costs/benefits to society from oil spills/prevention regulations

Regulatory Analyses for Economic and Environmental Impact for US Coast Guard
US Coast Guard Standards Evaluation and Analysis (2005)
Development of database of vessel-based hazardous materials spills and discharges and analyzing risks and impacts of these incidents as part of regulatory analysis.

Oil Spill Prevention, Preparedness, Response Program Broad Risk Assessment
US Coast Guard Office of Response (2002)
Risk analysis services and review of projects for the USCG Oil Spill Prevention, Preparedness, and Response Program Broad Risk Assessment Project aimed at providing information for strategic planning for the next decade.

Oil Spill Trend Analysis

Analysis of Trends for 50 Years of Oil Spill Data
ExxonMobil Qatar Ltd. (2021–2022)
Statistical analysis of 50 years of oil spill data from the US and around the world to determine long-term trends in spill frequency, volume, and rates for different types of spill sources.

US Oil Spill Trend Analysis–Updated through 2012
American Petroleum Institute (2013–2014)
Analysis of 45 years of oil spill data to determine relative trends in all sectors of oil industry (exploration and production, transport, storage, refining), and oil consumption sectors (manufacturing, consumers).

Analysis of US Oil Spill Rates
American Petroleum Institute (2011)
Update to previous statistical analyses on oil spill rates to include years through 2010.

US Oil Spill Trend Analysis
American Petroleum Institute (2008–2009)
Analysis of 40 years of oil spill data to determine relative trends in all sectors of oil industry (exploration and production, transport, storage, refining), and oil consumption sectors (manufacturing, consumers).

Development of Oil Spill Databases for US EPA Oil Program
US EPA Oil Program (2002–2007)
Development of comprehensive database of oil spill incidents from facilities regulated by EPA through its Spill Preparedness, Control, and Countermeasures (SPCC) Program and other inland spill sources.

Development of International Tanker Oil Spill Database
Minerals Management Service (2000–2002)
Analysis of international data relevant to tanker oil spills for use of Minerals Management Service in their studies to compare oil transport spill rates.

Vessel Operational Spillage Analysis

Ports Best Practices for Lubricant Accidental /Operational Discharge Prevention
Castrol Marine Ltd. (2009–2010)
Survey and analysis of best practices for reducing, preventing, and mitigating lubricant oil spillage and operational leakage from vessels in worldwide ports.

Analysis of In-Port Accidental Vessel Lubricant Spillages/Operational Discharges
Castrol Marine Ltd. (2008–2010)
Estimate of lube oil spillage and operational leakage from vessels in 4,708 worldwide ports; analysis of potential environmental and cost benefits of use of biodegradable lubricants.

Polychlorinated Biphenyl (PCB) Pollution

NRDA Issues and Recommendations Related to PCB Discharges into Hudson River
Scenic Hudson, Inc. (2018–present)
Review of Natural Resource Damage Assessment (NRDA) cases and technical literature on PCB contamination and damage assessment approaches to develop recommendations related to the historical polychlorinated biphenyl (PCB) discharges by General Electric into the Hudson River.

Environmental Salvage

Environmental and Response Assessment for Congo Salvage Project
Private Client (2013)
Analysis of potential environmental and socioeconomic impacts and response considerations for wreck oil removal and salvage operation for wreck (Tug Nana Tide) in coastal waters off Dem. Rep. Congo.

Environmental and Response Assessment for British Columbia, Canada Project
Private Client (2013)
Analysis of potential environmental and socioeconomic impacts and response considerations for wreck oil removal and salvage operation for wreck (USAT Brig. Gen. M.C. Zalinski) in British Columbia fjord.

Analysis of Costs and Impacts for Leaking Vessel Wreck
Fisheries and Oceans Canada (2013)
Evaluation of potential environmental and socioeconomic damages and response costs for spillage from wreck (USAT Brig. Gen. M.C. Zalinski) in British Columbia fjord.

Wreck Oil Removal Project: Risk Assessment/Prioritization of US Undersea Threats (RULET)
National Oceanic and Atmospheric Administration (2010–2013)
Development of comprehensive environmental risk criteria to assess the large number of wrecks in US waters, application of the risk criteria to prioritize wrecks for oil removal operations, and work with the USCG to develop a protocol for developing work plans for removal operations.

Analysis of Oil Spill Risk from Potentially Polluting Shipwrecks
US Coast Guard, American Petroleum Institute (2004–2005)
Development of international database of potentially polluting shipwrecks and analyzed risks and impacts of oil spillage from these wrecks, as well as worked on team to evaluate costs and benefits of salvage.

Marine Impacts of Oil from Shipping/Offshore Exploration & Production

Oil in the Sea IV: Inputs, Fates, and Effects
National Academies of Science, Engineering & Medicine (2020–2022)
Appointed committee member for committee tasked with provide an update of the previous report's (*Oil in the Sea III: Inputs, Fates, and Effects*, 2003) inventory of the sources, composition, and quantity of hydrocarbon inputs to the marine environment and assessment of the state of the science on the fate and effects of fossil fuel hydrocarbons in the marine environment.

Pollution in the Open Oceans: A Review of Assessments and Related Studies
UN/International Maritime Organization (2007–2008)
Participation in Joint Group of Experts on the Scientific Aspects of Marine Protection (GESAMP) review of studies related to open ocean pollution and environmental impact, including all shipping, offshore oil exploration & production, shipwrecks, vessel noise issues.

Oil in the Sea III: Inputs, Fates, and Effects
National Research Council Ocean Studies Board (1999–2001)
Development and analysis of several databases of North American and international oil spills and analysis of spillage from all sectors geographically to develop estimate of spillage rates on regional basis.

Estimation of Oil Input into Marine Environment (GESAMP)
International Maritime Organization/UNEP (1997–2006)
Joint Group of Experts on the Scientific Aspects of Marine Protection (GESAMP) analysis of historical oil spill data to estimate oil entering marine environment; development of extrapolation model to estimate smaller spill input; analysis of spillage rates in relation to transport/oil production; comparison to previous estimates; regional/international analysis to determine impacts of spill prevention conventions.

Port State Control Analysis

Port State Control/ Vessel Security Target Matrix Effectiveness Evaluation Method
US Coast Guard Office of Compliance (2003)
Develop statistical methodology for USCG to determine effectiveness of Port State Control- and Port Vessel Security Target Matrix in profiling vessels that may be safety and/or security risks, and make recommendations on weighting of factors in Port State Control- and Port Vessel Security Target Matrices.

Expert Witness Testimony/Litigation Support

Enbridge Line 3 Pipeline Environmental Impact Statement Testimony (Minnesota)
Minnesota Department of Commerce/Dept. of Natural Resources (2017)
Dr. Etkin reviewed the oil spill impact modeling and pipeline spill probability analysis in the draft and final environmental impact statements (EIS) and provided testimony for evidentiary hearings.

Analysis of Spill Response Costs for Inland Pipeline Spill (Michigan)
Reed Smith LLP/Enbridge Pipeline (2016)
Dr. Etkin analyzed response operation costs for inland oil pipeline spill to assess the appropriateness and reasonableness of costs and response actions relative to specific circumstances of the 2010 Enbridge Pipeline spill in Kalamazoo, Michigan.

Analysis of Spill Response Costs for Inland Pipeline Spill (Utah)
Holland & Hart LLP/Chevron Pipe Line (2016)
Dr. Etkin analyzed response operation costs for inland oil pipeline spill to assess the appropriateness and reasonableness of costs and response actions relative to specific circumstances of the spill.

Reasonableness of Spill Response Costs for Minor Vessel Spill (California)
McKasson & Klein LLP/Norbulk Shipping (2015–2016)
Dr. Etkin analyzed response operation costs for a minor vessel spill to assess the appropriateness and reasonableness of costs and response actions relative to specific circumstances of the spill.

Analysis of Probability of Well Releases and Potential Costs and Damages (Louisiana)
Taylor Energy and Associated Counsel (2013–present)
Dr. Etkin analyzed the likelihood of various hypothetical well release and blowout scenarios and evaluated the potential environmental impacts, natural resource damages, and cleanup costs to assist with a settlement case. This case is still in process.

Oil Spills from Non-Tank Vessels: Threats, Risks, and Vulnerabilities
US Senate Committee on Commerce, Science, and Transportation Subcommittee on Oceans, Atmosphere, Fisheries, and Coast Guard (2007)
Dr. Etkin testified as an expert witness on oil spill issues at the request of Senator Daniel K. Inouye (Chairman of the US Senate Committee on Commerce, Science, and Transportation Subcommittee on Oceans, Atmosphere, Fisheries, and Coast Guard). The hearing occurred in response to the Cosco Busan oil spill in San Francisco Bay.

Analysis of Fines and Penalties for Spill from Oil Terminal (Maryland)
Womble Carlyle Sandridge & Rice LLC/ Center Point Terminal (2008–2009)
Dr. Etkin prepared expert witness testimony for Circuit Court for Baltimore City, Maryland: State of Maryland Dept of Environment vs. Center Point Terminal Baltimore, LLC, and Petroleum Fuel & Terminal Company, a case involving the reasonableness of fines and penalties assessed against an oil facility owner and operator.

Analysis of Spill Response Costs and Relative Financial Responsibility (Louisiana)
Coats, Rose, Yale, Ryman & Lee PC (Houston, Texas)/Venice Energy/Targa Midstream (2007)
Dr. Etkin testified as an expert witness for 127th Judicial District Court of Harris County, Texas: Venice Energy Services Company, LLC and Targa Midstream Services Ltd Partnership vs. Hilcorp Energy Co. and Hilcorp Energy I, LP; Case No. 2007-02086 on strategic post-mortem analysis on oil spill response and cost impacts to determine reasonableness of costs and relative percent financial responsibility between two facility owners in spillage during Hurricane Katrina.

Analysis of Magnitude and Legitimacy of Spill Response Costs (Maryland)
Patton Boggs LLP, Washington, DC/ST Services (2001–2005)
Dr. Etkin provided expert testimony on behalf of Support Terminal (ST) Services, Inc., for US District Court for the District of Maryland Southern Division: Potomac Electric Power Co. v. Support Terminal Services, Inc.; Case No. PJM-02-4076 in a dispute over the magnitude and legitimacy of oil spill cleanup response costs for a 138,600-gallon pipeline spill at Chalk Point, Maryland (Patuxent River). The case included modeling of actual and hypothetical spill response costs given different responses that should have been taken in the aftermath of the spill. In addition, she analyzed actual costs for legitimacy with regard to their inclusion under the category of "cleanup response".

Analysis of Oil and Hazardous Material Inputs During 1991 Gulf War (United Nations)
Government of Kuwait (2002–2003)
Dr. Etkin provided expert testimony on behalf of the claimant, the government of Kuwait, regarding analysis of oil inputs and damage to Kuwaiti waters and coastal zones from the oil spillage into the Arabian Gulf as part of United Nations Compensation Commission of UN Security Council: Section E Resolution 687 and Resolution S/22559 Compensation and Claims as Result of Iraq's Unlawful Occupation and Invasion of Kuwait.

Analysis of Oil and Hazardous Material Inputs During 1991 Gulf War (United Nations)
Government of Saudi Arabia (2002)
Dr. Etkin provided expert testimony of the claimant, the Kingdom of Saudi Arabia, regarding analysis of oil inputs and damage to Saudi Arabian waters and coastal zones from the oil spillage into the Arabian Gulf as part of United Nations Compensation Commission of UN Security Council: Section E Resolution 687 and Resolution S/22559 Compensation and Claims as Result of Iraq's Unlawful Occupation and Invasion of Kuwait.

Tanker Spill Analysis (Alaska)
Fulbright & Jaworski LLP, Houston, Texas/SeaRiver Maritime (2001)
Dr. Etkin was deposed as an expert witness for United States District Court for the District Of Alaska: SeaRiver Maritime Financial Holdings, Inc., et al. (Plaintiffs) v. Rodney Slater, et al. (Defendants); Case

No. A97-0060-CV (HRH) by the attorneys for the plaintiffs (SeaRiver Maritime Financial Holdings, Inc., SeaRiver Maritime Inc., and SeaRiver International, Inc.) regarding tanker oil spills.

Analysis of Pipeline Spills and Spill Rates (Texas)
Fred Misko, Jr., Esq., Dallas, Texas/PD Hamilton (2001)
Dr. Etkin provided expert testimony and consulting services to the attorneys for the plaintiffs in United States District Court for the Eastern District of Texas, Lufkin Division: P.D. Hamilton (Plaintiffs) v. Koch Industries, et al. (Defendants); Civil Action No. 901CV132 (366498.1 1761) regarding oil pipeline spills and spill rates.

Pipeline Spill Benchmark Analysis (Texas)
Beck, Redden & Secrest, LLP, Houston, Texas/Koch Industries (1999)
Dr. Etkin was deposed as an expert witness for United States District Court for the Southern District Of Texas, Houston Division: United States of America, et al. (Plaintiffs) v. Koch Industries, Inc., et al. (Defendants); Civil Action No. H-95-1118 by the attorneys for the defendants (Koch Industries, Inc., et al.) regarding oil pipeline spills and spill rates.

Analysis of Offshore Exploratory Oil and Gas Well Spillage Rates (Florida)
Angerer & Angerer, LLC/Coastal Petroleum (1997)
Dr. Etkin provided expert testimony regarding rates of spillage from oil wells and testified in court for Coastal Petroleum Company v. State Department of Environmental Protection, Case No. 98-1998 (First District Court of Appeal). Drilling Permit Litigation in a case regarding a drilling permit for an offshore exploratory oil and gas well in Florida state waters.

Publications and Reports

General Oil Spill Risk Analysis and Decision-Making

Etkin, D.S. 2006. Risk assessment of oil spills to US inland waterways. *Proceedings of the 2006 Freshwater Spills Symposium*

Etkin, D.S. 2009. *Oil Spill Risk in Industry Sectors Regulated by Washington State Department of Ecology Spills Program for Oil Spill Prevention and Preparedness.* Prepared by Environmental Research Consulting for Washington Department of Ecology, Olympia, WA. Contract No. C0900186. February 2009. 28 p.

Etkin, D.S. 2010. *Oil Spills from Oil Majors: Implications for Arctic Spill Risk in US and Canada.* Prepared by Environmental Research Consulting for ExxonMobil Upstream Research Company, Houston, TX. Contract No. 507585. March 2010. 63 p.

Etkin, D.S. 2012. *Assessment of Marine Oil Spill Risk and Environmental Vulnerability for the State of Alaska: Appendix A: Incident Rate and Spill Volume Analysis.* NOAA Contract Number: WC133F-11-CQ-0002. Subcontract CKB1063B-2013-SVS-1. Submitted to National Oceanic and Atmospheric Administration, Seattle, Washington, USA. December 2012. 241 p.

Etkin, D.S. 2013. *Modeling Oil Spill Trajectories in the Beaufort Sea: Spill Scenario Development and Probability Analysis.* Prepared for World Wildlife Fund-Canada, Inuvik, Northwest

Territories, Canada. 7 November 2013. 28 p.

Etkin, D.S. 2015. Risk analysis and prevention. In *Handbook of Oil Spill Science and Technology*, pp. 3–36, Edited by M. Fingas, Wiley & Sons, Inc., Hoboken, New Jersey, USA. 693 p.

Etkin, D.S. 2016. *Modeling Oil Spill Trajectories in Baffin Bay and Lancaster Sound: Spill Scenario Development, Spill Probability Analysis, and Spill Response Development.* Prepared for World Wildlife Canada. 10 June 2016. 48 p.

Etkin, D.S., A. Wolford, D. French-McCay, J. Rowe, and M. Horn. 2018. Decision-making based on oil spill risk assessments. *Proceedings of the 41st AMOP Technical Seminar on Environmental Contamination and Response:* 1,110–1,136.

Etkin, D.S., D. French-McCay, J. Rowe, D. Crowley, J. Joeckel, and A. Wolford. 2018. *Hudson River Oil Spill Risk Assessment. Vol 1: Executive Summary.* Prepared by Environmental Research Consulting, RPS, SEAConsult, and Risknology for Scenic Hudson, Inc. May 2018. 60 p.

Etkin, D.S., D. French-McCay, J. Rowe, D. Crowley, J. Joeckel, and A. Wolford. 2018. *Hudson River Oil Spill Risk Assessment. Vol 2: Hudson River & Study Overview.* Prepared by Environmental Research Consulting, RPS, SEAConsult, and Risknology for Scenic Hudson, Inc. May 2018. 112 p.

Etkin, D.S., D. French-McCay, J. Rowe, D. Crowley, J. Joeckel, and A. Wolford. 2018. *Hudson River Oil Spill Risk Assessment. Vol 3: Oil Spill Probability Analysis.* Prepared by Environmental Research Consulting, RPS, SEAConsult, and Risknology for Scenic Hudson, Inc. May 2018. 210 p.

Etkin, D.S., D. French-McCay, J. Rowe, D. Crowley, J. Joeckel, and A. Wolford. 2018. *Hudson River Oil Spill Risk Assessment. Vol 4: Spill Consequences–Trajectory, Fate, and Resource Exposure.* Prepared by Environmental Research Consulting, RPS, SEAConsult, and Risknology for Scenic Hudson, Inc. May 2018. 146 p., plus appendices.

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Professional Activities/Honors

- Appointed member of National Academies of Science, Engineering, and Medicine (NASEM) Oil in the Sea IV Committee: 2020–2022
- Member UN/IMO/UNEP/UNESCO Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP): 1997–present
- Vice-Chair Maritime Law Association of US (Salvage Committee): 2018–2019
- Invited Participant US Coast Guard New York Ports & Waterways Safety Assessment 2017
- Hudson River Harbor Safety Committee Member 2018
- Ecology & Environment Resiliency and Restoration Seminar, October 2016 (Invited Speaker)
- Invited Expert Panelist for Royal Society of Canada Expert Panel on Behavior and Environmental Impacts of Crude Oil Released into Aqueous Environments 2015
- Member International Maritime Organization (IMO) Marine Environmental Protection Committee Correspondence Group on Environmental Risk Assessment Criteria 2007
- US Senate Subcommittee Hearing: Oil Spills from Non-Tank Vessels: Threats, Risks, and Vulnerabilities Invited Testimony–18 December 2007
- Wrecks of the World Conference Program Chair: Sept. 2009; June 2011; Oct. 2015
- Member UNH/NOAA Coastal Response Research Center Working Group on Oil Spill Modeling
- Member American Salvage Association 2009–present
- Senior Research Editor/Analyst–*Oil Spill Intelligence Report*: 1982, 1989–1999
- US Coast Guard Meritorious Team Commendation (for International Oil Spill Conference): 2001
- Peer Reviewer *J. Hazardous Materials, Marine Pollution Bulletin, Envntl Sci & Tech, J. Coastal Conservation, J. Petroleum Engineering, J. Environmental Mgmt.*
- Elected Associate Member *Sigma Xi* (Scientific Research Society): 1979–present