



Statement of Qualifications 2011

# Natural Resource Damage Assessment

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## Overview of Cardno ENTRIX

### The Firm

Founded in 1984, Cardno ENTRIX is a highly respected environmental and natural resource management consulting firm. Headquartered in Houston, Texas, Cardno ENTRIX employs over 500 employees in 40 offices in the United States, Canada, and Ecuador, specializing in biological and ecological sciences, ecological and human-health risk, ecological toxicology, natural resource damage assessment (NRDA), natural resource economics, ecosystem restoration, natural resource management, hydrology, geology, engineering, statistics, and geographic information systems.

Cardno ENTRIX clients include a variety of business and government interests worldwide. Our industrial client base includes leading Fortune 500 companies in the petroleum, mining, chemical, power generation, and automotive sectors. Our annual business revenue is over \$88M, with some 95 percent of the firm's business with the private sector.

Our company typically employs an interdisciplinary approach to problem solving that can call on a wide spectrum of engineering, scientific, economic, and regulatory experts. Our specialty is providing innovative and well-integrated solutions to complex resource issues. An essential element of our success is the effective balancing of regulatory requirements, technical concerns, client needs, and cost.

Over one-third of our staff has advanced degrees and post-graduate training, and of our senior staff typically have more than 20 years of experience. Our consulting scientists, biologists, ecologists, wetland scientists, geologists, engineers, planners, ecotoxicologists, chemists, risk assessors, economists, and project managers enable Cardno ENTRIX to form teams tailored to the client's unique needs for innovative assistance in meeting challenges associated with managing natural resources and environmental liabilities.

### The Services

Cardno ENTRIX is a national leader in the field of Natural Resource Damage Assessment. NRDA has been a core service area for the firm since its inception. For 20 years, Cardno ENTRIX has been a major presence in the NRDA community providing experienced support for both oil spill and contaminated site damage assessments at ground water, surface water, soil, and sediment contamination sites. Our staff has participated in NRDA's at some 45 sites and 50 spills in more than 30 states over 20 plus years.

Our expertise in the NRDA arena includes:

- Biology and Population Ecology
- Ecological Toxicology
- Natural Resource Economics
- Restoration Ecology
- Hydrology
- Forensic Chemistry
- Econometrics & Statistics
- Restoration Design & Implementation
- Litigation Support
- Cooperative Assessment
- NRDA Credit Banking
- Insurance & Third Party Claims
- Integration with RI/FS & Remediation
- Emergency Response & Response Planning

As a leader in the field, Cardno ENTRIX has experience with a full suite of habitats and contaminants; we have worked with a large number of federal, state, and tribal trustees; we have been involved in a number of capacities ranging from highly cooperative assessments to litigation support and expert witness

services. Cardno ENTRIX staff is capable of assisting in an NRD from beginning to end, including designing, implementing and monitoring the success of restoration projects identified during the NRDA process.

## The Staff

Cardno ENTRIX staff members are highly respected by state and federal response, resource management and Trustee agencies as well as by our private sector clients. Cardno ENTRIX's mixture of experienced professionals from varied disciplines enables us to address challenges that would normally require several consulting firms. Moreover, our staff is experienced in approaches for integrating response driven environmental liability management with NRDA liabilities while utilizing strategic risk management plans and site closure approaches.

Senior professionals within Cardno ENTRIX are actively involved in Response Agency, Natural Resource Trustee, and industry-led panels as well as active participants and leaders in professional societies and scientific organizations.

Cardno ENTRIX provides services for all phases of the NRDA process, from liability identification and injury assessment, restoration scaling, resource economics, and integration with site response activities, through to restoration project design and implementation. A fully integrated, interdisciplinary group of professionals supports each expert and discipline. These professionals include:

- Regulatory Specialists
- Biologists & Ecologists
- Environmental Toxicologists
- Environmental & Forensic Chemists
- Hydrogeologists
- Natural Resource Economists
- Economists
- Habitat Restoration Experts
- Environmental Planners
- Air Quality Specialists
- Environmental, Chemical, & Civil Engineers
- NEPA and Project Permitting Specialists

Cardno ENTRIX professionals have developed and applied unique, specialty products to manage clients' NRDA liability and establish settlement frameworks. These innovative tools are not "off the shelf," but are tailored to specific environments and problems. Moreover, many of these approaches offer alternatives to standard Trustee methods, which may not represent the state-of-the-art. These tools include:

- Habitat Equivalency Analysis (HEA)
- Net Environmental Benefit Analysis (NEBA)
- Resource Equivalency Analysis (REA)
- Simulated Estimated Mortality Model
- Chemical/Oil Spill Impact Module (COSIM)
- Stochastic Dynamic Population Modeling
- Sample Surveys Design and Implementation
- Econometric and Statistical Models
- Random Utility and Conjoint Models

## National Project Experience

### Contaminated Sites

#### Groundwater

- **Chevron - South Valley Superfund Site.** The contamination of groundwater resources at the South Valley superfund site in New Mexico has resulted in one of the largest NRDA claims ever filed in the U.S. Cardno ENTRIX provided litigation support and expert testimony in federal court on behalf of Chevron regarding the economic value of the injury and difficulties with the plaintiff's economics expert's testimony.
- **Confidential Clients – Colorado.** Cardno ENTRIX is working on behalf of a PRP Group to help resolve claims for alleged damages to ground water contamination at a landfill site. This is a cooperative assessment.
- **Confidential Client - New Jersey.** Cardno ENTRIX is providing litigation support and expert analysis regarding claims for damages to ground water (and surface resources exposed to contaminants via migration of ground water to surface waters) at a large facility in New Jersey.
- **IBM – New Jersey.** Cardno ENTRIX provided litigation support for a ground water NRD claim associated with a former manufacturing facility in New Jersey. Tasks being performed include evaluation of the trustee NRD claim; development of a ground water injury estimate incorporating principles and methods of economics, relevant site history, and state and local ground water management institutions and programs.
- **BP – New Jersey.** Cardno ENTRIX provided assistance in management of NRD liabilities due to potential ground water contamination at 6 facilities and approximately 135 gas stations at various locations in New Jersey. Tasks performed included review and critique of trustee claims, development of ground water injury estimates, and identification and evaluation of potential compensatory restoration measures.
- **Atlantic Richfield CO – New Jersey.** Cardno ENTRIX provided litigation support and expert testimony regarding potential magnitude of damages to ground water at the Ewing Township site.
- **Hunton and Williams – Washington, DC.** Cardno ENTRIX provided support in managing NRD liability at a site in New Jersey. Tasks included evaluation of the trustee claim, provision of an alternative estimate of damages, and identification and evaluation of potential compensatory restoration projects.
- **Confidential Client - New Jersey.** A confidential client has retained Cardno ENTRIX to assist in a pending NRD claim at a former chemical manufacturing facility in New Jersey. Potential natural resource injuries at the site include impacts to wildlife, wetlands and groundwater. Working closely with the client, Cardno ENTRIX is developing an expedited approach for estimating natural resource injury and scaling a restoration-based settlement proposal. Existing data, ecological risk assessment techniques, and habitat equivalency analysis are being used to develop injury estimates. Cardno ENTRIX is also identifying restoration-based compensatory restoration for alleged groundwater injury as an alternative to a cash settlement based on the State's formula for groundwater damages.
- **Dow Chemical Company – Michigan.** Cardno ENTRIX is engaged on behalf of Dow in a cooperative damage assessment with state, federal, and tribal trustees. Included in the assessment are potential damages to ground water resources.

- **Shell Oil Company - Colorado.** Cardno ENTRIX provided litigation support and expert economic analysis regarding a State of Colorado claim for natural resource damages at the Rocky Mountain Arsenal near Denver. While damages to surface water, sediments, soils, and wildlife are at issue, the majority of the claim relates to alleged damages to ground water.
- **Confidential Client – New Jersey.** Cardno ENTRIX is providing litigation support for a claim for damages to ground water resources at a former manufacturing facility.
- **Confidential Client – New Jersey.** Cardno ENTRIX is providing litigation support for a claim for damages to ground water resources at a former manufacturing facility.
- **Confidential Client – Multiple Sites in Western US.** Cardno ENTRIX provided an independent review and evaluation of estimates of damages at multiple sites filed by state, federal and tribal trustees as part of the ASARCO bankruptcy case. Included were five claims for damages to ground water resources associated with the Tri-States sites, Southeast Missouri Lead sites, and East Helena site.
- **Former Kimberly Clark Paper Mill – Maine.** Cardno ENTRIX is providing technical support for facilitating the closure of a RCRA site at the S.D. Warren Paper Mill where groundwater impacts are the alleged injured resources. In lieu of impracticable and costly groundwater remediation, site closure was achieved through conducting a restoration-based compensation analysis and a restoration project to compensate for long-term natural resource injuries. Settlement negotiations for the Cooperative NRDA are based on Habitat Equivalency Analysis (HEA) and restoration based compensation. The restoration project includes acquisition of a parcel of property to provide new river access points and expansion of a walking trail.

#### Other Contaminated Site NRDs

- **Dow Chemical Company – Michigan.** In addition to providing site characterization, ecological risk assessment, Net Environmental Benefits Analysis, and strategic liability management consulting services, Cardno ENTRIX is assisting Dow in a cooperative damage assessment with federal, state, and tribal trustees at a large site in Michigan. The site involves a complex set of potential concerns in sediment, river, terrestrial and lake systems.
- **Lake Hartwell - Georgia.** Cardno ENTRIX staff directed the human-use damage assessment and settlement discussions between federal and state trustees regarding an NRD claim for Lake Hartwell. Evaluated the trustees' estimate of monetary damages loss and developed alternative approaches for calculating the damages, reviewed cost projected costs of restoration plan and the statistical analyses on ecological issues.
- **St. Lawrence River - New York.** Cardno ENTRIX staff led the recreational human-use damage assessment for the site. The activities include developing models of recreational fishing damages based on an original data collection, designing a compensatory restoration analysis for offsetting potential damages, reviewing trustee analyses of potential damages for tribal human-use services.
- **Fox River/Green Bay.** Cardno ENTRIX staff served as the project manager for all aspects of the cooperative human-use damage assessment. The activities included: survey design and implementation; model development; analysis of restoration options; participation in settlement negotiations. The model developed for the assessment has been published in *Land Economics*
- **Lake Ontario - New York.** Cardno ENTRIX staff led the recreation NRD assessment, including the review of the trustees claim and the development of alternative damage estimates.

- **Palmerton Zinc Pile Superfund Site - Pennsylvania.** Cardno ENTRIX staff led the human-use NRD assessment for CBS in this cooperative assessment. The assessment has included potential damages to fishing, hunting and hiking.
- **Confidential Client – Texas.** For a PRP Group, Cardno ENTRIX is providing independent estimation of restoration requirements to resolve NRD liabilities at a former waste management site. We are also designing on-site restoration for integration into remedial activities.
- **Confidential Client – Multiple Sites in Western US.** Cardno ENTRIX provided an independent review and evaluation of estimates of damages at multiple sites filed by state, federal and tribal trustees as part of the ASARCO bankruptcy case. Included were claims for damages to various natural resources.
- **Lead Smelter – Missouri.** Cardno ENTRIX is providing strategic and technical services for integrating site characterization/remediation and NRDA processes at a lead smelter adjacent to the Mississippi River. AOC and SOW negotiations with USEPA Region 7/Missouri DNR and preparation of all required work plans were completed. Fieldwork is completed and preparation of the ecological risk assessment and Pre-Assessment Screen for a cooperative NRDA will be completed in early 2006.
- **Commencement Bay NRDA.** Cardno ENTRIX assessed the natural resource damages associated with long-term industrial contamination in a large aquatic and terrestrial system near Puget Sound Washington. Existing data were used to determine fate and transport of contaminants, identify potential habitat impacts, and estimate impacts to several species assemblages. This effort facilitated the estimation of a blended monetary and restoration-based compensation package. Restoration relied on state-of-the-science techniques to design a 30+-acre wetland in a manner designed to enhance utilization by federally listed salmonid species. Due to the uncertainty associated with both the restoration of the wetland habitat and the threatened and endangered salmon species, an adaptive management plan was developed that allows the Trustees and ATOFINA to modify the project elements over the 5-year monitoring period. The goal is to transfer the project area to a designated conservator with ATOFINA released from future responsibility. Finally, a process was created by which excess credit flowing from the restoration project could be sold to other parties with NRDA liabilities.
- **Former Indian Refinery Superfund Site – Illinois.** Cardno ENTRIX is managing and directing an integrated RI/FS and cooperative NRDA processes for the NPL-listed, former 900-acre Texaco, Inc. refinery under an Illinois Environmental Protection Agency (IEPA) Agreed Order by Consent. Primary responsibilities included facilitating discussions between Illinois EPA, Illinois DNR and US Fish and Wildlife Service through a site management team, integrating the ecological risk assessment and NRDA requirements, developing a site and watershed conceptual model, and preparing/implementing the RI/FS workplan that included integration of the NRDA process. A Cooperative Funding and Participation Agreement with natural resource Trustees was signed in December 2004. Current status includes preparing the RI report and Human Health/Ecological Risk Assessments as well as establishing a NRD settlement framework in 2006.
- **Crab Orchard National Wildlife Refuge Superfund Site – Illinois.** Cardno ENTRIX is participating on the Project Leadership Team responsible for developing and implementing RI-activities for the 33 AUS OUs present at the NPL-listed Crab Orchard National Wildlife Refuge. Primary responsibilities included facilitating discussions between the US Fish and Wildlife Service, USEPA and IEPA through a site management team, participating in technical working groups, integrating the ecological risk assessment and NRDA requirements, developing a individual OU and site-wide conceptual models,

and preparing/implementing the RI/FS workplan that is considerate of the NRDA process. Additional responsibilities include performing sediment/surface water sampling, and managing laboratory analysis, data validation and data interpretation. Sample design, analysis, validation and interpretation is being conducted in manner considerate of potential NRDA liabilities and the desire for comprehensive site closure. Fieldwork is expected to begin in early 2006.

- **The Cleveland-Cliffs Iron Company – Michigan.** The Deer Lake Area of Concern has been investigated for mercury contamination. This lake received mercury from two historic mining operations, as well as discharges of untreated municipal wastewater, and continues to receive mercury from the atmosphere. Based on the client's financial challenges, the comprehensive study was conducted in stages over a period of three years. State of the art "clean-hands, dirty-hands" sampling techniques were developed from USEPA's method 1669 for snowpack, zooplankton, and seston sampling. Ultra-trace analytical techniques for mercury (1630 and 1631) as well as a proprietary mercury fractionation procedure were used to differentiate mercury inputs from all sources and to characterize the dynamics of mercury cycling. Results have revealed that atmospheric deposition is the most significant continuing source of methyl mercury to this system. Although the mercury content of sediments is relatively high, the sediments are not a significant methyl mercury source to the fish. Careful analysis of fish tissue monitoring data from 23 years of regular monitoring has revealed that the natural attenuation remedy that has been employed since 1987 has been effective. Mercury uptake by top predator fish is presently the same in Deer Lake and local reference lakes that have only received mercury from atmospheric deposition. Based on the investigations, the Michigan DEQ has conceded that sediment dredging and capping remedies are not feasible for this lake. The client has successfully commenced a voluntary remedial action plan that is managing the reservoir to minimize methyl mercury concentrations in fish. The recommendations have also been endorsed by the local Public Advisory Council (PAC) for this Area of Concern. Ongoing support is being provided for negotiation of a global settlement for the client's total (including NRDA) liability at this site, including the local PAC through the Area of Concern delisting process.
- **Former Electronics Manufacturing Facility – Maine.** Cardno ENTRIX is providing strategic and technical consulting services for facilitating the closure of a combined RCRA/CERCLA site where integrating a RCRA/CERCLA closure and NRDA based closure strategy was the objective. Alleged injured resources include surface water, sediment, groundwater and wetlands. Ongoing settlement negotiations for the Cooperative NRDA are based on HEA and restoration based compensation. Restoration is expected to be conducted on company owned property following completion of the remedial activities.
- **Gardner, Carton & Douglas – Champaign, Illinois.** Reviewed the extensive amount of information that was collected following an ammonia release into the Saline Branch Ditch and the Salt Fork Vermilion River. The investigation determined that ammonia exposure was the likely cause of the first fish kill that occurred in the Salt Fork Ditch. The ammonia was converted to nitrate, which contributed to an algae bloom many miles downstream in the Salt Fork Vermilion River. The algae bloom likely caused the second fish kill, which likely resulted from a combination of low dissolved oxygen during the night and high pH during the day which would have likely increased the toxicity of residual ammonia. Restoration-based NRD settlement negotiations have commenced that use only existing data. No additional sampling has been needed.
- **Gardner, Carton & Douglas – Wyoming, Illinois.** Currently reviewing information that was collected following an ammonium nitrate-urea fertilizer release into the Spoon River that presumably caused a fish kill. This site might be the first NRDA involving agricultural operations.

- **Hercules, Inc. – Jackson, Arkansas.** Provided strategic consultation and technical negotiation related to a Natural Resource Damage Claim for Bayou Meto, Arkansas, which received releases from a phenolic herbicide production facility (Vertac Superfund Site). Measurable concentrations of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) have been measured in bayou sediments for distances up to 134 miles downstream. The Habitat Equivalency Analysis (HEA) model was used as the means for scaling injury and restoration to achieve settlement, based on data that documented that sources of TCDD had been controlled and the system was undergoing natural recovery. The Bayou Meto system was segregated into three segments based on ecological and physical parameters. Historical site data were cooperatively reviewed by the federal Trustees and the Client's team who used risk assessment techniques to establish lost services and recovery times for each segment. The cooperative team concluded that primary restoration (i.e. remediation) in the bayou was not necessary, and that compensatory restoration could be used to settle the claim. Compensatory restoration options were identified, and the Client and Trustees reached an Agreement in principle for settlement after seven months of cooperative effort. The client's costs were reduced by more than 90% from the Trustees' initial estimates for reaching settlement.
- **Confidential Client CERCLA NRDA Support.** Cardno ENTRIX is conducting a natural resource damage assessment at a Washington chemical manufacturing facility. The facility historically discharged into a multi-party industrial river and harbor system which is about to be designated a Superfund site. Site contaminants include PAHs, metals, PCBs, pesticides, solvents, and specialty chemicals. The project scope includes conducting a preliminary liability assessment, identifying additional studies, and evaluating potential restoration and settlement options. Cardno ENTRIX is conducting a preliminary analysis, based on existing site-specific RI/FS data on source, transport, fate, and fingerprinting analysis focused on facility-specific chemicals in the complex river system. Adding to our challenge is evidence suggesting both upstream and downstream transport of chemicals produced at multiple point sources. Our efforts have focused on a rapid assessment framework, and critical assumptions associated with local and regional injury estimates.
- **Confidential Client CERCLA NRDA Support.** Cardno ENTRIX is conducting a natural resource damage assessment at a Pacific Northwest chemical manufacturing facility. The facility historically discharged into a multi-party industrial river and harbor system, which is now a designated Superfund site. Site contaminants include PAHs, metals, PCBs, pesticides, solvents, and specialty chemicals. The project scope includes conducting a preliminary liability assessment, identifying additional studies, evaluating potential restoration and settlement options, and interacting with Trustee agencies and other potentially responsible parties. To support these tasks, Cardno ENTRIX is conducting a source; transport, fate and fingerprinting analysis focused on facility-specific chemicals in the complex river system. Adding to our challenge is evidence suggesting both upstream and downstream transport of chemicals produced at multiple point sources. Cardno ENTRIX has already integrated a database/GIS/library reference system to maximize the efficiency of technical analyses, data presentation, and information retrieval. These efforts have allowed us to rapidly develop an assessment framework, and identify critical assumptions associated with local and regional injury estimates. We are currently compiling available biological effect guidelines for different trophic levels, assessing the need for site-specific exposure and effect studies, and identifying the duration of injuries associated with chemicals used or created as byproducts during changing historical operations.
- **Former Col-Tex Refinery NRDA and Compensatory Restoration.** When several Texas trustee agencies began to pursue a NRD claim against ATOFINA Petrochemicals, Inc and Chevron Environmental Management Company, Cardno ENTRIX was called on to provide technical

assistance. Cardno ENTRIX provided guidance as the companies and trustee agencies worked to cooperatively define resource injuries associated with the former Col-Tex Refinery. Cardno ENTRIX then managed restoration scaling negotiations and provided the technical expertise required to implement the mutually agreed to Habitat Equivalency Analysis (HEA). When trustee agencies requested that any selected restoration project not only compensate the public for resource injuries but that it also satisfy five additional trustee agency criteria, Cardno ENTRIX responded by developing a series of restoration projects and negotiating an agreement with a local land trust to be the holder of easements. Finally, Cardno ENTRIX prepared and will implement the project monitoring protocols.

- **Central Massachusetts Wetland.** Cardno ENTRIX conducted a baseline assessment of potential risks to ecological receptors in a wetland impacted by historical releases of metals, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs). Sensitive issues at this site included the presence of a National Wildlife Refuge bordering three sides of the site, the presence of stunted vegetation within the site, and the presence of federally listed species. Cardno ENTRIX assisted with planning, sampling, and analysis of surface water, soil, sediment, and biota samples from the freshwater wetland. Cardno ENTRIX also conducted evaluations of background and local conditions, including congener-specific PCB fingerprinting analysis to determine the relative contribution of chemicals to the site from off-site sources. The use of site-specific information to focus the ERA and minimize uncertainty resulted in 2 to 3 orders of magnitude reductions in calculated risks and resulted in a much smaller area targeted for subsequent remedial investigation and feasibility studies (RI/FS). This project was also a pilot application of net environmental benefits analysis (NEBA) for the selection of remedial activities at NPL sites in Massachusetts. The NEBA relied on a Cardno ENTRIX study that estimated the relationship between concentrations of contaminants and ecological service levels. The quantification of this relationship, combined with the NEBA framework allowed Trustee agencies and the client to optimize remedial responses, demonstrate the absence of damage to the National Wildlife Refuge, and is expected to ultimately reduce remediation costs by millions and avoid a NRDA claim.
- **Blackbird Mine, Idaho.** Cardno ENTRIX provided NRDA strategy for a law firm regarding injuries to natural resources caused by the release of hazardous substances from a mine in Idaho. Cardno ENTRIX staff wrote a restoration plan used in settlement negotiations and was an expert witness regarding aquatic impacts. The plan to restore salmon-spawning and rearing habitat in several portions of the watershed has been largely successful and has resulted in the mining company being released from the future restoration requirements.
- **Former Chevron Refinery, Port Arthur, Texas.** Cardno ENTRIX conducted Habitat Equivalency Analyses to address natural resource injuries and restoration requirements at a large, complex contaminated site in Port Arthur, Texas. Based on site characterization and risk assessment information, Cardno ENTRIX specified ecological service losses and recovery profiles for these services. Restoration requirements through creation and/or enhancement of aquatic and estuarine systems at several potential restoration sites were also quantified using this method.
- **Confidential Client- New Jersey.** Cardno ENTRIX provided technical support to an insurance provider on potential NRD liabilities faced by an insured arising from contaminated groundwater at a site in northern New Jersey on a tributary of the Passaic River. Cardno ENTRIX reviewed site-related information and conducted a preliminary estimate of ground water, sediment, and human use damages at the site.

- **Jacks Creek Superfund Site.** Cardno ENTRIX provided NRDA support to a PRP Group following the receipt of a NRDA claim from the State of Pennsylvania for metal contamination in sediments resulting from the operation of a smelting operation on a site in central Pennsylvania. Cardno ENTRIX reviewed the claim, evaluated the technical basis for the claim and helped provide technically based strategic solutions for settlement.
- **Bayou Verdine, Louisiana.** Cardno ENTRIX conducted a NRDA for the loss of ecological services resulting from historical sediment contamination in Bayou Verdine and the upper portions of the Calcasieu Estuary for Conoco Phillips and CONDEA Vista. A baseline ecological risk assessment determined that loss of services was confined to sediment-dwelling fauna and a toxicity identification evaluation found that polycyclic aromatic hydrocarbons (PAH) were the chemical agents primarily responsible for the injuries. In cooperation with state and federal natural resource trustees, Cardno ENTRIX used data on PAH concentrations, naturally occurring physical stresses, and sediment toxicity evaluations to quantify the magnitude of injury and rates of recovery in the system. A unique spatial analysis was also used to determine the size of areas associated with various levels of injury in the upper estuary. Results of the NRDA were then used to scale a portfolio of compensatory restoration projects that satisfied the trustees' desires for in-kind restoration in the watershed. Selection and implementation of a restoration project is awaiting finalization of a Consent Decree by the U.S. Department of Justice.

## Maritime Oil Spills

- **British Petroleum MC-252 Natural Resource Damage Assessment, Gulf of Mexico (TX, LA, MI, AL, and FL)** – Within five days after the initial tragedy aboard the Deepwater Horizon, BP engaged Cardno ENTRIX to be the lead environmental consulting firm in support of all Natural Resource Damage Assessment (NRDA) efforts in the gulf, as well as to assist with response efforts.

Cardno ENTRIX has supplied BP with leaders, coordinators and field teams with relevant technical expertise for each working group in the Gulf. These include senior scientists and field scientists in Technical Working Groups in each of the following areas: birds, water column, fish, marine mammals and sea turtles, submerged aquatic vegetation, shallow and deep corals, shoreline technical, terrestrial and freshwater, chemistry and toxicology, cultural resources, data management, aerial imagery, and human use. The human use teams, under the direction of Natural Resource Economists have been conducting beach and shoreline recreational use counts across the entire length of the Gulf coastline. Results will be used in estimating damages.

Cardno ENTRIX is also engaged in restoration planning on behalf of BP, and to date has been working with BP to determine appropriate restoration measures and projects.

- **Dubai Star Oil Spill, San Francisco Bay, CA.** In November 2009 the Dubai Star released oil into San Francisco Bay near Oakland. Due to recently amended CA state laws, despite the very small volume of oil released, the state was compelled to close large areas of the bay to fishing and recreational boating. ENTRIX represented the responsible P&I Club in the assessment of potential recreational impacts and impacts to other natural resources. ENTRIX performed ephemeral data collection targeting natural resources of ecological and recreational significance. Spill information and sample data were used to estimate restoration requirements and ultimately negotiate settlement in principle with the state and federal trustees in less than one year after the incident.
- **DM-932, New Orleans, LA.** In July of 2008 the Barge DM932 collided with an oncoming vessel resulting in the release of an estimated 6,700 barrels of heavy fuel oil. The spill resulted in the closure of the Mississippi River to commercial and recreational boat traffic and impacts to shorelines

birds, and aquatic resources from New Orleans to the Gulf of Mexico. ENTRIX is currently representing the RP in the assessment of potential recreational impacts and impacts to other natural resources.

- **ConocoPhillips Terminal Riverhead, NY** – In October 2006, Cardno ENTRIX was retained by the vessel owners P&I insurer to evaluate the potential for natural resource injury on a shoreline following a No. 6 fuel oil release into Long Island Sound during a barge/terminal transfer. A two-day documentation effort was undertaken that involved photo-documenting the condition of the affected shoreline, collecting ephemeral data including sediment samples at affected and reference sites, and evaluating the potential for re-oiling of the shoreline. A brief report was prepared documenting the successful clean-up and minimal potential for natural resource injury.
- **Motiva Terminal Fire Providence, RI** – Cardno ENTRIX provided ICS Environmental Unit support for the response to a dock fire resulting in the release of gasoline, diesel, aviation gasoline, and fuel grade ethanol into the Providence River in July 2006. In response to Motiva's request for response support, a Cardno ENTRIX response team arrived within 24 hours of the initial call. The Cardno ENTRIX team coordinated with the responding state agencies to develop and implement a daily ephemeral data collection and sampling program consisting of shoreline assessment, water sample collection, and wildlife injury documentation. The program was implemented over a 3 week period during which time laboratory results were expedited from earlier samples to provide the agencies with information to guide their decision on whether to continue sampling. Timely information resulted in the suspension of sampling after 3 weeks. A brief report was prepared to document response activities and evaluate water column concentrations and shoreline observations with respect for the potential for measurable natural resource injury. Cardno ENTRIX concluded that due to the nature of the products released and the observed water column concentrations collected immediately after the release, that there was limited, if any, potential for measurable natural resource injury as a result of the incident.
- **M/V Bermuda Islander Oil Spill, Delaware Bay** - In April 2006, Cardno ENTRIX served as the Lead NRDA consultant and provided ICS Environmental Unit support in response to a No. 6 fuel oil release into the Delaware Bay that impacted Delaware and New Jersey shorelines. Cardno ENTRIX responded within hours of the initial call with several field teams to conduct shoreline assessment and assist in developing a plan for evaluating the potential impacts to migratory shorebirds, blue crabs, and horseshoe crabs. The Cardno ENTRIX teams coordinated with the state natural resource agency and the U.S. Coast Guard to implement the detailed assessment of shoreline to direct clean-up crews, collect ephemeral data including sediment, tarball, and crab egg samples, and assisted Tri-State Bird Rescue with documenting the potential for impacts to shorebirds. Cardno ENTRIX worked in a cooperative mode with the trustees to identify the most critical resources at risk and collect appropriate data with which to evaluate the potential for injury to those resources. Real-time maps were provided at the end of each day showing the results of shoreline surveys, resources at risk identified, and the survey plan for the following day. Daily updates were provided to the client at the end of each day. NRDA discussions with the trustees are ongoing.
- **Tank Barge MM53 Incident, Louisville, KY.** Following an incident in January 2006 in which the T/B MM53 spilled an undetermined amount of diesel fuel, asphalt, and thermal heating fluid (Thermalane® 600) in the Ohio River, Cardno ENTRIX was retained by the responsible party's insurer to assist with NRDA-related efforts. Cardno ENTRIX staff are involved in assessing the potential for natural resource injury to water column biota and mussels as a result of this incident. Cardno ENTRIX staff helped manage and implement ephemeral data collection, review available

toxicity threshold/screening criteria and analytical results, evaluate seasonal behavior and biology of mussels, and assist in GIS-based mapping.

- **Tank Barge DBL 152 Incident, Gulf of Mexico Offshore Sabine Pass, TX.** In November 2005, the T/B DBL 152 struck the submerged remains of an oil platform that collapsed during Hurricane Rita approximately 35 miles offshore of Sabine Pass, TX. The hull was damaged and four days later the disabled barge capsized releasing significant amounts of heavy “slurry” oil, which sank to the bottom. Cardno ENTRIX was retained by the law firm representing the vessel owner's P&I insurer to provide emergency environmental response and NRDA services. An advance team was immediately mobilized to begin collecting time-sensitive ephemeral data. Shortly thereafter, additional Cardno ENTRIX staff assumed leadership roles in the ICS Environmental Unit, working closely with the U.S. Coast Guard, NOAA and Texas General Land Office. Significant efforts included collecting water column, sediment and benthic samples; locating and tracking the movement of submerged oil using a variety of innovative methods, and providing planning support for submerged oil recovery operations using divers. Cardno ENTRIX also performed long-term monitoring to document the fate and transport of submerged oil for a period of 14 months after the incident. Ongoing efforts to date involve working cooperatively with the federal trustee (NOAA) to development and implement the NRDA injury assessment and restoration frameworks.
- **Tank Vessel Athos I Oil Spill, Delaware River & Bay, PA, DE & NJ.** Following the release of more than 250,000 gallons of crude oil into the Delaware River from the tanker Athos I in November 2004, Cardno ENTRIX was retained by the responsible party's spill management team to assist with environmental response and NRDA-related efforts. Cardno ENTRIX staff held key leadership positions in the ICS Environmental Unit and helped manage and implement response efforts including shoreline assessments (SCAT), GIS mapping and data management, photo-documentation and overflights, cleanup method and endpoint development, submerged oil monitoring, and identification and tracking of resources-at-risk. Cardno ENTRIX scientists also helped establish a dialogue with NRDA trustees early-on and assisted with tasks such as ephemeral data collection, water, sediment and tissue sampling, wildlife field surveys and tracking of wildlife rehabilitation data. Cardno ENTRIX continued working closely with the U.S. Coast Guard after the incident was federalized.
- **Buzzards Bay Oil Spill.** In the spring of 2003, Bouchard Barge 120 released number 6 fuel oil in Buzzards Bay Massachusetts. The law firm representing the insurance company selected Cardno ENTRIX to provide comprehensive NRDA services including emergency response, shoreline assessments, cleanup evaluation, emergency restoration design and implementation, human health risk assessment for contaminated shellfish, injury assessment, and liability quantification. Because potential impacts extend to highly valued coastal real estate, internationally renowned recreational areas, and several threatened and endangered species, these services are being provided intense public and political scrutiny.
- **Dredge M/V Stuyvesant Oil Spill.** In 1999, a dredge working at the mouth of Humboldt Bay in California released 2000 gallons of diesel fuel oil into the Pacific Ocean. During the emergency spill response over 1,200 oiled seabirds were collected including two federally listed endangered species. Using widely accepted modeling techniques; seabird mortality estimates exceeded 6,500 birds. Cardno ENTRIX created and employed a new modeling approach resulting in a total mortality estimate of less than 2,200. This Cardno ENTRIX innovation is likely to save our current client several million dollars and our future clients millions more.
- **Tank Barge Energy 5501 Gasoline Spill, New Haven, CT.** Cardno ENTRIX was retained by the barge company's P&I insurer, The American Club, to provide a rapid assessment of the potential for

environmental impacts and NRD liability following the January 2005 release of gasoline from the T/B Energy 5501 while docked at a terminal in New Haven Harbor, CT. Cardno ENTRIX mobilized a team of professionals to the scene to rapidly assess the potential for NRD liability. The Cardno ENTRIX team conducted shoreline reconnaissance, documented any immediate impacts to natural resources, or lack thereof, and collected time-sensitive environmental samples. A letter report documenting the finding of no significant impact was prepared for submission to the insurance company.

- **Barge Grounding.** Cardno ENTRIX was retained by a marine insurer following the grounding of a fuel/supply barge for a fish processing facility on a nearshore reef in the remote Western Alaska area of Togiak Bay despite the threat for a potential release in excess of 1,000 gallons of diesel fuel, less than 1-gallon was actually released. Cardno ENTRIX was immediately mobilized to the scene to proactively assess baseline conditions and, if necessary, to initiate an ephemeral data sampling program if any additional oil were released. The barge was successfully removed with no further releases.
- **Tug Boat Grounding.** Cardno ENTRIX was retained by a vessel insurer to monitor the distribution and potential impacts of oil released when an ocean-going tug ran aground on a reef offshore Chetumal, Mexico and broke-up during subsequent heavy surf in 1999. More than 2,000 gallons of diesel fuel and lubricants were released. Cardno ENTRIX conducted diving and photographic surveys, which generally documented little observable impact.
- **M/V Cape Mohican Oil Spill.** Cardno ENTRIX was retained by a law firm representing one of two responsible parties following the October 1996 release estimated from 8,000-40,000 gallons of IFO 180 fuel oil from a ship into the San Francisco Bay. On day two following the release, a storm spread the viscous oil throughout the central portion of the bay, out through the Golden Gate, and along approximately 40 miles of beach northward along the coast. In addition to the sensitivity of an oil spill in San Francisco Bay, the client had to contend with impacts to the coastal areas along Angel Island State Park, the federal Golden Gate National Recreation area, and the Gulf of the Farallons National Marine Sanctuary. The trustees made an initial claim for injury to Natural Resources including: birds (e.g., threatened and endangered species such as the Brown Pelican), sandy beach, rocky intertidal, and mudflat habitat, and loss of herring spawn due to oil substrate. Additionally, the trustees claimed lost human use injury due to various beach closures during the spill. Despite not being called in until day 15 following the spill, Cardno ENTRIX was able to obtain and review response data, integrate these data with the knowledge of the ecology of the bay, and develop a NRDA strategy to help the client respond to the trustees' claims. Through cooperative negotiations Cardno ENTRIX helped to decrease the trustees' claim for NRD damages by over 40% and to reduce transaction costs by helping the client reach a settlement on the NRD phase of the case within 12 months of the spill.
- **Port Mobil Incident, Staten Island, NY.** Cardno ENTRIX provided emergency environmental response services following the February 2003 explosion and subsequent fire of unleaded gasoline being offloaded from a barge docked at the Port Mobil Terminal on the Arthur Kill. The law firm representing the insurance company for Bouchard Transportation Company, Inc. selected Cardno ENTRIX to provide NRDA services including emergency response and shoreline assessments. Cardno ENTRIX mobilized a team of emergency response professionals to the scene to evaluate immediate impacts to natural resources and collect time-sensitive environmental samples.
- **M/V Brussel Release, Coney Island, NY.** Cardno ENTRIX was retained by the law firm representing the vessel's insurance company to provide emergency NRDA response services following the release of No. 6 fuel oil during bunkering operations near the entrance to New York Harbor. Cardno ENTRIX mobilized a team of NRDA professionals to determine the potential NRD

liability from the release. The Cardno ENTRIX team conducted shoreline reconnaissance, collected time-sensitive environmental samples, and interacted with federal and state response agencies to address and document any potential impacts to natural resources. A report documenting the lack of natural resource injuries was prepared and submitted to the insurer and responding agencies.

- **Bouchard Barge No. 45 Release, Port Jefferson, NY.** Cardno ENTRIX was retained by the law firm representing Bouchard Transportation Company's insurer to provide emergency environmental response services following the March 2002 release of diesel fuel from Barge No. 45 docked at a terminal facility in Port Jefferson, NY. Cardno ENTRIX mobilized a team of professionals to the scene to rapidly assess the potential for NRD liability and to document any immediate impacts to natural resources, or lack thereof, and to collect time-sensitive environmental samples. A letter report documenting the finding of no significant impact was prepared for submission to the insurance company and responding agencies.
- **Bouchard Barge No. 195 Release, Queens, NY.** Cardno ENTRIX was retained by the law firm representing Bouchard Transportation Company's insurer to provide a rapid assessment of the potential for NRD liability following the March 2002 release of No. 6 fuel oil from Barge No. 195 docked at the Kastle Astoria Terminal in Queens, NY. Cardno ENTRIX mobilized a team of emergency response professionals to the scene to document potential impacts to natural resources, or lack thereof, and to collect time-sensitive environmental samples. A letter report documenting the lack of impacts to natural resources was prepared for submission to the insurance company and responding agencies.
- **M/V Kure Oil Spill.** In 1997 the cargo vessel M/V Kure released 4,500 gallons of fuel off the coast of northern California. The subsequent slick impacted miles of shoreline, important seabird breeding colonies, and the federally endangered Marbled Murrelet. Cardno ENTRIX provided technical support during the emergency spill response and cooperatively quantified the level of injury.

## Facility and Pipeline Oil Spills

- **Enbridge Energy Company, Inc. Oil Spill, Marshall, MI.** On July 26, 2010 an estimated 19,500 bbls of heavy crude oil and diluent were released following the rupture of a 30-inch subsurface pipeline in south-central Michigan. After flowing through wetlands and a small creek, oil eventually reached the Kalamazoo River and travelled downstream for a distance of approximately 40 miles. Flooding at the time of the incident carried oil over the riverbanks and into adjacent floodplains containing forested wetlands and other sensitive habitats. Shoreline impacts included fouling of riverbanks and islands, overhanging vegetation and woody debris, as well as stranding of pooled oil within interior portions of floodplains as water levels receded.

Cardno ENTRIX was retained by Enbridge Energy to provide emergency response services and strategic NRDA support. Cardno ENTRIX evaluated immediate impacts to natural resources, helped direct and coordinate SCAT efforts, and collected time-sensitive environmental samples. Cardno ENTRIX is working in cooperation with state and federal agencies to develop and implement a framework for conducting a cooperative NRDA to assess potential injury to natural resources and recreational services associated with the release. Once injury levels and lost services have been determined, Cardno ENTRIX will assist the client in the process of selecting and scaling appropriate restoration projects.

- **Confidential Client – Romeoville, IL.** Cardno ENTRIX has recently responded to a crude oil pipeline release in northeast Illinois along the Des Plaines River Valley. This area is home to the Federally endangered Hine's emerald dragonfly and leafy prairie clover among others. Cardno

ENTRIX was retained to assist the responsible party with issues related to potential impacts to these sensitive species and other natural resources at risk of being affected by these releases. Critical habitat for the Hine's emerald dragonfly was potentially impacted by the release. Cardno ENTRIX scientists assisted with formulation of EPA-mandated response action plans for impacted wetlands, oversight of wetland clean-up, and development of appropriate cleanup endpoints using ecological risk assessment and net environmental benefits assessment (NEBA). In the future, Cardno ENTRIX will be leading efforts to restore wetlands impacted by oil and response activities and monitoring natural recovery. Cardno ENTRIX worked cooperatively with numerous public and private sector stakeholders, including local, state and federal regulatory and resource agencies, landowners and other members of the responsible party's consulting teams.

- **Confidential Client – Lockport, IL.** Cardno ENTRIX has recently responded to a crude oil pipeline release in northeast Illinois along the Des Plaines River Valley. This area is home to the Federally endangered Hine's emerald dragonfly and leafy prairie clover among others. Cardno ENTRIX was retained to assist the responsible party with issues related to potential impacts to these sensitive species and other natural resources at risk of being affected by these releases. Critical habitat was not directly impacted by this release. Cardno ENTRIX designed and implemented field studies including surface water, groundwater, sediment and invertebrate sampling to evaluate potential impacts within a down-gradient nature preserve. These efforts, combined with fingerprinting analysis performed by Cardno ENTRIX's forensic chemists, were able to demonstrate that natural resources with the nature preserve were not impacted by the release. Cardno ENTRIX worked cooperatively with numerous public and private sector stakeholders, including local, state and federal regulatory and resource agencies, landowners and other members of the responsible party's consulting teams.
- **ConocoPhillips Rahway River Oil Spill, Linden, NJ. In December 2005, approximately 82,000 gallons of No. 2 heating oil discharged into the Rahway River, a tidal tributary to the Arthur Kill, from a leaking valve at a tank farm for ConocoPhillips' Bayway Refinery.** Cardno ENTRIX was retained by ConocoPhillips to provide emergency environmental response and NRDA support services. A 3-person field team was mobilized to collect water and sediment samples, survey oiled shorelines, and interface with NRDA trustees and other agency personnel. Following completion of response activities, Cardno ENTRIX helped ConocoPhillips develop and negotiate a restoration-based settlement using information gathered during the response. The settlement was structured such that the responsible party contributed a proportional share to a government-sponsored habitat restoration project in need of funding. By applying our experience with similar situations on other spills, credibility with the trustees, and familiarity with the NRDA process, Cardno ENTRIX helped ConocoPhillips successfully negotiate a favorable NRDA settlement that avoided additional field studies or monitoring, minimized transaction costs and concluded the NRDA technical discussions within 4-5 months after the incident.
- **Point Wells Oil Spill, Puget Sound, WA.** Cardno ENTRIX provided environmental response and NRDA services associated with the release of approximately 5,600 gallons of No. 6 fuel oil into Puget Sound on December 30, 2003. Initially, Cardno ENTRIX staff led the ICS Environmental Unit and directed emergency cleanup activities including SCAT surveys, environmental monitoring, abiotic and biotic sampling; conducting mass balance analyses, assessing human health risks, obtaining environmental permits, and developing appropriate SEPs (supplemental environmental projects). Cardno ENTRIX also served as the RP's lead on-site representative for assessing natural resource injuries, conducting NRDA modeling, developing NRDA restoration projects, and conducting agency and tribal coordination.

- **Enbridge Pipeline Crude Oil Spill.** Cardno ENTRIX is currently providing technical consulting services to Enbridge (U.S.), a major pipeline operator, for a cooperative natural resource damage assessment in Minnesota. In July 2002, a subsurface pipeline ruptured, releasing 6,000 barrels of crude oil into a peat-forming wetland. The Trustees are pursuing a NRDA for injuries to approximately 10 acres of forested fen, scrub-shrub and herbaceous wetland habitat. Following emergency response, Cardno ENTRIX focused on facilitating coordination between the clean-up, NRDA and state wetland protection processes. A cooperative assessment group was formed to determine injury and plan for restoration using habitat equivalency analysis. A quantitative vegetation study was conducted in September 2002 to define baseline conditions. We have actively engaged the trustees in technical discussions on topics ranging from primary restoration of the affected wetlands and estimating natural resource recovery times to the loss of air services resulting from an *in situ* burn. Once injury levels and lost services have been determined, Cardno ENTRIX will assist the client in the process of selecting and scaling an appropriate habitat-based restoration project.
- **Little Lake Oil Spill.** In the spring of 2002, a Louisiana pipeline ruptured and the ensuing slick began to foul a complex wetland ecosystem. Cardno ENTRIX worked within the NRDA framework to determine the injury to aquatic habitats, marsh habitats, birds, wildlife, and injury to the public as a result of lost recreational opportunities. As a part of these efforts, Cardno ENTRIX created accurate high-resolution maps of the slick progression. These maps have been used to demonstrate an unexpectedly localized impact. In addition, Cardno ENTRIX created an innovative bird injury and recovery model to account for all avian losses. These activities have significantly reduced the scope of the restoration projects currently being considered during the cooperative NRDA.
- **East Timbalier Island Habitat Restoration.** In 2000, Cardno ENTRIX implemented a salt marsh restoration project on a barrier island in Louisiana to satisfy a natural resource damage assessment claim against Chevron Texaco. Cardno ENTRIX, scaled, designed, managed the planting subcontractors and performed yearly monitoring. We used an innovative method of remote sensing to reduce monitoring costs and reduced project risks by adding additional low cost plantings to ensure success. In spite of a serious drought during implementation, an outbreak of brown marsh disease statewide, the landfall of Hurricane Lili, and tropical storm Isidore, the project met final performance criteria and the Trustees will release the client from liability beyond 2003.
- **Well Blowout, Barataria Bay, Louisiana.** Cardno ENTRIX provided consulting services to the insurance company liable for damages to the waters and ecosystems of Barataria Bay, Louisiana. Damages were the result of wellhead blowout that ejected oil, water, and sand 200 to 300 feet into the air for approximately 11 hours. Cardno ENTRIX participated in a cooperative assessment to evaluate and quantify the level of injury to salt marshes, benthic habitat, water column, and birds. Cardno ENTRIX also provided technical expertise during the restoration selection and scaling process. Our professionals used Habitat Equivalency Analysis to scale marsh and benthic injury; and designed expeditious approaches to scale water column and bird injury restoration. Finally, Cardno ENTRIX is designing the marsh restoration project, negotiating performance criteria, and identifying monitoring requirements.
- **Chevron Perth Amboy Refinery - New Jersey.** Cardno ENTRIX was retained by Chevron to provide emergency environmental and NRDA response support following a crude oil spill into the Arthur Kill in February 2006. An advance team was immediately mobilized to begin collecting samples and other ephemeral data, as well as support ICS activities and agency coordination in the command post. Other response actions performed by Cardno ENTRIX included SCAT surveys, overflights, mapping, cleanup planning, and compilation of information useful for NRDA. Following the response, Cardno ENTRIX assisted Chevron develop and negotiate a highly favorable NRDA

settlement with trustees from NOAA, USFWS and the states of New Jersey and New York following an expedited approach. The cash-out settlement strategy allowed Chevron to avoid conducting follow-up studies, or implementing and monitoring one or more restoration projects. The case was settled approximately 8 months after the spill.

- **International Petroleum Corporation – Delaware.** In July 2006, approximately 2,300 gallons of processed waste oil entered the Christina River following an accidental release at an oil recycling facility located in Wilmington, Delaware. Cardno ENTRIX was retained by the responsible party to represent their interests in the Environmental Unit, as well as a cooperative, expedited NRDA. Key functions performed by Cardno ENTRIX during the response included joint SCAT surveys, mapping, sign-off inspections, photo-documentation and agency and trustee interactions. All response activities were performed in a manner that would allow the resulting data to be used for NRDA purposes. Cardno ENTRIX is currently engaged in assisting the client negotiate a damage assessment settlement with the trustees.
- **Gulf of Mexico Release:** As part of a case arbitrated in the United Kingdom, ENTRIX was asked to determine the likely fate and transport of a hypothetical 2 million barrel sub-sea blowout in the offshore waters of the Gulf of Mexico. It was assumed that the release would have continued for 4 weeks during which time impacts to Florida's Gulf Coast beaches, several of the southernmost keys, corrals, and sea turtles were expected. ENTRIX developed a fate and transport model that integrates data from the existing array of Federal and Florida coastal monitoring stations as well as multiple biological and recreational databases.
- **British Petroleum America Production Corporation – Gulf of Mexico.** Cardno ENTRIX was retained by British Petroleum America Production Company (BP) to assess potential injuries to natural resources in the Gulf of Mexico associated with damages to their offshore drilling platforms incurred during Hurricane Katrina in August 2005. Cardno ENTRIX staff coordinated NRDA response efforts including aerial surveys, environmental sampling, and a current study. Field efforts were conducted to determine which facilities, if any, were leaking oil or fuel and to assess the status of aquatic and marsh habitats in the vicinity of the impacted area.
- **ChevronTexaco – Katrina-related incidents.** Following Hurricane Katrina, Cardno ENTRIX was retained by ChevronTexaco to assess damages from three separate releases of crude oil. At Venice Dome a well head blowout resulted in 28.5 acres of oiled marsh. At Port Fourchon a pipeline rupture caused oiling to approximately 16 acres of marsh. At the Empire facility a tank failure released an estimated 24,000 bbls of crude oil into the marshes, oiling vegetation and wildlife. At Empire Cardno ENTRIX worked with the trustees to implement a prescribed burn to remove oil from the marsh. At all three facilities Cardno ENTRIX performed SCAT surveys, mapped the extent of shoreline oiling, documented oiled wildlife and other natural resources, used the Type A model to assess the aquatic injury and provided preliminary NRDA liability estimates. Monitoring of vegetation recovery is ongoing at all three facilities.
- **CITGO - Calcasieu River.** On June 19, 2006 approximately 1 million gallons of slop oil escaped from secondary containment into the Calcasieu estuary, resulting in 150 miles of shoreline oiling. Cardno ENTRIX provided a team of emergency response professionals to work with the USCG and trustees during cleanup operations to document the immediate impacts to Natural Resources, collect time sensitive samples and document the extent of habitat exposure. Following emergency response, Cardno ENTRIX biologists, ecologists, and wetland experts have continued work to design studies and collect the information necessary to complete the Natural Resource Damage Assessment

- **Chalk Point Oil Spill.** Cardno ENTRIX provided comprehensive NRDA and emergency response services in response to the release of approximately 125,000 gallons of fuel oil into a tributary of Chesapeake Bay from a pipeline servicing an electric power generating station in 2000. NRDA services included: site surveys to assess impacts to, and recovery of, aquatic resources; birds; protected species; marsh habitat; and lost human use. These cooperative studies were used to develop restoration projects to restore injured resources and recreational services. Response services included: emergency response oiled shoreline surveys; video surveys; bioremediation monitoring; and long-term monitoring of the persistence of oil along shorelines (beaches and marshes) and surface waters in the spill area.
- **John Heinz National Wildlife Refuge Oil Spill.** Cardno ENTRIX was retained by Sunoco/Sun Pipe Line Company to provide environmental spill response and NRDA-related consulting services following the February 2000 release of 190,000 gallons of crude oil into a National Wildlife Refuge from a subsurface pipeline rupture. Cardno ENTRIX mobilized a team of emergency response professionals to the scene to evaluate immediate impacts to natural resources, help direct and prioritize clean-up and recovery operations, and collect time-sensitive environmental samples. Following the emergency response phase, Cardno ENTRIX has continued working in cooperation with state and federal agencies to develop and implement a framework for conducting a cooperative NRDA. Natural resources and habitats affected by the spill include surface water, sediment, soil, benthic macroinvertebrates, and reptiles and amphibians present in freshwater, non-tidal surface water, emergent, scrub-shrub, and forested wetlands, and upland forest and meadow habitats. Potential recreational impacts were also quantified. On behalf of the client, Cardno ENTRIX has designed and implemented an extensive program of primary restoration and is currently assisting in the negotiation of compensatory restoration for ecological and recreational impacts.
- **Jet Fuel Spill, Vidor, Texas.** Cardno ENTRIX conducted a NRDA associated with the release of approximately 2500 gallons of JP-8 jet fuel from an underground pipeline near Vidor, TX. The released JP-8 fuel flowed through an adjacent bottomland hardwood before being carried into emergent wetlands and Waters of the United States by unusually high rainfalls. Cardno ENTRIX managed the initial spill response activities and coordinated all pre-NRDA and NRDA activities related to the release. Cardno ENTRIX conducted an investigation concerning the spatial extent of contamination and performed human health and ecological risk assessments for the impacted area. In cooperation with state natural resource trustees, Cardno ENTRIX quantified injuries at the site and estimated rates of recovery. Habitat Equivalency Analysis was used to scale compensatory restoration projects within the watershed in which the injuries had occurred. An evaluation of alternative restoration projects was conducted and a restoration plan was prepared for the state trustees.
- **Yaquina River Oil Spill.** A crash of an oil tanker truck resulted in a 10,000-gallon No. 6 fuel oil spill into the Yaquina River and investigations of the river by state, federal, and tribal trustees. Cardno ENTRIX scientists collected sediment and water samples immediately after the spill and additional sediment and invertebrate samples several weeks later to assess the potential for natural resource injuries and human health effects at the spill site, downstream fish beds, and public fishing areas. Cardno ENTRIX prepared an analysis that included fingerprinting studies of sediment and water in contaminated areas subject to multiple sources of oil, a screening human health and ecological risk evaluation, and macroinvertebrate metrics analysis in accordance with Oregon regulations.
- **Texaco Lake Barre Oil Spill.** Cardno ENTRIX evaluated impacts to approximately 4,000 acres of oiled *Spartina* marsh due to an under water pipeline release of some 6,500 barrels of oil in Louisiana in May 1997. Cardno ENTRIX conducted a comprehensive NRDA as part of a cooperative

assessment with multiple state and federal trustees. Injury determination assessments were undertaken for marsh, sediments, and aquatic and avian faunal services. Scaling of compensatory restoration project involving marsh enhancement was undertaken. Cardno ENTRIX managed all aspects of the design, implementation and monitoring of the restoration project.

- **Quinnipiac River Oil Spills.** Cardno ENTRIX responded to petroleum product releases into the Quinnipiac River near New Haven, Connecticut on two separate occasions. Cardno ENTRIX provided initial response efforts and consulted with the client on potential NRDA issues pertinent to each release. In both instances, the area of concern involved oyster seedbeds downstream of the release.
- **Susquehanna River Oil Spills.** Cardno ENTRIX provided NRDA initial response and follow-up services to Sun Pipe Line Company for two separate pipeline release incidents on the Susquehanna River. In May 1996, No. 2 fuel oil was accidentally released from a subsurface pipeline into the West Branch of the Susquehanna River near Williamsport, Pennsylvania. The following December, diesel fuel and unleaded gasoline were released into the North Branch of the Susquehanna River after a pipeline rupture near Vestal, New York. On both occasions, Cardno ENTRIX was retained to perform environmental assessments to evaluate the potential for natural resource injuries due to these releases. Working cooperatively with the natural resource trustees and emergency response personnel, Cardno ENTRIX performed field reconnaissance and sampling to determine the spatial and temporal extent of natural resource exposure to oiling, as well as, to document baseline environmental conditions. Following each of these response efforts, Cardno ENTRIX prepared summary reports for the client which presented field observations, sampling results, and conclusions regarding potential natural resource injuries. Thorough documentation highlighting the lack of significant spill-related natural resource impacts and directly addressing the trustees' concerns was influential in dissuading the trustees from pursuing NRDA actions for both of these incidents.
- **Chevron Pearl Harbor Pipeline Oil Spill.** Jet fuel was released from a Chevron pipeline into a stream that emptied into Pearl Harbor, Hawaii. The fuel impacted an endangered bird nesting refuge at a time when nesting birds were present. It also injured mangroves, shrimp, baitfish, and other invertebrates, and fish in Pearl Harbor. Cardno ENTRIX evaluated the injury to the natural resources and ran the Type A computer model. Subsequent negotiations with the federal trustees resulted in off-site mitigations with a similar value and in a positive settlement for all parties.
- **NRDA Litigation Support.** A confidential client retained Cardno ENTRIX to assist in developing the technical support for the overall legal strategy that might be used if an oil spill NRDA were to proceed to litigation. Cardno ENTRIX provided technical expertise for this project which included the selection of testifying and consulting experts, identification of the major technical strengths and weaknesses of the client's and trustees' studies, and other technical issues. The case was settled without litigation.
- **UNOCAL Pipeline Oil Spill.** Following a pipeline leak, heavy crude oil spilled across a coastal sage scrub community into an intertidal area, and spread onto marine waters near Avila Beach in central California. A popular recreational beach was closed for a period of time following the spill. Cardno ENTRIX was retained by UNOCAL to assist in environmental assessment of shoreline clean-up activities and in a NRDA. Cardno ENTRIX worked with the relevant agencies (NOAA, SSC, and California OSPR) to develop plans that minimized environmental effects of shoreline clean-up operations. Cardno ENTRIX worked cooperatively with the federal and state natural resource trustees to conduct initial injury studies, and proposed a cooperative assessment plan. Resources addressed included terrestrial vegetation, intertidal habitat, fish community, sea otter population, sediments, and recreational use. The assessment plan was adopted by the trustees and it became

the first cooperative NRDA conducted by California's OSPR. Cardno ENTRIX worked cooperatively with the trustees on a number of assessment studies and developed a settlement offer that included a detailed aquatic restoration plan.

- **Platform Irene Point Pedernales Oil Spill.** Following a leak of crude oil from a pipeline connecting Platform Irene with onshore facilities, Cardno ENTRIX was retained by the client to provide environmental consulting services. Cardno ENTRIX provided sampling, geochemical analyses and NRDA services, including strategic planning, assessment of released material and exposure to the water column, ocean water column sampling, recreational use study, lost recreational use injury assessment, and other injury assessment activities.

## Selected Other Past NRDA Projects

Cardno ENTRIX has extensive national experience in NRDA for both contaminated sites and oil spills. Cardno ENTRIX has been providing technical NRDA support to private sector clients for over 15 years. For example, Cardno ENTRIX project experience includes the following projects:

- Reedy River (South Carolina) Oil Spill
- Sugarland Run (Virginia) Oil Spill
- Texas Pipeline Oil Spill
- El Segundo Marine Terminal Oil Spill
- T/V EXXON VALDEZ Oil Spill
- Four Corners Pipeline (California)
- Shell Martinez Oil Spill
- Massena NRDA (St. Lawrence River)
- Confidential Client, Multiple Site Assessment
- San Jacinto River (Texas) Oil Spill
- Tampa Bay Oil Spill
- Texaco Puget Sound Plant Oil Spill
- T/V AMERICAN TRADER Oil Spill
- Shell Belpre (Ohio) Spill
- Locomotive Derailment, Central Oregon
- San Gabriel River Pipeline Oil Spill

## Professional Contributions

- Cardno ENTRIX developed a Natural Resource Database to provide the Delaware River Basin Commission a technical basis for assessing injuries. This baseline data facilitates a more accurate assessment of injury and damages. The database includes information on chemical, biological, and recreational resources in the region.
- Cardno ENTRIX prepared a two-volume guidance manual for the Petroleum Environmental Research Forum that will assist first-response NRDA teams in organizing and implementing the NRDA process. The manual provides checklists, NRDA team organization, job descriptions, forms, and other information required in the first few hours and days of a spill response.
- Cardno ENTRIX has hosted, organized, and conducted five NRDA and Ecological Risk Assessment seminars. Seminars focused on comprehensive management of natural resources and environmental liability. The emphasis was on the status of government regulations and the technical aspects of meeting these regulations. Procedures for assessing injuries, estimating damages, and resource restoration were discussed.
- Cardno ENTRIX personnel served on two expert review panels for the revised Type-A model, one for the marine environment model, and one for the great lakes environment model.
- Cardno ENTRIX convened and participated in an expert panel discussion of state-level NRDA issues. This panel identified potential strategies and approaches for the New Jersey Bar Association's

environmental section. Topics included links between site remediation and NRDA, integration of NRDA and ecological risk assessment, and New Jersey's approach to groundwater injuries. The discussion facilitated interaction between representatives of the NJDEP Office of Natural Resource Damages and legal representatives of the regulated community.

- Cardno ENTRIX personnel aided the Coast Guard and Trustee agencies in the selection of clean-up methodology and criteria that would reduce environmental and human health risks in recreational areas and in habitats actively used by threatened and endangered species. The professionalism and expertise demonstrated during this response earned several Cardno ENTRIX personal U.S. Coast Guard certificates in recognition of notable service.
- Cardno ENTRIX staff has a long history of active involvement in professional societies and major conferences. We have presented numerous papers on NRDA and related topics at meetings of the Society of Environmental Toxicology and Chemistry (SETAC) and at the International Oil Spill Conference.
- Cardno ENTRIX personnel have published several peer-reviewed journal articles on NRDA, including some of the few published papers on use of Habitat Equivalency Analysis.

## Cardno ENTRIX Specialty NRDA Products

Cardno ENTRIX has developed applied unique, specialty products to manage clients' NRDA liability. These innovative tools are not "off the shelf," but are tailored to specific environments and problems. Moreover, many of these approaches offer alternatives to standard Trustee methods, which may not represent the state-of-the-art.

These specialty tools include **Net Environmental Benefit Analysis (NEBA)**. NEBA is a tool used to assess and compare various remedial options and evaluate their direct benefit and/or harm to the environment. It can be used to evaluate remedial actions in terms similar to those used in NRDA and therefore can assess the NRDA liability implications of alternative remedial actions.

**Habitat Equivalency Analysis (HEA)** is increasingly used by Trustees to scale and value restoration in NRDA. Cardno ENTRIX is a leader in the development of innovative applications of HEA. The key to these applications is the use of integrated teams of economists and biologists to provide justification for alternatives to standard HEA applications.

**Resource Equivalency Analysis (REA)** is similar to HEA, but focuses on populations of organisms. Teams of Cardno ENTRIX biologists and economists have developed sophisticated population demographic and other ecological models for use in site-specific REAs. These serve as alternatives to simplified Trustee methods that may underestimate population recovery and hence overestimate liability. Cardno ENTRIX has used Population Viability Analysis methods to address endangered species issues in NRDA settings.

When animals suffer mortality as a result of a release, it sometimes is necessary to estimate total mortality from the number of carcasses found. When estimating mortality levels, Cardno ENTRIX employs a model, called the **Simulated Estimated Mortality Model** that has been accepted by trustee groups as an improvement compared to traditional estimation methods. This innovation has substantially reduced standard "multipliers" for the number of carcasses found, which is extremely valuable to clients.

In many cases, the Trustees quantify injury to aquatic biota using the National Oceanic and Atmospheric Administration's (NOAA) Type A model or their contractor's more detailed proprietary oil spill models. Until recently, there were few, if any, alternatives to these models. Because these models employ many conservative assumptions, which result in unrealistic injury estimates, Cardno ENTRIX and J. E. Edinger

Associates, Inc. jointly developed a fate, transport, and toxicity model called the **Chemical/Oil Spill Impact Module (COSIM)**. Our model incorporates more realistic, technically defensible approaches for several of the inputs for the fate and transport and toxicity components. These innovations have greatly improved the modeling of mortality at substantial benefit to our clients

## Professional Staff

Cardno ENTRIX's strongest quality is the experience and technical qualifications of our staff. Cardno ENTRIX staff members are well known to state and federal regulatory and resource management agencies for their high-quality, innovative work in strategic resource planning, and strong foundation in technical areas essential for the collaborative process.

Cardno ENTRIX's extraordinary mixture of experienced professionals combines attributes from several technical fields generally not found within one consulting firm. This broad range of technical skills and experience enables Cardno ENTRIX to address difficult challenges that normally might require two or more consulting firms that specialize in either engineering or environmental sciences.

A matrix of key Cardno ENTRIX staff and their skill sets relevant to NRDA activities is shown on the following page. However, the entire staff resources of Cardno ENTRIX, over 300 people, are available to each client as the project-specific requirements demand.

This section contains brief summaries, in alphabetical order, of the experience and expertise for key Cardno ENTRIX senior and supporting staff involved in NRDA activities, particularly those on the East Coast. Resumes for key senior staff involved in NRDA activities are provided in the Appendix. The specific organization of a Cardno ENTRIX project team draws upon the talent included in the attached summaries, as well as from other related disciplines. The project manager, size of the project team and other specific assignments will depend upon the specific scope, size, and focus of the project, and our client's needs.

**STEVEN BARTELL, Ph.D.**

*Vice President and Technical Director*

**Years Professional Experience**

33

**Education**

PH.D., Oceanography and Limnology, University of Wisconsin

M.S., Botany (plant ecology), University of Wisconsin

B.A., (Magna cum laude) Biology, Lawrence University

**Expertise and Experience**

*Ecological Risk Analysis*

*Risk Based Decision Analysis*

*Ecological Modeling*

*Numerical Sensitivity and Uncertainty  
Analysis*

*Environmental Chemistry*

*Adaptive Environmental Management*

*Environmental Toxicology*

Dr. Bartell provides extensive technical skills and experience in assessing ecological risks posed by physical, chemical, and biological stressors in aquatic systems. He has demonstrated abilities in the development, application, and analysis of quantitative models used in estimating risks posed by multiple chemical contaminants on aquatic populations, communities, and ecosystems. Bartell has worked with a variety of public and private sector clients in diverse projects in ecological risk assessment. This work has included review and evaluation of the USEPA Framework and Guidelines for ecological risk assessment; development and drafting of the methodology for assessing ecological risks posed by chemical contaminants for the Commonwealth of Kentucky; evaluating the potential for introducing quantitative risk assessment methods in support of environmental legislation for Environment Canada; review and evaluation of proposed ecological risk assessment approaches for the states of California and Florida, as well as for the country of Japan. He has performed ecological risk assessments for a diverse set of environmental stressors for many public and private sector clients, including: ecological disturbances from commercial traffic on the Upper Mississippi River and Illinois Waterway (U.S. Army Corps of Engineers [USACE]); habitat alteration and degradation (USACE); multiple chemical stressors in the Patuxent River watershed and estuary (National Oceanographic and Atmospheric Administration); biological control of gypsy moths (U.S. Department of Agriculture); invasive mussels (USACE); use of herbicides for control of illegal marijuana culture (U.S. Department of Agriculture); habitat degradation (U.S. Department of Energy); radionuclides and toxic metals (several Canadian and British mining companies); herbicides and pesticides (Zeneca Ag Products, Syngenta Crop Protection, BASF Corporation); direct soil injection of pesticides (Toro Equipment Company); toxic metal violations of the Clean Water Act (U.S. Department of Justice); and organic contaminants, metals, herbicides, and habitat degradation (HydroQuébec).

**NEAL S. BRODY**

*Vice President and Technical Director*

**YEARS PROFESSIONAL EXPERIENCE**

25

**EDUCATION**

J.D., Duke University School of Law

B.A., Government, Wesleyan University

**EXPERTISE AND EXPERIENCE**

*Natural Resource Damage Assessment*

*Superfund Assessments*

*Litigation*

*Mergers / Acquisitions*

*Legal Strategy*

Mr. Brody has over 25 years experience with his recent efforts focused on Natural Resource Damage Assessments (NRDA). His focus is on complex environmental matters with particular focus on economic costs and damages, which include the estimation and analysis of potential claims for natural resource damages, strategic counseling of alternative settlement positions in Superfund and natural resource damages cases, allocating response and natural resource damages costs among parties, estimating claims and exposure to claims in bankruptcy proceedings and developing best management practices to optimize environmental performance. Mr. Brody's expertise encompasses a broad spectrum of environmental, health and safety issues, including their application in contracts, mergers and acquisitions, real estate transactions, as well as all forms of litigation and alternative dispute resolution.

**HEATH BYRD**

*Project Scientist*

**Years Professional Experience**

7

**Education**

B.S., Environmental Economics, University of Georgia

**Expertise and Experience**

*Environmental Economics*

*Habitat Equivalency Analysis*

*Net Environmental Benefits Analysis*

*Statistics*

*Modeling*

Mr. Byrd has estimated damages of human uses, wildlife, habitats, and groundwater related to NRDA's for oil spills and CERCLA sites, as well as estimating potential NRDA liability at sites. He has evaluated potential restoration projects for human use damages and has performed restoration-scaling calculations for wildlife, habitat, and groundwater injuries. His technical expertise includes Habitat Equivalency Analysis (HEA), Net Environmental Benefit Analyses (NEBA), and trophic-level scaling models. He has performed statistical analyses of soil, surface and ground water samples, wildlife populations, human recreational behavior, and ecological systems as part of NRDA and other assessments. His modeling experience includes the development of models related to power plant clean water act permits, models to estimate the number of birds killed in a coastal oil spill, wildlife and fisheries population dynamics models, and models of human recreational behavior.

**JOHN DIMITRY**

*Senior Project Scientist*

**Years Professional Experience**

17

**Education**

M.S., Marine Science, University of Delaware

B.A., Biology, Franklin and Marshall College

**Expertise and Experience**

*Natural Resource Damage Assessment*

*Oil Spill Response and Planning*

*Environmental Injury Assessments*

*Habitat Equivalency Analysis*

*NPDES Permitting and 316(a) and (b)  
Studies*

*Estuarine Biology*

*Fisheries and Invertebrate Studies*

Mr. Dimitry is experienced in developing strategic approaches for NRDA's, designing and conducting NRDA studies, and in the application of the restoration-based HEA approach in determining compensation. He has fulfilled duties ranging from initial response coordination and sample collection to managing large NRDA projects, and facilitating negotiations with State and Federal Trustees. Mr. Dimitry is familiar with NRDA regulations under both the Oil Pollution and the Comprehensive Environmental Response, Compensation, and Liability Acts. Mr. Dimitry also has experience in National Pollution Discharge Elimination Systems permitting related to Clean Water Act Sections 316(a) and (b). He has worked extensively on both the Delaware and Chesapeake Bays.

**W. BARRY GILLESPIE, JR., Ph.D.**

*Senior Consultant*

**Years Professional Experience**

13

**Education**

Ph.D., Biological Sciences (Emphasis in Aquatic Ecotoxicology), The University of Mississippi, 1998

M.S., Biological Sciences (Emphasis in Aquatic Ecotoxicology), The University of Mississippi, 1994

B.S., Biology, Millsaps College, 1991

**Expertise and Experience**

*Constructed Wetlands*

*Natural Resource Damage Assessment*

*Wetland Mitigation and Restoration*

*Aqueous and Sediment Toxicology*

*Water Quality Assessments*

*Aquatic Ecotoxicology*

*Risk Assessment*

Dr. Gillespie is a Senior Consultant with over 12 years experience in aquatic and sediment ecotoxicology, wetlands design/construction and restoration, ecological risk assessments, permitting, natural resource damage assessments, and project management. In addition to ecotoxicology based projects, he has worked extensively on LNG related permitting issues, wetland permitting issues (Individual 404 and Nationwide), restoration based natural resource damage assessments and constructing wetlands for treatment of contaminated waste streams. He has worked on risk based studies concentrating on the fate and effects of materials (i.e., surfactants, metals, pesticides, non-metal inorganics, etc.) in aquatic systems. Dr. Gillespie has managed numerous large projects addressing concerns associated with watershed based issues (nutrient and sediment loading), pulp and paper mill effluents, chemical manufacturing and petroleum refinery effluents, and agricultural run-off (insecticides, herbicides and dairy waste). Dr. Gillespie has worked on numerous natural resource damage assessment claims, focusing largely on restoration based compensation.

**GARY HARMON, Ph.D.**

*Project Scientist*

**Years Professional Experience**

16

**Education**

Ph.D., Ecology, 1992, State University of New York

B.A., Environmental Studies, 1980, State University of New York

**Expertise and Experience**

*Habitat Restoration*

*Wetland Ecology and Delineation*

*Habitat Equivalency Analysis*

*Natural Resource Damage Assessment*

Dr. Harmon has over 12 years of experience in ecology and environmental management. He has spent the last 6 years managing NRDA's and habitat restoration projects. In addition, his technical duties have included the preparation of conceptual design plans for wetland and stream restoration projects, the development of monitoring protocols and sampling plans for projects with regulatory oversight, and the design and implementation of wetland-planting plans. Dr. Harmon is well-versed in federal and state wetland regulations and Section 404 permitting. Dr. Harmon is certified as a Professional Wetland Scientist.

**WILLIAM J. WARREN-HICKS, Ph.D.**

*Vice President and Technical Director*

**Years Professional Experience**

34

**Education**

Ph.D., Environmental Statistics, Duke University

M.S., Environmental Toxicology and Statistics, University of Texas School of Public Health

B.S., (Magna cum laude) Biology with Honors, University of Houston

**Expertise and Experience**

*Collision Risk Modeling*

*Analysis of Avian Survey Measurement*

*Statistical Analysis of Air Quality Data*

*Exposure and Effects Data Analysis*

*Risk Assessment Methods*

*Criteria Development*

*Development and Implementation of Regulations*

*Support of Programmatic Goals and Objectives*

Dr. Hicks has over 30 years of experience supporting industry and EPA programs and research initiatives in water, air, and terrestrial environments. He has been a project manager for major research initiatives including: ecological risk assessment methods and software (WERF), assessments of whole effluent toxicity test variability (WERF), site-specific nutrient criteria, development of risk assessment methods for DOE sites (DOE EM-6), state-of-the-science in ecological risk assessment uncertainty methods (American Chemical Society), and case studies in ecological risk assessment (CEFIC Long-term Research Initiatives).

Dr. Hicks integrated Monte Carlo Analysis into the Probabilistic Risk Assessment of Pesticides and instructed EPA's Office of Pesticide Programs (OPP), individual chemical companies, and industry coalitions on the appropriate incorporation of uncertainty into analyses. He created courses in statistics and probability for Environment Canada's Priority Substances Assessment Program. Developed short courses at Duke University and SETAC in decision sciences, statistics, and probabilistic risk assessment. He has participated in over 50 platform and poster presentations at NWCC, SETAC, and SOT annual meetings. Frequent invited session chair and speaker at conferences, symposium, and ASTM meetings.

**WAYNE KICKLIGHTER**

*Technical Director*

**Years Professional Experience**

17

**Education**

M.S., Ecology-Fisheries, San Diego State University

B.S., Biology, Memphis State University

**Expertise and Experience**

*Natural Resource Damage Assessment*

*Fisheries Biology*

*Aquatic Ecology*

*Instream Habitat Evaluation*

*Stock Assessment.*

Mr. Kicklighter has over 13 years of professional experience assessing the effects of human activities on freshwater, estuarine and marine systems. This work has focused on evaluation of baseline conditions, impact assessment, recovery and restoration of aquatic resources, and development of mitigation measures. Mr. Kicklighter has developed and effectively managed multiple natural resource damage assessments (NRDA), biological evaluations, remediation, site characterization and environmental monitoring projects. He has extensive experience conducting field studies, including developing and implementing aquatic biology assessments for general site investigations, oil and chemical releases, remediation, and permitting and mitigation projects. Specific field studies have included electrofishing, seining, trawling, gillnets, longline, hook-and-line, snorkeling, SCUBA, video transects, spawning and carcass surveys, trapping, habitat assessments, IFIM, core sampling, and sediment and water quality methodologies.

**JODY A. KUBITZ**

*Senior Consultant*

**Years Professional Experience**

22

**Education**

Ph.D., Fisheries & Wildlife/Environmental Toxicology, Michigan State University

M.S., Resource Development, Michigan State University

B.S., Zoology, North Dakota State University.

**Expertise and Experience**

*Natural Resource Damage Assessment*

*Ecological Risk Assessment*

*Contaminated Sediment Cleanup*

*Sampling Programs*

Dr. Kubitz is a senior environmental liability manager with extensive experience in assessing and managing the adverse effects of chemical releases to the environment. He has managed sediments and surface waters that are contaminated with metals, petroleum, PCBs and dioxins/furans. Dr. Kubitz has conducted ecological risk assessments (ERAs) and natural resource damage assessments (NRDAs) for several industrial clients. During the last five years, Dr. Kubitz has led Regions V and VII of the U.S. Environmental Protection Agency, Region III of the U.S. Fish and Wildlife Service along with Trustee and Remediation agencies in the States of Illinois and Missouri through the development of work plans that integrate human health risk assessment (HHRA), ERA, and NRDA into the remedial investigation and feasibility study (RI/FS) processes. He also negotiated the statement of work for the investigation of Doe Run Company's slag storage area adjacent to the Mississippi River in Herculaneum, Missouri. These integrated work plans will use a single field sampling program to address all issues, which will provide a significant cost savings to the clients. Dr. Kubitz is experienced in developing sampling programs that isolate and identify contributions from multiple sources of contamination. Multiple sources have been present in many sites he has investigated, including: The San Jacinto River, the Reedy River, the Mississippi River, the lower Fox River and Green Bay, the Des Plaines River, the Detroit River, Deer Lake and the Carp River, and the Embarras River. Dr. Kubitz has developed NRDA settlements base on natural attenuation of petroleum, metals, and persistent organic compounds (PCBs and dioxin). He has published several papers on sediment toxicity assessment, and participated in the U.S. EPA working group that tested and published the first standard methods for sediment bioassays in 1994.

**DOUGLAS J. MACNAIR, Ph.D.**

*Senior Consultant*

**Years Professional Experience**

14

**Education**

Ph.D., Economics, North Carolina State University;

M.A., Applied Economics, State University of New York at Binghamton;

B.A., History, State University of New York at Fredonia.

**Expertise and Experience**

*Natural Resource Damage Assessments*

*Natural Resource Economics*

*Environmental Valuation*

*Sample Survey Methods*

*Litigation Support*

*CERCA/RCRA*

Dr. MacNair is a senior resource economist with extensive experience evaluating Natural Resource Damage liability associated with both one time and ongoing release events. He has managed numerous human-use natural resource damage (NRD) assessments, including the Fox River/Green Bay WI, Lavaca Bay/Point Comfort WA and Lake Hartwell in GA and SC. He has represented responsible parties associated with the Berman oil spill, the *American Trader* oil spill, and the *New Carissa* oil spill.

Dr. MacNair's technical expertise includes the design, implementation, and interpretation of econometric models that evaluate recreational use of the impact of hazardous waste releases on those uses. He has also developed the survey protocols, data management strategies, and quality control process for NRD related recreational surveys included the Michigan Fishing and Outdoor Recreation Survey which collected information from 1,000 Michigan residents and the Wisconsin Fishing and Outdoor Recreation Survey which collected information from 2,000 Wisconsin residents and included 42 stated preference questions that compared alternative fishing and outdoor recreation trips. In addition Dr. MacNair has designed and written database management systems using Dbase for the U.S. Forest Service and the NASDAQ over-the-counter stock market.

Dr. MacNair also develops databases and statistical analyses to support environmental health and safety audit programs and works with utility companies to evaluate environmental health costs associated with energy sector activities. The expertise outlined above is reflected in publications and presentations which can be found in both the economics and NRD literature.

**RALPH K. MARKARIAN, Ph.D.**

*Technical Director*

**Years Professional Experience**

31

**Education**

Ph.D., Aquatic Toxicology, Pennsylvania State University  
M.S., Environmental Science, Washington State

**Expertise and Experience**

*Natural Resource Damage Assessments*

*Net Environmental Benefit Analysis*

*Habitat Equivalency Analysis*

*Spill Response and Restoration Planning*

*Petroleum Toxicology*

*Trustee Negotiation*

Dr. Markarian has experience in US and international environmental assessments. For over 25 years, he has served as both senior technical and lead representative for over 25 damage assessments. His expertise extends to the design and management of major toxicological programs involving groundwater and soil contamination/remediation, effluent toxicity, human health, and ecological risk assessments. His NRDA experience includes rivers, lakes, estuaries, open ocean, shoreline areas and marsh habitats. Assessments covered all aspects of the aquatic ecosystem including toxicity, contaminant bioaccumulation, food chain contamination, fish consumption risks, vegetation impacts, and seabird mortality.

**ROBERT W. NAILON**

*Senior Project Scientist*

**Years Professional Experience**

26

**Education**

M.S., Wildlife and Fisheries Sciences, Texas A&M University, 1983  
B.S., Biology, Southern Methodist University, 1979

**Expertise and Experience**

*Wetland Mitigation and Restoration*

*Habitat Restoration*

*Wetland Determinations*

*Section 404 Permitting Experience*

*Natural Resource Damage Assessments*

*Oil Spill Response and Contingency  
Planning*

*Agency-Client Liaison on Environmental  
Issues*

*Fisheries Management*

*Water Quality Assessments*

*Global Positioning Systems*

Mr. Nailon has over 25 years of experience in the ecological sciences. He routinely conducts wetland determinations and Section 404 permitting assistance to private industry and government clients. He also designs, provides construction oversight, and monitors a variety of wetland habitat restoration and mitigation projects. Mr. Nailon is a primary responder in the Cardno ENTRIX Emergency Gulf of Mexico Region Spill Response Team, providing assistance nationally and internationally to clients in pre-assessment NRDA and NRDA issues. He routinely serves as a field team leader in potential NRDA investigations pertaining to wetland, fisheries, and water quality issues in riverine, estuarine, and marine systems.

**CHRISTOPHER PFEIFER**

*Senior Project Scientist*

**Years Professional Experience**

13

**Education**

M.S., Environmental Science, University of North Carolina

B.A., Physical Geography, University of Delaware

**Expertise and Experience**

*Oil Spill Response & Planning*

*Wetlands Science*

*Restoration Ecology*

*Habitat Equivalency Analysis*

*Geographic Information Systems*

Mr. Pfeifer has participated in numerous inland and coastal oil spills. He has experience in all phases of NRDA, including emergency response, environmental assessment and sampling, field supervision, study design, restoration project scaling, design, and implementation, trustee interaction, and project management. Mr. Pfeifer has experience in the planning and design of terrestrial and aquatic habitat restoration projects for oil spill and development impact mitigation. He has used GIS to perform spatial data analysis for environmental planning and natural resource management. Mr. Pfeifer also has experience in water quality protection and natural resource valuation, including habitat equivalency analysis.

**GORDON ROBILLIARD, Ph.D.**

*Technical Director*

**Years Professional Experience**

36

**Education**

University of Washington, Ph.D. Zoology

University of Washington, M.S. Zoology

University of Victoria, B.Sc. (Honours) Biology

**Expertise and Experience**

*Natural Resource Damage Assessment*

*Risk Assessment*

*Habitat Restoration*

*Trustee Negotiation*

Dr. Robilliard has over 30 years experience as a consulting scientist with an emphasis on marine, estuarine and aquatic ecosystems. He has also designed and directed studies in wetland, riparian and terrestrial environments. He has designed, managed, conducted, participated in and/or directed over 380 environmental projects including: natural resource damage assessments (NRDA), oil spill contingency plans, ecological risk assessments, oil and chemical spill impact assessments, habitat restoration projects, EIS/EIR and related environmental assessment reports, biological inventory and monitoring studies, siting studies, NPDES permit applications and monitoring programs, storm water impact assessments, threatened and endangered species evaluations, and strategic planning programs. Dr. Robilliard has worked in diverse geographic locations including most of the contiguous United States, Alaskan Arctic, Hawaii, Canada, Antarctica, New Zealand, Mexico, Ecuador, Puerto Rico and Colombia.

**DR. JOHN P. SLOCOMB**

*Senior Consultant*

**Years Professional Experience**

26

**Education**

B.S., Zoology, Ohio University, 1969

Ph.D., Biology, Virginia Polytechnic Institute and State University, 1978

Post-Doctoral, Ecological Modeling, Virginia Polytechnic Institute and State University, 1979

Water Quality and Toxic Substances Modeling, Manhattan College Summer Institute, 1981

**Expertise and Experience**

*Risk Analysis & Management*

*Probabilistic Risk Modeling*

*Environmental Impact Analysis*

*Natural Resource Damage Assessment*

*Contaminated Sediment Evaluation*

*Risk-Based Site Closure*

*Due Diligence*

*Environmental Statistics*

*Project Management*

Dr. Slocomb has over 25 years experience in risk assessment, environmental impact analysis, natural resource management and statistics. He has managed comprehensive ecological and human health risk assessments and including design, analysis, and public communication. He has worked closely with natural resource trustees to develop spatial statistical methods for assessing ecological injury in complex settings and has provided statistical support for forensic geochemistry analysis and contaminant source identification. He developed a systematic environmental risk management process that is used for identifying environmental threats, assessing risks, developing cost-efficient response actions, and developing and implementing risk management plans. He is very experienced in applying statistical methods to environmental problems. Dr. Slocomb has used Monte Carlo simulation for probabilistic ecological and human health risk assessments, and in investigations ranging from analysis of fish community structure to industrial process control. He is also proficient in statistical sampling designs for vegetation and wildlife surveys, mark-recapture investigations, estimating statistical parameters from censored data, and sample size estimation. He has provided litigation support in areas of large-lake environmental investigations, oil and chemical spills, and the toxicity of industrial effluents to fish and aquatic invertebrates. He was instrumental in providing technical and litigation support that resolved an interstate NPDES permitting dispute over nutrient and heavy metals loading in a large Northeastern U.S. lake, which included a comprehensive investigation of fish population health. He has also provided technical and litigation support to the petroleum, mining and chemical industry for ecological and human health risks associated with exposure to PAHs, BTEX, DDT, PCBs, MTBE, and heavy metals.

<b>THEODORE TOMASI, Ph.D.</b>	<b>Technical Director</b>
<b>Years Professional Experience</b>	23
<b>Education</b>	Ph.D., Natural Resource Economics, University of Michigan M.A., Economics, University of Colorado
<b>Expertise and Experience</b>	Dr. Tomasi has experience in NRDA from both the trustee and private sector perspectives. He was a trustee expert for the Tampa Bay and Presidente Rivera oil spills and at contaminated sites in Michigan and Idaho. Since coming to Cardno ENTRIX, he has been an industry expert for the Buzzards Bay, Lake Barre, San Jacinto, Dredge Stuyvesant, Chalk Point, and several other oil spills. He is leading the Tittabawassee River NRDA on behalf of Dow Chemical among other significant contaminated sediment and mining sites. Dr. Tomasi provided expert testimony in federal court on damages to groundwater at the South Valley Superfund Site in New Mexico and other contaminated ground water sites nationwide. Prior to his experience with Cardno ENTRIX, Dr. Tomasi spent 15 years in academia developing methods for valuing environmental quality change.
<i>Natural Resource Economics</i>	
<i>Environmental Economics</i>	
<i>Natural Resource Damage Assessments</i>	
<i>Environmental Valuation</i>	
<i>Sample Survey Methods</i>	
<i>Groundwater Valuation</i>	
<i>Litigation Support</i>	
<b>JEFFREY R. WAKEFIELD, Ph.D.</b>	<b>Senior Project Scientist</b>
<b>Years Professional Experience</b>	6
<b>Education</b>	Ph.D., Economics, University of Delaware M.S., Marine Biology and Biochemistry, University of Delaware B.S., Biotechnology, Rochester Institute of Technology
<b>Expertise and Experience</b>	Dr. Wakefield has trained and published as both a biologist and economist. Since joining Cardno ENTRIX, he has designed models to simulate populations and biological processes, created algorithms to estimate oil induced seabird mortality, acted as the lead statistician on a project to investigate the relationship between the concentration of metals and wetland productivity, and participated in net environmental benefits analysis. He has performed statistical analyses of soil, surface and ground water samples, wildlife populations, human recreational behavior, and ecological systems.
<i>Environmental Economics</i>	
<i>Resource Equivalency Analysis</i>	
<i>Marine Biology</i>	
<i>Seabird Modeling</i>	
<i>Population Genetics</i>	
<i>Trophic Scaling</i>	

**JESSICA WEBBER**

*Senior Project Scientist*

**Years Professional Experience**

12

**Education**

M.E.M., Environmental Management, Duke University

B.A., Biology, University of Delaware

**Expertise and Experience**

*Natural Resource Damage Assessment*

*Habitat Assessment*

*Oil Spill Response & Planning*

*Habitat Equivalency Analysis*

*Trophic Scaling*

Ms. Webber has participated in and led multiple NRDA's. She has performed a variety of tasks including oil spill emergency response, project management, sample collection and documentation, data analysis and reporting, wetland and terrestrial habitat assessments, and identifying, evaluating, and selecting restoration options. Ms. Webber is also skilled in scaling restoration projects using Habitat Equivalency Analysis, Resource Equivalency Analysis, and trophic scaling methods and in aerial photograph interpretation. She has written a NRDA guidance manual for initial response and acted as senior editor on several Draft Assessment and Restoration Plans. She also has experience in NPDES permitting related to Clean Water Act Section 316(a) and (b) and risk assessments for thermal and chemical stressors.

