Environmental Science and Damage Assessment

Abt ASSOCIATES

Abt Associates (Abt) is a mission-driven, global leader in research and program implementation in the fields of health, social and environmental policy, environmental science, and international development. The company has multiple offices in the United States and program offices in more than 60 countries. A major component of Abt's environmental work is focused on assessing the impacts of contamination on natural resources, evaluating how those impacts affect human use and cultural values, and determining the monetary damages that responsible parties must pay to offset these impacts and implement appropriate restoration actions. In the United States, this "polluter-pays" regulatory framework is known as Natural Resource Damage Assessment (NRDA). Abt (and predecessor companies, including Stratus Consulting) has been a leader and innovator in the NRDA field for over 30 years. Abt has supported federal, state, and tribal trustees on over 100 NRDA cases across the United States (Figure 1). Additionally, Abt has supported over 40 different Native American and First Nations governments on NRDA and other environmental cases/services. Finally, Abt has provided key support in the development of the Environmental Liability Directive (ELD) framework for the European Union (EU), which is an analogous system to NRDA in the United States.

Quantifying Impacts and Monetary Damages

Both the United States and the EU have provided authority for government officials, including tribal governments (e.g., First Nations), to seek compensation on behalf of the public when an oil spill or other environmental contamination occurs. The EU's ELD approach is based on the NRDA framework utilized in the United States.

UNITED STATES

Natural Resource Damage Assessment (NRDA)

In the United States, an oil spill requires the responsible party to not only respond to the spill and pay for the cleanup, but also to compensate the public and tribes for impacts to natural resources such as surface water, aquatic biota, and waterfowl, including for lost ecological, tribal, and human use services that those natural resources provide. Federal, state, and tribal agencies hold natural resources in trust for the public. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund) of 1980 and the Oil Pollution Act of 1990 (OPA) provided these trustees with the statutory authority to collect compensation for the public when hazardous substance releases and oil spills, respectively, diminish the value of natural resources. The compensation, or damages, must be used to restore natural resources and natural resource services that were harmed as a result of the spill. NRDA is the process of evaluating the harm that an oil spill causes and calculating the damages required to compensate the public.

Several common methods are used to calculate the amount of restoration/compensation required to offset the harm (or "injury") to natural resources. OPA specifies that trustees must use resource-to-resource or service-to-service scaling, if the natural resources restored are of the same type and quality as those that were injured. This scaling method is also called equivalency analysis. Two of the most common equivalency analysis methods are ***Resource equivalency analysis (REA)*** and ***Habitat equivalency analysis (HEA)***.

If trustees believe that the restoration scaling using equivalency models does not capture the type or extent of the injuries and associated service losses, they can use other methods of estimating the value of injured resources. Two of the most common economic methods for estimating damages are ***Revealed preference*** and ***Stated preference***.

In addition to these common damage or compensation estimation methods, some trustees have developed more formulaic approaches to quantifying damages within the NRDA context. For example, Washington State's Oil Spill Natural Resource Damage Assessment Rule (WAC 173-183) indicates that monetary damages for oil spills should be $1–$100 per gallon for spills smaller than 1,000 gallons and $3–$300 per gallon for spills of 1,000 gallons or more. The state has utilized this rule to collect payments following hundreds of oil spills. These funds are used by the state for restoration and enhancement activities.

Regardless of the method that trustees choose, they ultimately determine either the amount of restoration required to offset the injuries or the amount of compensation that the responsible parties should pay the public for the injuries. Any compensation received must be used to restore, rehabilitate, replace, and/or acquire the equivalent of the injured natural resources.

Resource equivalency analysis (REA)

An REA is a resource-to-resource equivalency model, where one quantifies the injured resource (such as the number of lost birds from failed reproduction), and damages are based on the cost of implementing restoration required to restore an equivalent amount of that resource.

Habitat equivalency analysis (HEA)

An HEA is similar to an REA, but the model calculates the quantity of habitat restoration that is equivalent (over time and space) to the quantity of the injured habitat. Damages are based on the cost of implementing the restoration. Because restored habitat is rarely identical to injured habitat, the HEA incorporates a "services" scaling term that can account for differences in the quality of injured and restored habitats. As a result, the HEA model is a service-to-service model.

Revealed preference

Revealed preference methods quantify damages by observing changes in human behavior as a result of a discharge. Common revealed preference studies include quantifying losses in recreational use (e.g., fishing, hunting, beach-going). These studies may require onsite observation such as on-the-ground observations or aerial imagery to count recreators. They may also involve surveys, where members of the public are asked to answer questions that reveal changes in their behaviors and use of natural resources as a result of the discharge. Damages are based on the value of the trips foregone or the reduction in the value of the experience to the recreator. Common valuation methods include the travel cost model, where damages are inferred based on observations of sites chosen and costs incurred to visit those sites. If site-specific data are not available, trustees can use a benefits transfer, estimating losses based on data from other studies.

Stated preference

Stated preference methods require the design and implementation of a survey instrument to ascertain how the public values natural resources, which can include mail, phone, or in-person surveys. These surveys can have multiple designs and goals. Contingent valuation models typically aim to determine how much money the public is willing to pay for nonmarket goods and services, such as avoiding contamination of natural resources. Conjoint analyses employ a survey instrument that asks the public to rank restoration projects or state how much restoration they think is required to offset a specific injury. Damages are based on the value that the public places on the injured natural resources. Conjoint analyses in NRDA are sometimes called total value equivalency, value-to-value equivalency, or value equivalency analysis.

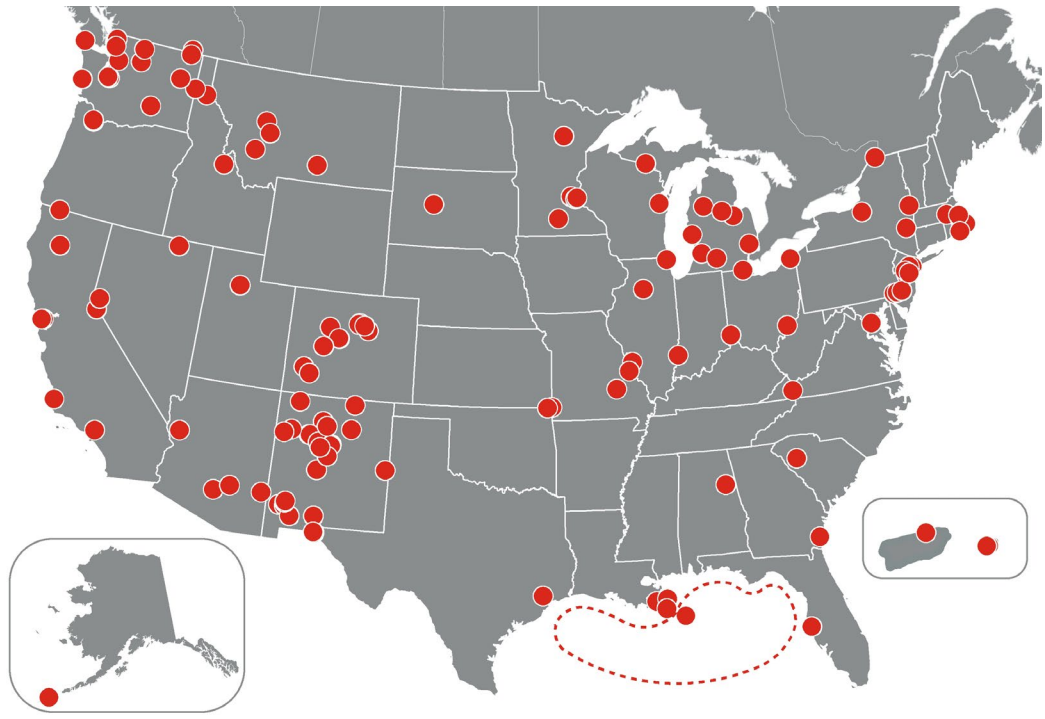

Figure 1

Abt staff have worked on over 100 NRDA cases in the United States, Puerto Rico, and the U.S. Virgin Islands.

EUROPEAN UNION

Environmental Liability Directive

Abt helped write the EU's ELD, which aims to ensure that the financial consequences of environmental harm will be borne by the responsible party ("economic operator") who caused the harm. The ELD is similar to NRDA in the United States but with different terminology. For example, rather than natural resource injuries, the ELD refers to "environmental damage," which is defined as damage to protected species and natural habitats, damage to water, and damage to soil. Operators carrying out listed dangerous activities such as oil transport are strictly liable (i.e., no need to prove fault) for environmental harm from these activities. Affected persons and environmental nongovernmental organizations have the right to request the competent authority to take remedial action if they deem it necessary.[1]

Abt has worked for more than 12 years to produce research and training materials to increase the awareness of and facilitate the implementation of the ELD across the EU. This collaboration included a major European Commission research project (Resource Equivalency Methods for Assessing Environmental Damage in the EU – REMEDE) between 2006 and 2008, which produced a toolkit for undertaking equivalency analysis to determine monetary damages, as well as more recent training materials. Abt led the writing and editing of a recently published book based on this toolkit entitled, "Equivalency Methods for Environmental Liability: Assessing Damage and Compensation under the European Environmental Liability Directive."

[1]See http://ec.europa.eu/environment/legal/liability/index.htm for more information about the ELD.

U.S. AND CANADIAN INDIGENOUS GROUPS

Environmental Support

Native American communities and Canadian First Nations for whom Abt has provided environmental services include:

U.S. Native American Groups

Bad River Band of the Lake Superior Tribe of Chippewa Indians of the Bad River Reservation, WI

Bay Mills Indian Community, MI

Bristol Bay Native Corporation, AK

Cherokee Nation

Cheyenne River Sioux Tribe of the Cheyenne River Reservation, SD

Coeur d'Alene Tribe

Confederated Tribes and Bands of the Yakama Nation

Confederated Tribes of Siletz Indians of Oregon

Confederated Tribes of the Grand Ronde Community of Oregon

Confederated Tribes of the Umatilla Indian Reservation

Confederated Tribes of the Warm Springs Reservation of Oregon

Eastern Shawnee Tribe of Oklahoma

Fond du Lac Band of Lake Superior Chippewa

Grand Portage Band of Lake Superior Chippewa

Hopi Tribe of Arizona

Keweenaw Bay Indian Community

Lac du Flambeau Band of Lake Superior Chippewa

Little River Band of Ottawa Indians, MI

Little Traverse Bay Bands of Odawa Indians, MI

Lower Elwha Klallam Tribe

Makah Indian Tribe of the Makah Indian Reservation

Menominee Indian Tribe of Wisconsin

Miami Tribe of Oklahoma

Navaho Nation, AZ, NM, and UT

Nez Perce Tribe

Nottawaseppi Huron Band of the Potawatomi, MI

Oneida Tribe of Indians of Wisconsin

Onondaga Nation

Ottawa Tribe of Oklahoma

Peoria Tribe of Indians of Oklahoma

Pueblo of San Ildefonso, NM

Pueblo of Santa Clara, NM

Saginaw Chippewa Indian Tribe of Michigan

Saint Regis Mohawk Tribe

Sault Ste. Marie Tribe of Chippewa Indians, MI

Seneca-Cayuga Tribe of Oklahoma

Shoshone-Paiute Tribes of the Duck Valley Reservation, NV

Spokane Tribe of the Spokane Reservation

Tohono O'odham Nation of Arizona

Washoe Tribe of Nevada & California

Wyandotte Nation

Yerington Paiute Tribe of the Yerington Colony & Campbell Ranch, NV

Zuni Tribe of the Zuni Reservation, NM

First Nations of Canada

Saskatchewan First Nations Natural Resource Centre of Excellence, SK

Soda Creek Indian Band of the Xat'sull First Nation, BC

Tŝilhqot'in National Government, BC

Williams Lake Indian Band, BC

With an established history of working closely with tribal leaders and members, Abt understands the unique environmental issues faced by Native Americans. Abt has supported over 40 different tribes, nations, Native American communities, and First Nations on NRDA and other environmental cases and services. We understand that each indigenous population has distinct values and uses of natural resources, and we always handle such information in a sensitive and respectful manner. Some examples of recent environmental assessment projects on which Abt has collaborated with Native American groups follow.

San Ildefonso Pueblo, New Mexico

Abt is providing support to the Pueblo de San Ildefonso on a number of environmental issues, including evaluating the fate, transport, and effects of contaminants on the Pueblo; and on climate change adaptation planning. The Pueblo is located immediately downstream of the Los Alamos National Laboratory (LANL), a federal nuclear facility in operation for more than 50 years. Examples of how Abt is supporting the Pueblo include:

- Analyzing and interpreting environmental site data and models to evaluate present and future contaminant pathways from the LANL facility
- Implementing a cultural survey to better understand the impacts of contamination on the Pueblo's cultural uses of natural resources
- Examining the potential impacts of climate change on contaminant transport
- Assisting the Pueblo with climate change adaptation and resiliency planning, including conducting planning workshops with community groups – elders, youth, resource managers, and the tribal council
- Assisting the Pueblo with various aspects of the ongoing LANL NRDA.

Tar Creek Tribes, Oklahoma

Abt is supporting the Tar Creek Tribes with an assessment of human health, ecological, and cultural impacts of lead and other metals contamination due to historical mining activities in the Tri-State Mining District. The Tar Creek Tribes for this case include seven northeast Oklahoma Tribes: the Cherokee Nation, the Eastern Shawnee Tribe of Oklahoma, the Miami Tribe of Oklahoma, the Ottawa Tribe of Oklahoma, the Peoria Tribe of Indians of Oklahoma, the Seneca-Cayuga Tribe of Oklahoma, and the Wyandotte Nation. Because of their unique uses of natural resources, Native Americans are often exposed to metals and other contaminants at higher levels than the general public, and Abt is assisting the tribes with holistically assessing the impacts of contamination on their traditional tribal lifeways in a Tribal Human Health Risk Assessment. We are also supporting the tribes in assessing impacts to natural resources and cultural service losses as a part of NRDA activities at the site. In addition, we are supporting restoration planning efforts to compensate for the affected resources and cultural losses.

Husky Oil Spill, North Saskatchewan River, 2016

Abt is currently partnered with RESPEC to support the Saskatchewan First Nations Natural Resource Centre of Excellence's (SFNNRCE) independent assessment of the 2016 Husky Oil Operations 16TAN pipeline oil spill into the North Saskatchewan River. Abt's support is framed in the context of many NRDA and ELD methods, including assessing the impacts of the spill on cultural and natural resources and quantifying the monetary damages associated with these impacts. In close collaboration with RESPEC and SFNNRCE, Abt has analyzed chemical data collected during and after the spill to assess the potential toxicity of the oil to cultural and natural resources, and evaluated these data in the context of existing environmental laws and guidelines in Canada. Abt has also reviewed and evaluated technical reports produced by Husky and their contractors, and is in the process of quantifying impacts and estimating monetary damages associated with these impacts.

ABT ASSOCIATES

KEY STAFF

Jamie Holmes

is an environmental scientist who has worked on NRDAs, contaminant fate and transport analyses, surface and groundwater assessments, ecological effects assessments, and natural resource restoration planning since 1991. He has worked at mine sites, nuclear sites, organochlorine and pesticide manufacturing sites, and refinery sites, as an employee of Abt and its predecessor companies (Stratus Consulting, Hagler Bailly), as well as the U.S. Army Corps of Engineers. His recent research has been focused oil slick characterization by combining multiple remote sensing methods and synoptic field data. His graduate research focused on hydrograph separation in stormflow, geochemical mixing models, and sources of acid mine drainage at the Ely and Elizabeth copper mines in Vermont. Mr. Holmes has extensive field experience in flow measurement and water quality sampling. In addition, he also has extensive experience in data analysis, geographic information systems (GIS) spatial analysis, assessing the effects of contaminants on aquatic and terrestrial biota, and developing and evaluating resource restoration projects. Mr. Holmes is currently managing NRDA work on behalf of the Suquamish Tribe in Washington. He is also managing NRDA work at a site in Montana where the co-trustees include the Confederated Salish and Kootenai Tribes and the Kalispel Tribe.

***Diana Lan*e**

is a biologist with 20 years of experience in restoration ecology, environmental program evaluation, NRDA, and climate change analysis. For the past seven years, Dr. Lane has been deeply engaged with restoration planning for the Deepwater Horizon (DWH) oil spill case and is currently providing the State of Louisiana with high-level technical and strategic restoration planning support for their projected portfolio of more than 1 billion dollars in DWH NRDA restoration funding. She led the preparation of innovative restoration planning documents for state and federal agencies across the country. Dr. Lane's work on climate change impacts has ranged from evaluations of the impact of catastrophic watershed events on drinking water supplies to the oversight of a model integrating climate change effects on coral reef cover and economic values. Across all of her assignments, Dr. Lane brings keen analytical insights and a focus on addressing client needs.

Jeff Morris

has expertise in aquatic toxicology, aquatic biology, biogeochemistry, and contaminant fate and transport related to the impacts of mining (hard rock and coal), oil and gas production, and industrial and municipal activities. He has designed and conducted laboratory and field investigations on the fate and effects of metals, petroleum hydrocarbons, polychlorinated biphenyls (PCBs), per- and polyfluoroalkyl substances (PFAS), ammonia, bacteria, and pathogens on aquatic biota, including fish, invertebrates, shellfish, and biofilm. These include detailed investigations into the biogeochemical mechanisms driving diel metal cycling in mining-impacted streams; acute toxicity of metals and impacts on olfactory inhibition in salmonids; and the toxicity of DWH oil and dispersant on more than 35 species of fish, invertebrates, and shellfish in the Gulf of Mexico. Additionally, he has expertise in technology development for environmental bioremediation, and holds patents on processes and equipment utilized to prevent acid mine drainage and enhance microbial degradation of petroleum hydrocarbons in water and sediment using microbial fuel cell technology. At Abt, Dr. Morris conducts research and analysis, and serves as a manager for projects in support of NRDAs and other environmental investigations. He has published more than 45 peer-reviewed manuscripts in over 20 scientific journals, which have been cited in peer-reviewed literature over 1,200 times (Morris Publications).

Jennifer Peers

is an environmental scientist who has conducted numerous evaluations of natural resource damages and equivalency analyses to compensate for harm to the environment. Her expertise includes environmental impacts, water quality, ecological services, and remediation planning. Her work focuses on aquatic and terrestrial natural resources; impacts of mining, oil and gas production, and industrial pollution; ecological services; restoration planning; ecological impacts of climate change; and tribal natural resources. Ms. Peers provides state, federal, and tribal clients with technical and strategic support on NRDAs and Superfund cleanups, and has provided technical training on equivalency analyses in the United States and on the ELD to multiple European member states.

Kaylene Ritter

is an environmental scientist with more than 12 years of experience working with Native American communities across the United States on assessing the environmental, health, and cultural impacts of contamination on Native American lands. Her work ranges from assisting tribes with human health risk assessments incorporating traditional and subsistence exposure pathways; to developing and implementing cultural survey instruments and conducting interviews/focus groups; to assessing contaminant transport pathways and exposure of ecological and human receptors; to restoration planning and damages determination; to assisting with the development of long-term climate monitoring plans that take into account traditional tribal lifeways. Dr. Ritter's current portfolio of projects includes supporting Native American Tribes in the Pacific Northwest (Spokane Tribe of Indians; NRDA related to uranium mining), the Southwest (Pueblo de San Ildefonso; assessment of contamination from the LANL nuclear facility), the Central Plains (seven Native American Tribes in Oklahoma; lead and mining contamination from the Tri-State Mining District), and the Midwest (Anishinaabe communities in the Lake Superior basin; wild rice ecological and cultural valuation).

Connie Travers

is a hydrogeologist with 30 years of experience in hydrogeology, water resources, and environmental chemistry. She has worked on numerous projects that integrate her expertise in groundwater and surface water characterization and assessment with her experience in contaminant transport. Ms. Travers has extensive experience in the development, testing, and application of models to predict the mobility of water and inorganic and organic contaminants in the environment. Her expertise in groundwater flow, hydrology, and transport and fate processes has been used extensively by litigation teams involved in mediation and settlements of environmental lawsuits. Over the last 20 years, Ms. Travers has evaluated surface water and groundwater components of natural resource damage claims at multiple sites throughout the United States, including the NRDA brought by the trustees against BP on the DWH oil spill. She has worked at more than 50 abandoned, active, and proposed mine sites working for the mining industry, federal and state agencies, and Native American communities. She has also been active in assessing the impacts of climate change on natural resources, preparing a review of tools and methods used to evaluate the impacts of climate change on groundwater resources, and coauthoring an assessment of climate change impacts on U.S. fisheries. Ms. Travers has managed field investigations including soils, surface water, sediment, waste materials, and groundwater sampling; aquifer testing; stream flow measurements; monitoring well installation; and cone-penetrometer and Geoprobe work.

Abt Associates is an engine for social impact, dedicated to moving people from vulnerability to security. Harnessing the power of data and our experts' grounded insights, we provide research, consulting and technical services globally in the areas of health, environmental and social policy, technology and international development.

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