



Shaping the Future

Cardno ENTRIX

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October 17, 2012

Mr. Tim Karsten  
Head Chemicals Branch  
UNEP DTIE  
11-13, chemin des Anémones  
Geneva, Switzerland

**Subject: Accreditation to attend the UNEP Mercury Negotiations**

Dear Mr. Karsten:

This letter is to acknowledge our support and request to join United Nations Environmental Program (UNEP) Global Mercury Partnership in the area of fate and transport of mercury. We are committed to working with UNEP Global Mercury Partnership and participating in the current negotiations and any future activities, as determined by the treaty, to achieve global reductions in anthropogenic mercury emissions.

Cardno ENTRIX is an international environmental and natural resources management consulting firm specializing in water resources management, natural resources management, environmental liability and risk management, and environmental permitting and compliance. Since 1984 Cardno ENTRIX has provided consulting services to public and private clients seeking guidance and solutions for complex environmental challenges. Cardno ENTRIX is highly regarded and respected throughout both the public and private sectors for our technical expertise, our science-based approach to sustainable business solutions, and our reputation for integrity and responsiveness.

We have multiple teams within the company that are actively involved in assessing mercury contamination in natural and built environments. Cardno ENTRIX has extensive expertise in fate and transport of mercury in various media. We have been involved in the development and implementation of remediation measures for the reduction of mercury contamination in lake and river ecosystems, and conducted scientific studies to understand the linkages between mercury in sediment, water, and biota. We have been involved in long-term characterization of the effect of mercury contamination on zooplankton and fish in aquatic ecosystems impacted by mercury. Our team has direct experience in hydrodynamic and water quality modeling for assessment of mercury transport and accumulation, and for development of management strategies.

Cardno ENTRIX has also worked with regulatory agencies and provided guidance for the development and implementation of site-specific mercury total maximum daily loads (TMDL) criteria for aquatic ecosystems. Our team evaluated the risks associated with industry compliance with mercury TMDLs and prepared additional guidance for addressing these new

UNEP DTIE  
October 17, 2012

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regulatory requirements at individual power plants across the United States. We have assessed and modeled depositional patterns in mercury-impacted regions to determine compliance with federal regulations.

We also provide expertise in the design and implementation of abatement and corrective actions for contaminated built environments. We have successfully remediated water supply systems, pipelines, sites, and buildings contaminated with mercury and redeveloped sites for adaptive reuse, while developing and implementing sampling and monitoring programs.

We believe that Cardno ENTRIX's commitment to provide the best scientific approach in mitigating mercury contamination would enhance the ability of the UNEP Global Mercury Partnership to effectively control mercury pollution. We are looking forward to working with the other partners to achieve the goals of the convention.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Jim Eisenhardt', written in a cursive style.

Jim Eisenhardt  
Northeast Business Unit Manager  
for Cardno ENTRIX  
Direct Line (+1) 302-294-8823  
Email: jim.eisenhardt@cardno.com

A handwritten signature in blue ink, appearing to read 'Svetoslava Todorova', written in a cursive style.

Svetoslava Todorova  
Senior Project Scientist  
for Cardno ENTRIX  
Direct Line (+1) 315-427-5985  
Email: svetoslava.todorova@cardno.com

Enc: Cardno ENTRIX About the Firm  
EPRI Mercury Guidance Manual  
Environmental Forensics Brochure  
Green Remediation

cc: Brenda Sanders, Cardno ENTRIX

# UNEP GLOBAL MERCURY PARTNERSHIP REGISTRATION FORM\*

## PARTNERSHIP AREA

Please check partnership areas that your organization intends to contribute to:

- artisanal and small scale gold mining
- mercury cell chlor alkali production
- mercury air transport and fate research
- mercury in products
- mercury releases from coal combustion
- mercury waste management
- mercury supply and storage

Please indicate in your support letter how your organization intends to contribute to each of the indicated partnership areas.

## ORGANIZATION NAME

Cardno ENTRIX

## NAME, FUNCTIONAL TITLE OF REPRESENTATIVE

Svetoslava Todorova, PhD, MPA, Senior Project Scientist

## ADDRESS OF ORGANIZATION

108 West Jefferson Street, Suite 501, Syracuse, NY 13202

## TEL. No.

(+1) 315-214-5439

## EMAIL

svetoslava.todorova@cardno.com

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## TYPE OF ORGANIZATION

- Government
- Regional economic integration organization
- Non-government Organization
- Industry
- Scientific community
- Other, please specify:

Environmental Consulting Company

\*UNEP Global Mercury Partnership Registration Forms are to be accompanied by a letter to UNEP signifying support for the UNEP Global Mercury Partnership and commitment to achieving the partnership goal.

The support letter should specify how the organization intends to contribute to meeting the goal of the UNEP Global Mercury Partnership.

Please submit the support letter and registration form to:

Head, UNEP Chemicals Branch, DTIE  
11-13, chemin des Anémones  
CH-1219 Châtelaine - Geneva, Switzerland  
Fax: (+41 22) 797 3460  
E-mail: mercury@chemicals.unep.ch

Down to Earth.  
Down to Business.



Professional Services

# We make the environment our business.

Cardno ENTRIX is an environmental and natural resource management consulting firm specializing in water resources management, natural resources management, environmental permitting and compliance, and environmental liability management.



**Since 1984**, our clients have benefited from the wealth of knowledge and experience of our professional staff. We take pride in employing a multidisciplinary team of consultants, including experienced and recognized experts. Our technical staff, which includes biologists, cultural resources experts, chemists, geologists, oceanographers, toxicologists, natural resource economists, and environmental, chemical, and civil engineers brings valuable skills to every client assignment.

Our firm has a very unique make-up within the industry. Working side-by-side with our scientists are teams of regulatory and compliance experts, engineers, economists, and litigation support consultants. As a result, we address challenges from multiple angles and identify alternatives that bring real value to multiple parties involved. Cardno ENTRIX understands that clients require experienced problem solvers who can apply expert environmental, regulatory and economically feasible solutions to assist them in managing sustainable operations and growth—both today and for generations to come.

## Services & Capabilities

Cardno ENTRIX offers a full range of professional consulting services for private and public clients, including industry and government agencies, that are faced with challenges that demand environmental experience, strategic planning, and practical sustainable solutions. Our project teams are experienced in delivering high profile infrastructure projects and developing cost-saving solutions for clients across the United States and internationally. For over a quarter century, Cardno ENTRIX has provided consulting services in four critical areas:

- > Water Resources Management
- > Natural Resources Management
- > Permitting & Compliance
- > Environmental and Natural Resource Liability Management



## Water Resources Management

Cardno ENTRIX provides a comprehensive portfolio of environmental planning, permitting, engineering and economic consulting services to public and private entities engaged in the management, protection, development, treatment, delivery, use, and reuse of valuable water resources.

Working as a multidisciplinary team, Cardno ENTRIX professionals apply an integrated approach to every project and situation. We combine water resource science and engineering with a deep understanding of ecological and biological systems and natural systems engineering to develop sustainable and effective approaches to water and watershed management. Clients frequently hire Cardno ENTRIX for our unique combination of strategic insights and depth of technical expertise. And often, Cardno ENTRIX becomes involved in the early planning stages of a project, which helps our clients identify and develop solutions that protect and restore water resources, while reducing water use conflicts.

Our grasp of the science, economics, engineering, and compliance components behind water management solutions is frequently a critical element of our clients' decision making and an important

factor in a project's success. We work collaboratively with clients, resource agencies, regulators and communities to create successful, sustainable solutions that balance the productive use of water with societal needs and environmental protection.

## Natural Resources Management

The conservation and wise management of our limited natural resources drives many of the social, economic, and land use decisions that we face in today's world. Cardno ENTRIX passionately supports solutions to the often competing demands for these resources that are environmentally and economically sustainable. We integrate best available science across multiple disciplines to evaluate the range of effects of each project, and develop cost-effective alternatives to avoid, minimize and mitigate for potential effects in the long term.

At Cardno ENTRIX, natural resource management begins with a clear understanding of the physical, chemical and biological factors that interact and control ecological processes in terrestrial, wetland and aquatic ecosystems—and the species that depend on them. Within this framework, our team of scientists, restoration engineers and resource economists link client goals with

regulatory requirements to manage and conserve our natural resources.

## Permitting & Compliance

Cardno ENTRIX provides regulatory analysis and compliance services for a wide variety of development projects for both private and public sector clients. Our environmental permitting and compliance practice aggressively tackles a vast array of environmental, socio-economic, and regulatory challenges to ensure that regulatory constraints are fully understood and that projects can be completed in a timely manner.

Our regulatory specialists provide support to clients across the United States and internationally, particularly on controversial energy and resource development projects, to address potential impacts to water resources, wetlands, land uses, threatened and endangered species, cultural resources, and indigenous populations. Our experience includes the preparation of appropriate documentation to address the requirements of permits, licenses, and certifications under a variety of federal, state, and international energy, resource management, and funding protocols.

Our regulatory compliance work is conducted with strategic consideration, technical excellence, and senior management review—with a full



understanding of the likelihood that it will be subjected to intense scrutiny by regulatory agencies, non-governmental special interest organizations, other stakeholders, and the public. Our strong commitment to science-based analysis, engineering excellence, and defensible environmental documentation is a hallmark of Cardno ENTRIX.

### **Environmental and Natural Resource Liability Management**

Our Liability Management practice is comprised of scientists, engineers, and economists, along with a highly experienced litigation support team. This multidisciplinary group has deep experience assisting clients address current and emerging liabilities including the regulatory, business and social drivers that can affect corporate environmental governance and financial reporting.

In terms of traditional site-based liability, Cardno ENTRIX employs all the requisite resources necessary for response to CERCLA and NRDA-related initiatives. Regarding emerging issues, our Global Product Stewardship team is assisting companies comply with complex global chemical regulations like REACH, as just one example.

Cardno ENTRIX also has a team of economists in-house. By evaluating liability, uncertainty and assets which often do not have an obvious market price, Cardno ENTRIX enables clients to consider the effects and tradeoffs among different natural resource strategies and environmental regulations. And, should an issue ever be headed toward litigation, we employ a deep bench of talent experienced in civil and administrative litigation matters relating to natural resources and the environment. This holistic approach has helped many clients realize substantial benefits and cost savings—improving balance sheets, stakeholder relations and the sustainability of their businesses.

“Congratulations to all involved - the UTR Middle Reach Project has set the standard for how stream restoration projects in the Tahoe basin can - and should - be implemented.”

**Robert Larsen** California Regional Water Quality Control Board, Lahontan Region

“I am exceptionally pleased with the quality of their work, as well as the talented staff they brought to our task. They were, to a person, willing to take detailed direction and follow through on each aspect of the project...”

**Lewis Queirolo** NOAA

“Cardno ENTRIX involvement in this project provided the close-project support, knowledge and installation experience necessary for the success achieved on budget and on schedule. I would welcome the opportunity to work with Cardno ENTRIX again on future projects.”

**John F. Krishack, PE.** USACE Project Manager



## **Our Philosophy**

Our vision is to be a world leader in the provision of professional services to improve the physical and social environment.

## **We Believe:**

- > The character and integrity of each member of the firm are critical to the conduct of our business.
- > Creativity and technical diversity enhance our assets.
- > Excellence in our professional practice and effective management of client assignments are equally important.
- > Our business must be efficiently managed to achieve long-term value and a stable environment for our people.

## **Our Core Values:**

- > Self Confidence
- > Partnering
- > Great People
- > Passion
- > Innovation
- > Integrity
- > Sustainability



## **About Cardno ENTRIX**

Cardno ENTRIX is an environmental and natural resource management consulting firm specializing in water resources management, natural resources management, environmental permitting & compliance, and environmental liability management. We serve a wide range of private and public clients, including industry and government agencies, who are faced with challenges that demand environmental experience, strategic planning, and practical sustainable solutions.

## **About Cardno**

Cardno is a professional infrastructure and environmental services company, with specialist expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno's team includes leading professionals who plan, design, manage and deliver sustainable projects and community programs. Cardno is an international company listed on the Australian Securities Exchange [ASK:CDD].

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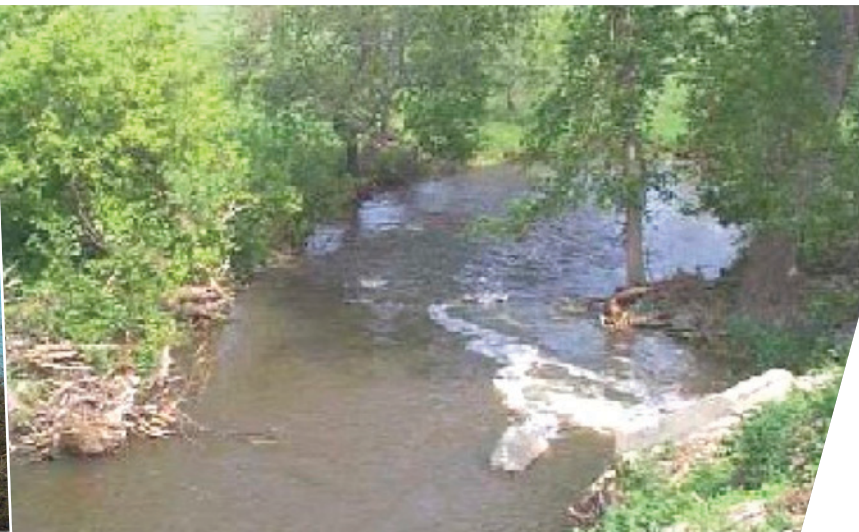
**1 800 368 7511**

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# EPRI Mercury Guidance Manual



**Client:**

Electric Power Research Institute

**Location:**

Nationwide

**Sector:**

Environmental

**Key services:**

- > Mercury total daily maximum load (TMDL) compliance
- > Mercury fate and transport
- > Risk analysis
- > Mercury water quality standards & site specific adjustments
- > Fish tissue analysis and concentrations
- > Waste characterization and toxicity determination
- > NPDES permitting

## Overview

Thousands of waterbodies across the United States are considered impaired due to elevated levels of mercury in fish tissue. In response to this concern, and various court orders under the Clean Water Act (CWA), the United States Environmental Protection Agency (USEPA) and State regulatory agencies are developing Total Maximum Daily Loads (TMDLs), which is the maximum amount of pollutant a waterbody can receive without exceeding applicable water quality standards. Mercury TMDLs are an ongoing concern for the electric power industry. In 2003, ENTRIX, Inc. scientists assisted Electric Power Research Institute (EPRI) in preparing a guidance document for implementation of EPA's new methyl mercury criterion in fish tissue. In addition to a complete review of the status of science on mercury fate and transport in water, this document provided guidance on derivation of site-specific criteria and regulatory compliance.

ENTRIX evaluated the risks associated with industry compliance with mercury TMDLs and prepared additional guidance for addressing these new regulatory requirements at individual power plants across the United States. ENTRIX is tasked with analyzing a large database of mercury concentrations and loads collected from diverse waste streams and discharges from power plants located all across the country. This data was compared against the water quality standards promulgated under mercury TMDLs nationwide.

Risks for compliance with mercury TMDLs are being quantified and would be used to educate, inform, and proactively prepare the industry to comply with these CWA regulations. Detailed technical guidance is being prepared to assist individual power plants.

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We make the  
environment our  
business.



Green Remediation

# Sustainable Environmental Practices for Previously Contaminated Sites



Environmental Practices for Contaminated Sites In April 2008, the USEPA published a green remediation primer with the key message that: “decision makers should consider all environmental effects of clean-up actions and a final solution should incorporate options to maximize net environmental benefits.”

The EPA’s objectives, outlined below, are followed by a short discussion of green remediation opportunities for client projects.

The goal of green remediation is to integrate sustainable practices into decision-making; thereby increasing the environmental, economic and social benefits of cleanup. EPA advocates strategies for green remediation that result in sustainable development, not only ensuring environmental and human health protection but also promoting ecologically viable economic development. The primer stresses that EPA supports remedial strategies that result in beneficial re-use including commercial operations, industrial facilities, housing, green space, and renewable energy development.

Sustainable practices result in clean-ups that minimize the environmental and energy “footprints” of all actions during the life of a project. The Primer outlines a number of best management practices (BMPs) that emphasize a “whole-site” approach.

## **Energy Requirements of the Treatment System**

- > Use of passive energy technologies with little or no demand for external power.
- > Installing renewable energy systems to replace or offset utility electricity requirements.

## **Air Emissions**

- > Minimize use of heavy equipment requiring high volumes of fuel.
- > Reduce atmospheric release of toxic and priority pollutants and greenhouse.

## **Water Requirements and Impacts on Water Resources**

- > Reclaim treatment water for beneficial re-use such as irrigation.
- > Use native vegetation requiring little or no irrigation.

## **Land and Ecosystem Impacts**

- > Use minimally invasive in situ technologies.
- > Use passive energy technologies such as bioremediation and photoremediation.



### **Material Consumption and Waste Generation**

- > Use technologies that minimize waste generation.
- > Re-use materials whenever possible.

### **Long Term Stewardship Actions**

- > Reduce emission of CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>, and other greenhouse gases.
- > Solicit community involvement to increase public acceptance and awareness.

### **The EPA's green remediation objectives include some of the following:**

- > Achieve remedial action goals for protecting human health and the environment
- > Support the use and re-use of remediated parcels, including both commercial and ecosystem redevelopment
- > Increase and maximize operational efficiencies
- > Reduce total pollutant and waste burden on the environment
- > Minimize degradation or capture and enhance ecological value at the site and other affected areas
- > Reduce emissions and greenhouse gas production
- > Minimize impacts to water quality and water cycles

### **Recent Projects**

Cardno ENTRIX recently helped a large mid-west manufacturing company develop a strategic plan for closing an old manufacturing plant. The confidential firm had considered simply closing the plant and performing mandated remediation. Cardno ENTRIX's business solutions framework led to a plan for re-using the property as an intermodal transport facility. Our solution not only reduced remediation costs but returned economic value.

Cardno ENTRIX designed constructed wetland systems for treatment of scrubber wastewater at coal-fired power plants in North Carolina, targeting removal of selenium and mercury for NPDES compliance.

Cardno ENTRIX recently assisted a mining company evaluate alternatives for mine operations and restoration. We developed a quantitative decision model that accounted for environmental, social and economic impacts. This led to a plan that was acceptable to senior management and external stakeholders while providing significant cost savings in the tens of millions of dollars.

Cardno ENTRIX was able to demonstrate that the Monitored Natural Attenuation (MNA) remedy was effectively managing the mercury in the sediments of a large

hydropower reservoir. Settlement was achieved with a net cost savings of approximately \$60 million.

### **Opportunities for Green Remediation**

#### **Transition to Re-Use**

With the growth of Brownfields remediation, the re-development and re-use of previously contaminated sites has now become commonplace throughout the United States. Cardno ENTRIX can assist clients transitioning to new facility uses. Our services include: (1) development of Brownfields remedial strategies; (2) assessment of the adequacy of previous remedial activities and determination and monitoring of residual risk levels; (3) development and implementation of closure plans for industrial facilities; and (4) preparation of sustainable facility development plans, considering residual contamination, planned uses, costs, and other factors.

#### **Remedial Best Management Practices**

The EPA's promotion of green remediation Best Management Practices (BMPs) provides a number of opportunities for reducing the cost and improving the environmental benefits of remediation projects. Incorporating green remediation

methodologies into the remedial planning process can provide support for:

- > Using less invasive, passive remediation approaches such as monitored natural attenuation.
- > Treating contaminated water for discharge or re-use with constructed wetlands.
- > Using low energy in situ soil remediation (i.e., passive soil venting) techniques instead of excavation.
- > Relying upon sediment capping instead of dredging.
- > Using NEBA to evaluate alternative remediation strategies. Net environmental benefits are the gains in environmental services or other ecological properties attained by actions, minus the environmental injuries caused by those actions. This test will provide a more realistic assessment of alternatives than the current practice of qualitatively determining whether the costs of the selected alternative are “grossly disproportionate” to costs.
- > Incorporating remediation planning into redevelopment planning (commercial and ecosystem) may limit remediation activities and enhance net environmental benefits.
- > Catalyze coordination of Natural Resource Damage (NRD) activities with the remediation process and place more emphasis on restoration.
- > Compensating for risk uncertainty by highlighting that the benefits of being “green” far outweigh the “uncertainty” related to environmental risk assessment analysis.

## How Cardno ENTRIX Can Help

Since 1984, Cardno ENTRIX has been a recognized leader in the field of environmental and natural resource liability management. Cardno ENTRIX pioneered the management approach incorporating natural resource liability and asset management into the risk-based (remedial) process and regulatory framework. Our approach is known as Net Environmental Benefit Analysis (NEBA) which regulatory agencies have embraced on a case-by-case basis on many sites that Cardno ENTRIX has managed.

A well-designed strategy for evaluating green remediation opportunities can reduce remediation costs and future liabilities, improve the corporate balance sheet, enhance the company's reputation with key stakeholders, and advance sustainability objectives.

Cardno ENTRIX has a unique combination of scientists, engineers, and economists that specialize in green remediation business solutions and risk management. Our group is highly skilled in applying strategic quantitative decision-making techniques to remedial issues and can help companies realize the potential benefits of green remediation. The approach quantifies the comprehensive value and costs of alternative management plans using a systematic, transparent process that reflects corporate goals and the opportunities provided by green remediation. This framework provides a straightforward approach that helps companies maximize the value of their environmental and capital assets.



## About Cardno ENTRIX

Cardno ENTRIX is an environmental and natural resource management consulting firm specializing in water resources management, natural resources management, environmental permitting & compliance, and environmental liability management. We serve a wide range of private and public clients, including industry and government agencies, who are faced with challenges that demand environmental experience, strategic planning, and practical sustainable solutions.

## Contact

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Manager - Business Solutions and Risk Management/Vice President

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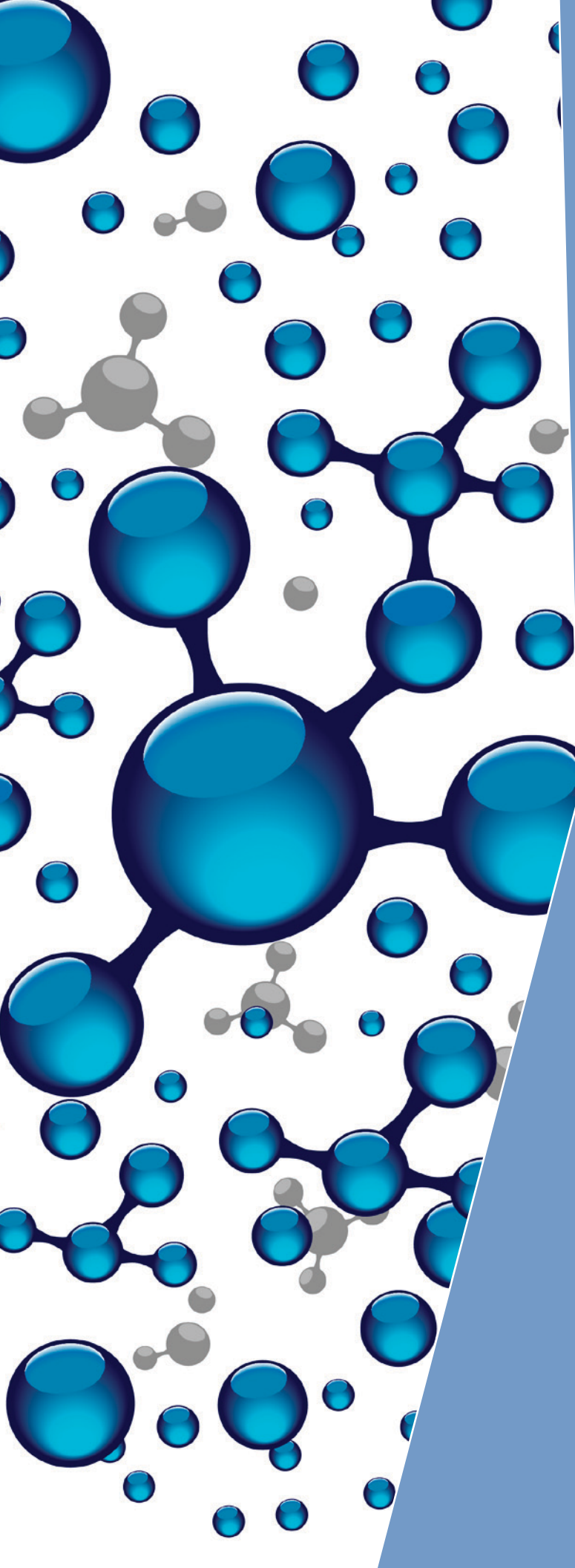
[www.cardno.com](http://www.cardno.com)



Statement of  
Qualifications



Environmental Forensic  
Services



### **Our Vision**

Our vision is to be a world leader in the provision of professional services to improve the physical and social environment.

### **Our Beliefs**

- > The character and integrity of each member of the Firm are critical to the conduct of our business.
- > Creativity and technical diversity enhance our assets
- > Excellence in our professional practice and effective management of client assignments are equally important.
- > Our business must be efficiently managed to achieve long-term value and a stable environment for our people.

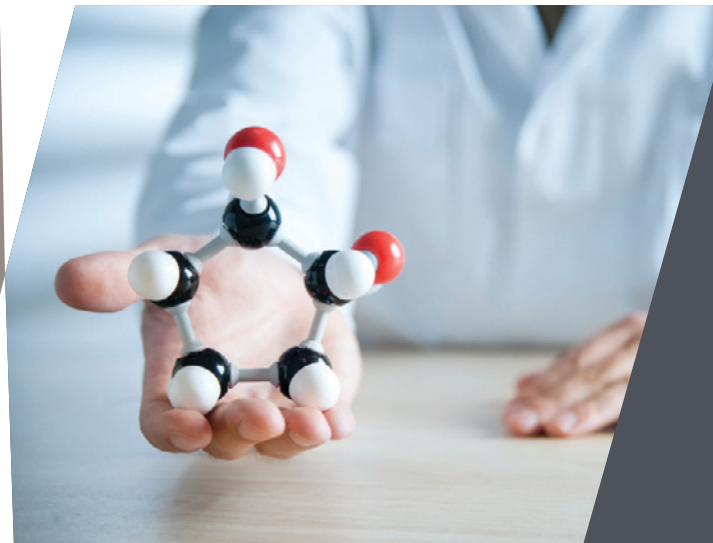
### **Our Core Values**

- > Self Confidence
- > Safety
- > Partnering
- > Great People
- > Passion
- > Innovation
- > Integrity
- > Sustainability



# Environmental Forensics Chemistry Group

Informed planning, data analysis, and services -  
based on expertise, built on experience.



**Cardno ENTRIX** is a highly respected environmental and natural resource management consulting firm. We employ 1,350 employees in 50 offices in the US, Canada, Colombia, Ecuador, Peru and Ireland, specializing in ecological and human-health risk assessment, environmental forensic chemistry, environmental toxicology, natural resource damages, natural resource economics, habitat restoration, and natural resource management services. Our industrial client base includes leading Fortune 500 companies in the petroleum, mining, chemical, power generation, and automotive sectors.

## Overview

Cardno ENTRIX is an environmental and natural resources management consulting firm specializing in water resources management, natural resources management, permitting and compliance, and liability management. Clients turn to Cardno ENTRIX for help navigating complex environmental challenges because of our reputation for integrity, responsiveness, and innovation. Our clients benefit from the wealth of knowledge and experience of our multi-disciplinary team of environmental professionals. Cardno ENTRIX senior staff and management are highly regarded and respected throughout private and public sectors for their technical expertise, science-based approach and ability to provide sustainable business solutions.

Cardno ENTRIX uses an interdisciplinary approach to problem solving for environmental forensics investigations. An essential element of our success is effective and defensible environmental sampling, analysis planning and design for oil spill, NRDA investigations, litigation support and complex environmental cases. The use of environmental forensic tools provides multiple lines of evidence in the allocation of responsible parties at sites that have been contaminated.

Environmental forensics is not simply analysis, it requires understanding of chemistry, fate, and transport as they relate to contaminant alterations.

At Cardno ENTRIX you'll find experts in:

- > Air Quality
- > Asset Valuation
- > Botany
- > Business Solutions
- > Chemistry
- > Cultural Resources
- > Ecology
- > Economics
- > Geographic Information Systems
- > Geology
- > Geomorphology
- > Hydrogeology
- > Oceanography
- > Permitting
- > Planning
- > Remediation
- > Restoration
- > Risk Assessment
- > Sustainability
- > Toxicology
- > Water Quality
- > Wildlife Biology

# Cardno ENTRIX Shaping the Future

Cardno ENTRIX's experts use tools tailored to specific situations and environments that offer effective solutions to environmental forensic challenges.



## Key Environmental Forensic Services

- > Age-dating
- > Air and vapor intrusion investigations
- > Chemical data analysis and visualization
- > Environmental chemistry sampling, analysis planning, and design
- > Forensic "fingerprinting" study design and execution
- > Litigation support and expert witness
- > Oil spill and NRDA investigations
- > Source identification and allocation

## Forensic Tools

- > Chemical fingerprinting (e.g., GC-FID, GC-MS, PIANO, geochemical biomarkers, additives & signature chemicals)
- > DNA fingerprinting
- > Isotopic fingerprinting (bulk and CSIA)
- > Mineralogical fingerprinting (including microscopic and chemical elemental analysis at particle level)
- > Radioisotope dating
- > Tree-ring fingerprinting

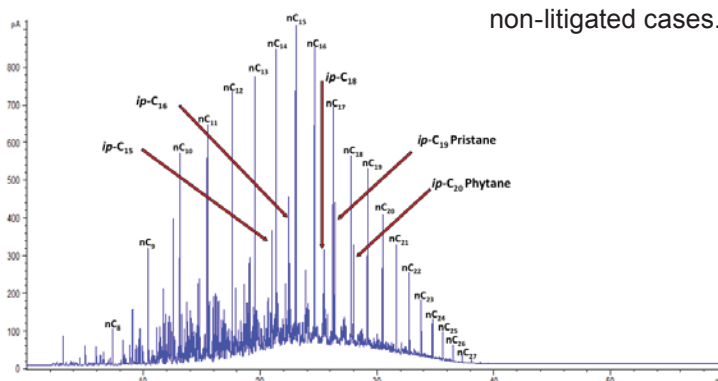
## Data Interpretation and Visualization

- > Chromatogram Interpretation
- > Double Ratio Cross Plots
- > Model-based Cluster Analysis (MBC)
- > PAH Histogram Profiling (Petrogenic/pyrogenic/biogenic)
- > Polytopic Vector Analysis (PVA)
- > Principal Component Analysis (PCA)

At Cardno ENTRIX environmental forensics practice activities can be easily integrated with our other business services, including toxicology and risk assessment, liability management, economics and geospatial services.

## Qualifications

The Cardno ENTRIX Environmental Forensic Group practices "informed planning." What sets us apart is the integration of our environmental chemists and biochemists with our biologists, ecologists, engineers, and toxicologists in multidisciplinary project teams. This integration is a foundation of our effectiveness in tailoring data collection and analysis to support the specific goals of an investigation. Our chemists understand the subtle differences between risk assessment, injury assessment, and remedial investigation. Those differences carry across to sampling and analysis designs that are developed with an understanding of data quality objectives and the different potential uses of the data. Our investigations provide defensible sampling and analysis for challenging litigated and non-litigated cases.





### Multidisciplinary Team –

- > Integrating environmental chemists, biochemists, biologists, microbiologists, ecologists, engineers, and toxicologists

### Effectiveness –

- > Tailoring data collection and analysis to support the specific goals of an investigation

### Extensive Knowledge –

- > Providing hands on data generation experience and understanding the different data needs of risk assessment, injury assessment, and remedial investigation

### Broad Experience –

- > Extensive experience in auxiliary areas including: analytical chemistry, laboratory research, and forensic models

### Global Forensic Expertise

The Cardno ENTRIX Environmental Forensic practitioners have an international reputation for professional excellence and accomplishment. Environmental forensic expertise is only achieved by experience and requires years of dedicated work on challenging projects.

The Cardno ENTRIX team provides a multidisciplinary approach to complex environmental challenges through collaboration and innovative thinking. The Environmental Forensic practice offers a diverse range of services to site owners, attorneys, and potentially responsible parties around the world.

### Forensic Consulting

Cardno ENTRIX uses a multidisciplinary approach to forensic consulting to provide the scientific insight necessary to support potential litigation activities at contaminated sites. At Cardno ENTRIX, we focus on providing complete forensics services through the processes of informed planning, data analysis, and interpretation. Our forensic experience includes crude oil releases, age-dating of petroleum and non-petroleum related projects, sub-soil vapor intrusion, chlorinated solvents, PCBs, dioxins,

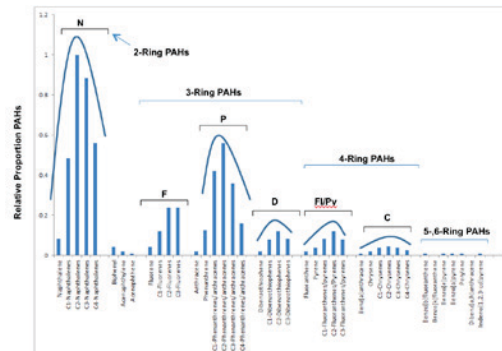
coal tar sites, heavy metals, and waste oils European Union directive investigations.

### Laboratory/Data Quality and Usability

Our environmental forensics team includes trained laboratory chemists and auditors with extensive years of hands on experience. We use this expertise to evaluate the reliability of chemical data and the laboratories that generated them for the usability of chemical data for forensic interpretation and admissibility of those data in litigation.

Through informed planning, we design sampling and analysis programs that “get it right” the first time.

**Ken Scally**  
Senior Consultant - Practice Leader



# Example Projects

Cardno ENTRIX's Environmental Forensic team has successfully performed project assignments for a variety of clients in the petroleum, energy, chemical, and mining sectors. The following are representative of these projects:

## United States Projects

- > Age-dating petroleum releases at a historical gas station, Ithaca, New York
- > Source evaluation and age-dating of petroleum and chlorinated hydrocarbons, Florida Keys
- > PIANO analysis in Petroleum Product Investigation, Stockton, California
- > Investigation of the source of PCBs in soil near a historical power plant at a former U.S. Navy base, Unalaska, Alaska
- > Monitoring of atmospheric deposition of PCBs, Organochlorine Pesticides and PAHs Narragansett Bay, Rhode Island
- > Metal and other contaminant evaluation in sediment, Port of Los Angeles, California
- > PCB investigation at Paoli Rail Yard, Baltimore, Maryland
- > Immunoassay analysis of PCBs at a site adjacent to a former pulp mill, Ketchikan, Alaska
- > Dioxin source evaluation, Midwestern United States
- > Determination of Dioxin background in soil and sediment, Fort Bragg, California
- > Evaluation of Dioxin Source and Dioxin background in soils, Antioch, California
- > Evaluation of potential Dioxin formation during manufactured gas production, Northeastern United States
- > Pesticide air sampling protocol for sampling in a small community, Puerto Rico
- > Assessment of wastewater intrusions in marine coastal ecosystems, Florida Keys
- > Radioisotope dating of sediments evaluating, PCB, PAH, petroleum hydrocarbon, heavy metal, 137Cs and 210Pb, Northeastern United States
- > Characterization of mercury sources to Deer Lake ecosystem using mercury fractionation techniques, Ishpeming, Michigan



## International Projects

- > PCB source evaluation at a former caulking manufacturing facility, Quebec, Canada
- > Source identification of petroleum hydrocarbons in soils at a former industrial site, Lyon, France
- > Forensic investigation of metal contamination at and around a historical foundry, Lyon, France
- > PIANO analysis of a gasoline plume release, France
- > Forensic investigation and age-dating of a diesel release into a major drinking water supply, Ireland
- > Source evaluation and allocation of responsibility for a release of crude oil to a marine environment, Italy
- > Source evaluation and age-dating of a release of diesel and kerosene at a quarry, Ireland
- > Waste oil sampling design, analysis, and expert witness evaluation of laboratory data, Ireland
- > Chlorinated solvents TCE and PCE in sub-soil and indoor air vapor intrusion sampling and analysis, United Kingdom
- > Evaluation of remedial options for a TCE release to groundwater, Ireland

## **Ken Scally, MSc**

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Ken Scally is an International Environmental Forensic Chemist with more than 17 years of experience in petroleum hydrocarbon analysis and forensic data interpretation. He specializes in the chemical composition and interpretation of petroleum hydrocarbons – crude oil, refined fuels, polycyclic aromatic hydrocarbons (PAHs) and other substance sources of contamination in terrestrial and marine environment. Mr. Scally has a detailed understanding of oil chemistry, its formation and breakdown products, along with extensive knowledge of degradation pathways, ageing, and source correlation indicators. As an environmental forensic chemist, Mr. Scally has participated in environmental forensic conferences worldwide and has lectured graduate and undergraduate courses in Environmental Forensics at academic institutes in Ireland and the United Kingdom. Mr. Scally has extensive experience in laboratory Quality Assurance / Quality Control Management with his involvement as a technical laboratory assessor for commercial laboratories and regulatory bodies within Europe. Mr. Scally's strengths include project management and a technical / hands on understanding of environmental forensic investigations. Mr. Scally has a MSc. in Environmental Forensics and a BSc. in Chemistry

## **Ioana G. Petrisor, PhD**

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Dr. Ioana G. Petrisor is a biochemist with 20 years of experience specializing in environmental forensics. She has applied a variety of forensics fingerprinting methods to track sources and age-date contaminants in soil, sediments and water. Dr. Petrisor has helped national and international clients to track crude oil & petroleum products, chlorinated solvents, metals, perchlorate and PCBs using chemical, isotopic, mineralogical and tree-ring fingerprinting, atmospheric tracers, as well as signature chemicals. Dr. Petrisor has been accepted as Expert Witness and testified in several major cases. Dr. Petrisor is the Editor-in-Chief of Environmental Forensics Journal and is teaching professional Environmental Forensics classes as Instructor with EOS Alliance and AEHS Foundation. She is developing a pioneering Environmental Forensics certification program and is involved in professional societies, including: ISEF; AEHS Foundation; ASTM; ITRC; ACS; and the Los Angeles Bar Association. She has managed and conducted innovative research for the U.S. DOE, U.S. DOD, and European Community. Dr. Petrisor has a Ph.D. in Biochemistry and a B.S. degree in Biochemistry.

## **Steve Huntley**

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Steve Huntley has more than 30 years of experience in industry and environmental consulting. Mr. Huntley brings a unique set of skills to the field of environmental chemistry and forensics. A major focus of his forensics work has been related to evaluating potential sources of dioxins and PCBs, though he has also conducted forensics evaluations on metals, PAHs, and VOCs. He was first introduced to environmental forensics in 1989 when he began an eight-year effort to identify sources of dioxins, PCBs, and other contaminants in Passaic River and Newark Bay sediments. That effort involved detailed on-the-ground reconnaissance of operating facilities along the shorelines, historical document reviews, process chemistry evaluations, sediment core sample collection and chemical analysis, sediment radioisotope dating, and dioxin and PCB fingerprinting. Since then, Mr. Huntley has conducted forensic evaluations at sites throughout the U.S. including Berry's Creek (NJ), Flushing River (NY), Kalamazoo River (MI), Saginaw River (MI), River Raisin (MI), Port Angeles Harbor (WA), Westport Slough (OR), Paoli Rail Yard (PA), and numerous industrial sites throughout California. He has specific expertise in the application of statistical fingerprinting techniques for resolving source fingerprint patterns.

## **About Cardno ENTRIX**

Cardno ENTRIX is an environmental and natural resource management consulting firm specializing in water resources management, natural resources management, environmental permitting & compliance, and environmental liability management. We serve a wide range of private and public clients, including industry and government agencies, who are faced with challenges that demand environmental experience, strategic planning, and practical sustainable solutions.

## **About Cardno**

Cardno is a professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno's team includes leading professionals who plan, design, manage and deliver sustainable projects and community programs. Cardno is an international company listed on the Australian Securities Exchange [ASX:CDD].