MICHAEL S. TRACY (Bar No. 101456)
AMY G. NEFOUSE (Bar No. 159880)
MATTHEW B. DART (Bar No. 216429)
ERIN O. DOYLE (Bar No. 260646)
DLA PIPER LLP (US)
401 B Street, Suite 1700
San Diego, CA 92101-4297
Tel: 619.699.3620
Fax: 619.699.2701

Attorneys for Designated Party
BAE Systems San Diego Ship Repair Inc.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, SAN DIEGO REGION

In re Tentative Cleanup and Abatement Order No. R9-2010-0002

EXPERT WITNESS DESIGNATION OF DESIGNATED PARTY BAE SYSTEMS SAN DIEGO SHIP REPAIR INC.

Presiding Officer: David A. King

Pursuant to the Order Issuing Final Discovery Plan for Tentative Cleanup and Abatement Order No. R9-2010-0002 and Associated Draft Technical Report, and California Code of Civil Procedure section 2034.010 *et seq.*, Designated Party BAE Systems San Diego Ship Repair, Inc. ("BAE Systems") submits this designation of the following retained expert witnesses who may provide expert testimony in this matter:

1. R. Dreas Nielsen
   Integral Consulting Inc.
   411 1st Avenue South
   Suite 550
   Seattle, WA 98104

2. D. Scott Becker, Ph.D.
   Integral Consulting Inc.
   411 1st Avenue South
   Suite 550
   Seattle, WA 98104

3. Philip Spadaro
ARCADIS
2300 Eastlake Avenue East
Suite 200
Seattle, WA 98102

4. Paul Doody
ARCADIS
6723 Towpath Road
PO Box 66
Syracuse, NY 13214

5. Poh-Boon Ung
ARCADIS
11000 Regency Parkway West Tower
Suite 205
Cary, NC 27518

6. Matt Butcher
ARCADIS
2300 Eastlake Avenue East
Suite 200
Seattle, WA 98102

The qualifications and brief narrative statements of the general substance of the testimony these experts are expected to give are contained in the attached Declaration of Michael S. Tracy.

BAE Systems expressly reserves the right to add, modify, or delete any expert from this list of expert witnesses, and to submit supplemental lists of expert witnesses as provided by the Code of Civil Procedure. BAE Systems reserves the right to call any other expert witness in the capacity of an impeaching or rebuttal witness. BAE Systems further reserves the right to call any expert witnesses either presently or later identified by any other party to this proceeding, although not specifically retained by BAE Systems.

Dated: July 19, 2010

DLA PIPER LLP (US)

By _____
MICHAEL S. TRACY
AMY G. NEFOUSE
MATTHEW B. DART
ERIN O. DOYLE
Attorneys for BAE Systems San Diego Ship Repair Inc.

MICHAEL S. TRACY (Bar No. 101456)
AMY G. NEFOUSE (Bar No. 159880)
MATTHEW B. DART (Bar No. 216429)
ERIN O. DOYLE (Bar No. 260646)
DLA PIPER LLP (US)
401 B Street, Suite 1700
San Diego, CA 92101-4297
Tel: 619.699.3620
Fax: 619.699.2701

Attorneys for Designated Party
BAE Systems San Diego Ship Repair Inc.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, SAN DIEGO REGION

In re Tentative Cleanup and Abatement Order No. R9-2010-0002

NON-EXPERT WITNESS DESIGNATION OF DESIGNATED PARTY BAE SYSTEMS SAN DIEGO SHIP REPAIR INC.

Presiding Officer: David A. King

Pursuant to the Order Issuing Final Discovery Plan for Tentative Cleanup and Abatement Order No. R9-2010-0002 and Associated Draft Technical Report, and the California Code of Civil Procedure to the extent applicable, Designated Party BAE Systems San Diego Ship Repair, Inc. ("BAE Systems") submits this designation of the following non-expert witnesses who may provide testimony in this matter:

1. David Barker, Regional Water Quality Control Board, San Diego Region
2. Julie Chan, Regional Water Quality Control Board, San Diego Region
3. Tom Alo, Regional Water Quality Control Board, San Diego Region
4. Shaun Halvax, BAE Systems

BAE Systems expressly reserves the right to add, modify, or delete any witness from this list of witnesses, and to submit supplemental lists of witnesses as necessary. BAE Systems reserves the right to call any other designated witness in the capacity of an impeaching or rebuttal

witness. BAE Systems further reserves the right to call any witnesses either presently or later identified by any other party to this action, although not specifically designated by BAE Systems.

Dated: July 19, 2010

DLA PIPER LLP (US)

By _____

MICHAEL S. TRACY
AMY G. NEFOUSE
MATTHEW B. DART
ERIN O. DOYLE
Attorneys for BAE Systems San Diego Ship Repair Inc.

MICHAEL S. TRACY (Bar No. 101456)
AMY G. NEFOUSE (Bar No. 159880)
MATTHEW B. DART (Bar No. 216429)
ERIN O. DOYLE (Bar No. 260646)
DLA PIPER LLP (US)
401 B Street, Suite 1700
San Diego, CA 92101-4297
Tel: 619.699.3620
Fax: 619.699.2701

Attorneys for Designated Party
BAE Systems San Diego Ship Repair Inc.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, SAN DIEGO REGION

In re Tentative Cleanup and Abatement Order No. R9-2010-0002

DECLARATION OF MICHAEL S. TRACY IN SUPPORT OF DESIGNATED PARTY BAE SYSTEMS SAN DIEGO SHIP REPAIR INC.'S FIRST EXPERT WITNESS DESIGNATION

Presiding Officer: David A. King

I, Michael S. Tracy, declare:

1. I am an attorney licensed to practice in the State of California and am a partner with DLA Piper LLP (US), the law firm of record for Designated Party BAE San Diego Ship Repair, Inc. ("BAE Systems"). I make this declaration pursuant to Order Issuing Final Discovery Plan for Tentative Cleanup and Abatement Order No. R9-2010-0002 and Associated Draft Technical Report, and California Code of Civil Procedure section 2034.010 *et seq.*

2. The following expert witnesses have been retained by BAE Systems:

a. **R. Dreas Nielsen**

i. Qualifications. Mr. Nielsen is a Senior Managing Marine Scientist, Quantitative Analysis at Integral Consulting, Inc. A copy of his resume is attached as Exhibit A.

ii. Substance of testimony. Mr. Nielson is expected to provide testimony regarding the quantitative analysis of data and integration of lines of evidence in support of decision-making in Tentative Cleanup and Abatement Order No. R9-2010-0002 and Associated Draft Technical Report ("TCAO/DTR"), including but not limited to the analysis of patterns of chemical contamination and their relationship to measures of biological effects. Mr. Nielson may also provide testimony regarding the appropriateness of the scientific basis and methodology underlying the TCAO/DTR, including but not limited to determinations regarding effects on aquatic life, aquatic-dependent wildlife, human health, and San Diego Bay beneficial uses. Mr. Nielson may also comment on whether the cleanup criterion and remedial alternative were appropriate given the scientific basis, methodology and determinations underlying the TCAO/DTR. Mr. Nielsen may also apply statistical analysis in his opinions.

iii. Readiness. Mr. Nielsen has agreed to testify in this matter, and will be sufficiently familiar with the pending action to submit to a meaningful oral deposition concerning his expected testimony.

iv. Fees for testimony. Mr. Nielsen's fee for testimony is $265 per hour.

b. **D. Scott Becker, Ph.D.**

i. Qualifications. Mr. Becker is a Managing Scientist at Integral Consulting, Inc. A copy of Mr. Becker's resume is attached as Exhibit B.

ii. Substance of testimony. Mr. Becker is expected to provide testimony regarding assessment of ecotoxicological indicators pertaining to the health of benthic communities, including but not limited to evaluation and interpretation of benthic community data, sediment toxicity tests, and fish health. Mr. Becker may also provide testimony regarding the appropriateness of the scientific basis and methodology underlying the TCAO/DTR, including but not limited to determinations regarding effects on aquatic life, aquatic-dependent wildlife, human health, and San Diego Bay beneficial uses. Mr. Becker may also comment on whether the cleanup criterion and remedial alternative were appropriate given the scientific basis,

methodology and determinations underlying the TCAO/DTR. Mr. Becker may also comment on the effect, if any, that given constituents of concern had or should have had, given the known toxicity, chemistry, and benthic analysis, on the remedial alternative selected and the remedial footprint chosen.

iii. Readiness. Mr. Becker has agreed to testify in this matter, and will be sufficiently familiar with the pending action to submit to a meaningful oral deposition concerning his expected testimony.

iv. Fees for testimony. Mr. Becker's fee for testimony is $250 per hour.

c. **Philip Spadaro**

i. Qualifications. Mr. Spadaro is a Principal Scientist, Senior Vice President, and International Sediments Director at ARCADIS. A copy of Mr. Spadaro's resume is attached as Exhibit C.

ii. Substance of testimony. Mr. Spadaro is expected to opine on the technological and economic feasibility of the selected sediment cleanup criterion and the selected remedial alternative. In doing so, Mr. Spadaro will apply his extensive sediment cleanup experience in assessing the technological feasibility of the available technologies. He is further expected to opine on balancing the incremental benefit of attaining further reductions in the concentrations of constituents of concern as compared with the incremental cost of achieving those reductions.

iii. Readiness. Mr. Spadaro has agreed to testify in this matter, and will be sufficiently familiar with the pending action to submit to a meaningful oral deposition concerning his expected testimony.

iv. Fees for testimony. Mr. Spadaro's fee for testimony is $300 per hour per hour.

d. **Paul Doody**

i. Qualifications. Mr. Doody is a Director and Senior Vice President at ARCADIS. A copy of Mr. Doody's resume is attached as Exhibit D.

ii. Substance of testimony. Mr. Doody is expected to opine on the technological and economic feasibility of the selected sediment cleanup criterion and remedial alternative. In doing so, Mr. Doody is expected to evaluate the technological feasibility of the available technologies with an emphasis on environmental engineering principles, remedial design and risk assessment. He is further expected to opine, using his engineering and remedial design experience, on the balancing of incremental benefit of attaining further reductions in the concentrations of constituents of concern as compared with the incremental cost of achieving those reductions.

iii. Readiness. Mr. Doody has agreed to testify in this matter, and will be sufficiently familiar with the pending action to submit to a meaningful oral deposition concerning his expected testimony.

iv. Fees for testimony. Mr. Doody's fee for testimony is $286 per hour.

e. **Poh-Boon Ung**

i. Qualifications. Mr. Ung is a Principal Economist at ARCADIS. A copy of Mr. Ung's resume is attached as Exhibit E.

ii. Substance of testimony. Mr. Ung is expected to opine on the technological and economic feasibility of the selected sediment cleanup criterion and remedial alternative. It is expected that Mr. Ung will opine on the potential environmental economic impacts expected from performing a remedial alternative pursuant to the TCAO/DTR. Likewise Mr. Ung is expected to opine on the economic impacts of selecting an alternative remedial with a larger remedial footprint than the TCAO/DTR contemplate. Mr. Ung will apply environmental economic analysis to assess the technological feasibility of the available technologies. It is further anticipated he will opine from an environmental economic analysis perspective on the

balancing of incremental benefit of attaining further reductions in the concentrations of constituents of concern as compared with the incremental cost of achieving those reductions

iii. Readiness. Mr. Ung has agreed to testify in this matter, and will be sufficiently familiar with the pending action to submit to a meaningful oral deposition concerning his expected testimony.

iv. Fees for testimony. Mr. Ung's fee for testimony is $246 per hour.

f. **Matt Butcher**

i. Qualifications. Mr. Butcher is a Principal Scientist at ARCADIS. A copy of Mr. Butcher's resume is attached as Exhibit F.

ii. Substance of testimony. Mr. Butcher is expected to opine, from a statistical assessment perspective, on the technological and economic feasibility of the selected sediment cleanup criterion and remedial alternative. It is further anticipated that Mr. Butcher will apply statistical analysis to an evaluation of the technological feasibility of the available cleanup technologies. Mr. Butcher is further expected to apply statistical analysis to opine on balancing the incremental benefit of attaining further reductions in the concentrations of constituents of concern as compared with the incremental cost of achieving those reductions. As a trained aquatic ecologist he is also expected to opine on aquatic ecological issues and their potential impact on the cost/benefit analysis of the selected remedial alternative and selected remedial footprint.

iii. Readiness. Mr. Butcher has agreed to testify in this matter, and will be sufficiently familiar with the pending action to submit to a meaningful oral deposition concerning his expected testimony.

iv. Fees for testimony. Mr. Butcher's fee for testimony is $246 per hour.

3. The ARCADIS team, as a whole, is expected to provide comprehensive economic and feasibility assessment of the selected sediment cleanup criterion and the remedial alternative chosen as well as comprehensively evaluate the benefits and costs of different cleanup criterion and of an

enlarged remedial footprint.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

This declaration is executed on July 19, 2010, at San Diego, California.

MICHAEL S. TRACY

EXHIBIT A

Integral Consulting Inc.
411 1st Avenue S.
Suite 550
Seattle, WA 98104

telephone: 206.230.9600
facsimile: 206.230.9601
dnielsen@integral-corp.com

Dreas Nielsen

Senior Managing Scientist

Marine Scientist, Quantitative Analyst

PROFESSIONAL PROFILE

Mr. Dreas Nielsen is a senior managing scientist at Integral Consulting Inc., who specializes in quantitative analysis of environmental data. Mr. Nielsen's scientific expertise is principally in the areas of sediment contamination, chemical bioaccumulation, biological effects of contaminants, and chemical transport and fate. His approach to scientific topics stresses analytical and quantitative methods, with an emphasis on computer applications. During his 24 years of experience, Mr. Nielsen has performed and managed the collection and analysis of biological, physical, chemical, and geographic data from sites throughout the United States. Potential impacts at these sites were associated with heavy manufacturing, petrochemical manufacturing, wood treatment, wood pulp and paper production, shipbuilding, mining, and smelting. Mr. Nielsen's experience with these sites covers a broad range of contaminants, media, pathways, and exposures. Throughout this diverse range of conditions, he has collected, analyzed, modeled, and presented data to support ecological and human health risk assessments, RI/FSs, natural resource damage assessments, and cost allocation.

Mr. Nielsen's technical expertise includes data management, statistical analysis, integration of database and geographic information systems, mathematical modeling, programming, and information delivery via web sites. Mr. Nielsen has designed and developed numerous databases customized to meet specialized needs of projects and clients and has developed project-specific web pages, including GIS-based interfaces, to facilitate broad and straightforward access to project data and analyses.

CREDENTIALS AND PROFESSIONAL HONORS

M.S., Oceanography, Oregon State University, 1982
B.S., Biology, Union College, 1976

RELEVANT EXPERIENCE

Ecological Risk Assessment and Natural Damage Assessment

Natural Resource Damage Assessment, Tombigbee River, Alabama—Evaluated potential damages in a DDT-contaminated estuary for a variety of receptors and exposure

conditions, incorporating spatial variability in conditions throughout the site, and addressing different remedial scenarios. Developed time- and area-weighted exposure estimates for mosquitofish based on preferred habitat and the timing of seasonal flooding of the site, and related to measured DDT concentrations in tissue. Used the results to inform the design of post-remedial monitoring.

Natural Resource Damage Assessment, Greens Bayou, Texas—Conducted analyses of the spatial and vertical distribution of chlorinated solvents and pesticides. Developed estimates of exposure and damage to the benthic community to be used as a basis for compensatory restoration estimates. Estimated the post-remedy recovery period based on remedial design and sediment accumulation rate estimates, and developed recommendations for the post-remedial monitoring plan.

Natural Resource Damage Assessment, Saginaw River, Michigan—Coordinated the compilation, review, and analysis of data from three decades of sampling of a PCB-contaminated river and bay. Performed temporal and 3-dimensional spatial analyses of the data, including computation of mass-based assessment and cleanup thresholds. Presented results to oversight agencies, and prepared position papers to support litigation of a natural resource damage claim.

Natural Resource Damage Assessment, St. Lawrence River—Developed the database of sediment and tissue PCB data used jointly by PRPs and Trustee agencies in the cooperative natural resource damage assessment conducted on the St. Lawrence River.

Ecological Impacts of Ichthyoplankton Entrainment, Gulf of Mexico—Evaluated environmental impact statements that were prepared for liquefied natural gas regasification facilities in the Gulf of Mexico, focusing on the assessment of entrainment and impingement impacts to fish eggs and larvae. The evaluation produced qualitative and quantitative estimates of the effect of the data, assumptions, calculation methods, and models used on the overall impact assessments. Recommended alternative approaches to improve substantially the accuracy and precision of these impact assessments.

Ecological Risk Assessment, Newport, Delaware—Managed the compilation of tabular and GIS data for an ecological risk investigation at a former wood-treating facility in the eastern United States. This project evaluated and rectified data integrity problems in data sets produced by a previous contractor and integrated the tabular data with spatial data to facilitate site-specific ecological risk assessment. Also used these data to characterize exposure of receptors at the site.

Ecological Risk Assessment, Fox River, Wisconsin—Provided technical review of the development and application of a food web model to predict PCB dynamics in an industrial estuary, focusing on ecological, physiological, and computational issues.

Ecological Damage Assessment Following a Chemical Spill, Ohio River—Evaluated species abundance data in samples from impacted and unimpacted areas. Assessed the appropriateness of different statistical models for estimating the probability that any rare (threatened or endangered) species were affected.

Natural Resource Damage Assessment in Commencement Bay, Washington—Evaluated natural resource damages resulting from contamination of sediment of an urban waterway with metals, PCBs, and other organic chemicals. Automated the calculation for a spatially complex site to allow rapid evaluation of alternative scenarios.

Sediment Assessment

Sediment Data Analysis, Upper Columbia River, Washington and British Columbia—Coordinated the analysis of both recent and historical sediment chemistry data from the Upper Columbia River to assist in the planning of future sampling programs. Analyses included multivariate analyses of element abundances, analysis of spatial and vertical variation in concentrations, characterization of background conditions and comparison to site conditions, and evaluation of partitioning to pore water. These analyses identified several different classes of sediment in the river, characterized by different chemical and physical characteristics. Evaluation of the fingerprints of these classes relative to potential source materials provided insights into both the spatial and proportional influence of potential sources.

Evaluation of Groundwater-Sediment Interactions, Patrick Bayou, Texas—Evaluated the potential contributions of groundwater, based on measured concentrations and flow gradients, to influence ecological risk in an adjacent waterway. Contrasted predictions of groundwater transport calculations with results of toxicity testing in the waterway.

Detailed Sediment Investigation, San Diego, California—Managed a comprehensive sediment investigation at two shipyards in San Diego Bay, focusing on the effects of metals, organo-metallic compounds, PAH, PCBs, polychlorinated triphenyls, and petroleum hydrocarbons on aquatic life, aquatic-dependent wildlife, and human health. This investigation included a sediment triad study; bioaccumulation tests; ecological and human health risk assessments using site-specific exposure data; analyses of fish histopathology, age and condition, and PAH exposure; sediment profile imaging; and analyses of sediment mineralogy. Developed a method to synthesize the many measurements of biological conditions to produce a quantitative estimate of impairment relative to reference conditions. Also developed a deductive approach to causation analysis that provides a definitive assessment of the potential impact of site-related chemicals. Developed alternate site-specific cleanup levels and assessed their predictive performance. A feasibility study also was conducted to evaluate alternative remedial designs.

Review of Regulatory Proposals—Conducted a technical review of the evaluation approaches used in EPA's July 1996 draft documents *The National Sediment Contaminant Point Source Inventory: Analysis of Facility Release Data* and *The National Sediment Quality Survey: A Report to Congress on the Extent and Severity of Sediment Contamination in Surface Waters of the United States*. Identified flaws in the technical basis and mathematical formulation of the HAZREL ranking system, and conducted an error analysis to demonstrate the impact of these flaws. Evaluated the sediment quality values used for sediment screening, and applied statistical analysis that revealed their lack of comparability. Demonstrated that the evaluation

methods used in both documents were driven by the number of samples collected in a geographic region rather than the characteristics of those samples, and recommended modifications of the methods.

Development of Sediment Assessment Guidance, Olympia, Washington—Managed a project to support the Washington State Sediment Management Unit, which included developing guidance for sediment sampling and analysis plans, reviewing approaches for deriving human health-based sediment quality criteria, and developing an action plan for creation of multi-user disposal sites.

Evaluation of Bioaccumulation-Based Sediment Standards, Olympia, Washington—Managed and carried out evaluations of bioaccumulation of organic and inorganic chemicals in fish and shellfish using data from the literature and from an extensive chemical database for Puget Sound. Evaluated the effects of sediment conditions, chemical properties, and biota characteristics on bioaccumulation potential, and prepared a critique of bioaccumulation assessment methods that includes recommendations regarding data collection and assessment approaches.

Forensics

Dioxin Source Analysis, Washington—Provided senior technical consulting and oversight of analyses using multivariate data analysis methods to evaluate potential sources of dioxins to residential soils. Multiple methods (discriminant analysis, unmixing analysis, and spatial similarity analysis) confirmed the presence of two spatially and chemically distinguishable dioxin/furan fingerprints.

Sediment Metal Pattern Classification, Washington—Planned and oversaw pattern analyses of sediment metals data, developing a classification scheme to distinguish sediments reflecting different sources or partitioning and transport mechanisms.

Beach Dust Resuspension Analysis, Washington—Planned and provided senior technical oversight of a screening-level evaluation of the potential impact on riparian soils of aerial transport of resuspended dust from sediments exposed during lake drawdown.

Cost Allocation, Anniston, Alabama—Managed a project to evaluate potential sources of metals and PCBs to a contaminated residential area, using environmental measurements, historical documents, and emission rate calculations based on industrial operating characteristics and feed materials, in support of cost-recovery litigation.

Mercury Bioaccumulation Modeling, New York—Provided senior technical consulting on the development of a bioenergetics-based food web model to evaluate the multi-year bioaccumulation response of fish to different mercury exposures.

Cost Allocation, Ohio—Reviewed documents and data generated during a multi-year assessment and cleanup of a waste disposal and recycling site. Evaluated the nature, fate, and distribution of contaminants found at the site in relation to raw materials, waste products, and practices at the client's manufacturing site. Evaluated potential formulations of industrial materials used decades ago, to determine potential contaminants of concern

originating at the client's facility, and reviewed records of waste haulers to develop independent estimates of the client's proportionate contribution to the site.

Data Management, Analysis, and Communication

Ecological Risk Assessment and Remediation Alternative Assessment—Developed an interactive web application that integrates a database of chemical data with spatial (GIS) data to allow users to explore changes in ecological risks associated with different remediation approaches in a forested wetland. Chemical data were loaded into a database from electronic laboratory deliverables, GIS data were organized and standardized, and a web mapping interface was implemented. The tool allows users to select different areas for remediation and to apply different cleanup levels and residual levels, and calculates surface area-weighted average chemical concentrations and ecological hazard indexes for several receptor species.

Calcasieu Impact Assessment, Calcasieu Estuary, Louisiana—Developed an integrated GIS and relational database application to assess natural resource damages in a Gulf Coast ecosystem. Developed and applied data quality objectives, data quality assurance procedures, and data summarization rules for the acquisition, review, and interpretation of historical data from the estuary, including sediment, water, and tissue chemistry, species abundance, and toxicity test data. Created a software interface to the integrated application for use by an industry coalition and a public agency, and created a customized version for a private client. Conducted analyses to highlight spatial and temporal variation throughout the estuary, as well as systematic differences between historical data sets.

Document Management for Toxic Tort Litigation Support—Designed an on-line system to allow client access to a database of technical documents relating to exposure and health effects of a widely used industrial material. The on-line system provides the ability to search for documents using citation information and keywords and allows display of document text and technical comments.

Data Explorer for Human Health Exposure Assessment—Developed a desktop application that integrates tabular and GIS data to allow users to explore potential human health exposures to residual industrial wastes in a residential area. Spatial information on the locations of contaminated areas and of homes and businesses was integrated with tabular data on chemical concentrations and the history of individuals' residential and employment locations. The application provides the user with a map-based interface that allows exploration of both temporal and spatial relationships between contaminant locations and individuals' potential exposures.

Management of Photographic Data on Human Activities—Developed software tools to automate the acquisition and review of automatically collected photographs of human use activity at a contaminated site.

Post-Katrina Damage Assessments to Insured Properties, Gulf Coast—Developed web-based interfaces to display the locations of insured properties, peak wind speeds, and storm surge heights in the track of Hurricane Katrina.

Health Risk Assessment, Detroit, Michigan—Developed a database to support screening and detailed characterization of potential mercury contamination in houses following servicing of mercury-containing natural gas pressure regulators. This database supported real-time data collection via data entry forms on handheld computers, with daily uploading of data, reporting of results, and scheduling of multiple field crews for several different phases of assessment and cleanup. The database included a map interface to support efficient assignment of sampling locations to field crews and was deployed on the client's network.

California Earthquake Authority Rapid Damage Assessment System, California—Designed an on-line system to automatically acquire real-time data on earthquake ground motion from U.S. Geological Survey processing centers, integrate that with a database of client properties, and present the information in a GIS-based web interface.

Landslide Litigation Support, California—Developed map-based, on-line systems to present narrative and photographic data on environmental and structural damage resulting from severe weather and geological subsidence.

RCRA Assessment at a Pulp Mill, Savannah, Georgia—Designed and implemented database features to store the topology of a drainage pipe network so that the downstream effects of facility processes and discharges could be evaluated, and the potential sources of downstream contamination identified. Pipe data stored in the database were linked with GIS data to allow visual querying and display of the pipe and discharge information.

Ecological Assessment, Rocky Flats, Colorado—Developed a database to integrate information collected during 7 years of ecological monitoring at the Rocky Flats Environmental Technology Site in Colorado. This database integrated the disparate data formats used by different monitoring programs during several years and presented the user with a single, consistent interface to all of the data.

Cost Allocation, Commencement Bay, Tacoma, Washington—Designed and implemented a database to support Superfund site administration, including PRP search, source control tracking, and remedial action tracking. Wrote the user's and programmer's guides for this database.

Site Characterization

Remedial Investigation and Feasibility Study, Onondaga Lake, New York—Conducted evaluations of the potential effects of alternate remedial actions for a feasibility study for cleanup of Onondaga Lake, New York. Coordinated the management of sampling data, which involved more than 1,500 samples of sediment, water, and tissue. The samples were analyzed for organic, inorganic, and conventional parameters by five separate laboratories.

Focused Feasibility Study, Crawfordsville, Indiana—Managed a project to evaluate remedial options for a wooded floodplain containing PCBs released from an industrial facility upstream, as well as downstream transport through a channel draining the wooded area.

Smelter Hill Remedial Investigation and Feasibility Study, Anaconda, Montana—Refined the specifications and implemented the software to transfer RI/FS data from the Smelter Hill Superfund site to EPA's Clark Fork Data Management System.

Property Damage Litigation Support, Texarkana, Arkansas—Managed a project to assess the transport of PAH downstream from several historical and current sources, in support of expert testimony in a property-damage litigation case.

Chemical Fate and Transport

Remedial Investigation and Feasibility Study, Ward Cove, Alaska—Managed the development of screening and 3-dimensional models of contaminant transport and fate in Ward Cove (Ketchikan), Alaska, and carried out other analyses of sediment accumulation and bioaccumulation for the determination of areas of concern and appropriate remedial actions. The predominant influence of organic matter degradation required model customization to account for effects such as *in situ* production of 4-methylphenol. Also specified statistical methods for long-term monitoring of biological and chemical conditions.

Modeling of Permitted Discharge Impacts on Sediment, Puget Sound, Washington—Conducted an evaluation of models for assessing the potential impact on sediment of permitted discharges in the State of Washington. Performed modeling of several example sites, developed application guidance for the WASP4 model, and conducted training in model usage.

Other Technical Reviews

Ecological Impact Assessment, National Engineering Laboratory, Idaho—Managed the quality assurance review of organic and inorganic analysis data from the Idaho National Engineering Laboratory.

Development of Reference Area Performance Standards, Puget Sound, Washington—Completed a quality assurance review and evaluation of marine bioassay data to support the establishment of reference area performance standards. Participated in refining these standards and co-authored the final report.

PRP Search, Commencement Bay, Washington—Participated in the data summarization and review for a PRP search at a CERCLA NPL site with 9 problem areas, approximately 500 facilities, and 1,000 parties. EPA and site-specific evaluation criteria were applied to identify PRPs.

Litigation Support

Damage Claims from Volatile Organic Chemicals in Groundwater, Multiple Sites Nationwide—Managed a litigation support project to perform technical review of more than 8,800 documents from 16 contaminated sites and provide appropriate documents and site summaries to 10 different testifying experts. Developed a customized bibliographic database that included document descriptions, site descriptions, and experts' requirements,

but also supported document tracking and overall document management tasks. Conducted database development, document review, and data entry all on an accelerated schedule: in 4 months, the product of 3 years of document collection efforts was compiled and reviewed.

Cost Allocation, Anniston, Alabama—Managed a project to evaluate potential sources of metals and PCBs to a contaminated residential area, using environmental measurements, historical documents, and emission rate calculations based on industrial operating characteristics and feed materials, in support of cost-recovery litigation.

Cost Allocation, Ohio—Reviewed documents and data generated during a multi-year assessment and cleanup of a waste disposal and recycling site, to provide litigation support for a client named as a PRP. Evaluated the nature, fate, and distribution of contaminants found at the site in relation to raw materials, waste products, and practices at the client's manufacturing site. Evaluated potential formulations of industrial materials used decades ago, to determine potential contaminants of concern originating at the client's facility, and reviewed records of waste haulers to develop several independent estimates of the client's proportionate contribution to the site. Thorough review of available data demonstrated that the client's contribution to the site was minimal in terms of both volume and hazard. All of the documents reviewed were compiled into an electronic database that could be searched by document type, title, authors, date, and Bates number, and that would display scanned images of selected documents.

PUBLICATIONS

Pastorok, R.A., M.K. Butcher, and R.D. Nielsen. 1996. Modeling wildlife exposure to toxic chemicals: trends and recent advances. *Hum. Ecol. Risk Assess.* 2(3):444–480.

Pastorok, R.A., R.D. Nielsen, and M.K. Butcher. 1996. Future directions in modeling wildlife exposure to toxic chemicals. *Hum. Ecol. Risk Assess.* 2(3):570–579.

Miller, C.B., and R.D. Nielsen. 1988. Development and growth of large, Calanid copepods in the Ocean Subarctic Pacific, May 1984. *Progr. Oceanogr.* 20:275–292.

INVITED PRESENTATIONS/POSTERS/PANELS/PEER REVIEWS

02/09—Fifth International Conference on Remediation of Contaminated Sediments. Graphic visualization of correlation and similarity. D. Nielsen, M. Aldea, and G. Palushock (presented by M. Aldea). Jacksonville, FL.

02/09—Fifth International Conference on Remediation of Contaminated Sediments: A multinomial exact test for interpretation of sediment profile image data. D. Nielsen and J.D. Germano (poster). Jacksonville, FL.

01/06—Workshop on U.S. Seawater Vaporization: Getting to Resolution. An evaluation of the approaches used to predict potential impacts of open loop LNG vaporization systems on fishery resources of the Gulf of Mexico. Houston, TX.

10/05—Environmental Technologies Panel Meeting. Sediment assessments for remedial investigations. National Shipbuilding Research Program. Seattle, WA.

07/04—Society of Wetland Scientists 25th Annual Conference. Restoration of the Mesopotamian marshlands: Applications of hydrodynamic models. Seattle, WA.

09/04—Sediment Management Workgroup Members Meeting. Use and extension of the sediment quality triad approach at working shipyards. Seattle, WA.

EXHIBIT B

Integral Consulting Inc.
411 1st Avenue S.
Suite 550
Seattle, WA 98104

telephone: 206.230.9600
facsimile: 206.230.9601
sbecker@integral-corp.com

D. Scott Becker, Ph.D.

Managing Scientist

PROFESSIONAL PROFILE

Dr. Scott Becker is an ecotoxicologist specializing in sediment quality evaluations, sediment toxicity testing, benthic ecology, fish ecology, and fish pathology. He has directed a wide variety of projects related to the ecological effects of toxic chemicals in freshwater, estuarine, and marine sediments throughout the United States. Dr. Becker has conducted numerous ecological risk assessments (ERAs) and natural resource damage assessments (NRDAs) to evaluate potential injuries to benthic macroinvertebrates, fishes, and aquatic-dependent wildlife at a variety of Superfund, RCRA, and other kinds of sediment sites. He is a co-developer of the apparent effects threshold (AET) approach for establishing sediment quality guidelines (SQGs), and he used that approach to help develop the sediment management standards for Washington State. Dr. Becker has used the most recent advances in sediment science to evaluate chemical toxicity at various sediment sites, including development of site-specific SQGs, use of the SQG quotient approach, use of toxicity identification evaluations (TIEs), and evaluation of metals bioavailability using acid volatile sulfide (AVS), simultaneously extracted metals (SEM), chemical speciation and electron microprobe analysis.

Dr. Becker has also evaluated the effects of sewage disposal, pulp mill effluents, and dredge-spoil dumping on sedimentary environments. He has authored a variety of journal publications and technical reports, and has chaired regional workshops to develop standardized environmental sampling protocols for Puget Sound. Dr. Becker has given technical presentations to numerous state and federal agencies, and he has participated in negotiations of remedial actions with multiple stakeholder groups. He has helped design remediation plans that included dredging, containment capping, thin layer placement, and monitored natural recovery (MNR). He has also helped design remedial plans that optimize habitat, including enhancements of macrophyte beds, soft-bottom benthic habitat, fish spawning and nursery areas, wetlands, and shoreline stabilization.

CREDENTIALS AND PROFESSIONAL HONORS

Ph.D., Fisheries, University of Washington, Seattle, Washington, 1984
M.S., Marine Environmental Science, State University of New York, Stony Brook, New York, 1978
B.S., Biology, State University of New York, Brockport, New York, 1973

CONTINUING EDUCATION AND TRAINING

Hazardous Waste Operations Management and Supervisor 8-hour Certification (2005)
Hazardous Waste Operations and Emergency Response 40-hour Certification (1984)
SCUBA Certification, Professional Association of Diving Instructors (1976)
New York State Teaching Certification, Secondary Science (1973)

PROFESSIONAL AFFILIATIONS

Society of Environmental Toxicology and Chemistry (SETAC)
American Fisheries Society (AFS)
American Institute of Fishery Research Biologists (AIFRB)
North American Benthological Society (NABS)

RELEVANT EXPERIENCE

Ecological Risk Assessment

Upper Columbia River (UCR) Ecological Risk Assessment, Washington—Played a lead role in developing the RI/FS and ERA work plans to evaluate potential effects of metals on the UCR ecosystem. Made numerous stakeholder presentations on historical information and plans for future studies.

Onondaga Lake Baseline Ecological Risk Assessment, New York—Led ERA to determine the effects of metals (especially mercury) and organic compounds (i.e., polycyclic aromatic hydrocarbons [PAHs], polychlorinated biphenyls [PCBs], chlorinated benzenes) on phytoplankton, zooplankton, macrophytes, benthic macroinvertebrates, fishes, and aquatic-dependent wildlife in Onondaga Lake. Developed site-specific SQGs and used them in a quotient approach to identify sediments that warranted remediation.

Acid Brook Delta Ecological Evaluation, New Jersey—Directed an ERA on the effects of metals (especially mercury) on benthic macroinvertebrates, fishes and aquatic-dependent wildlife in Pompton Lake. Demonstrated that actual risks were less than those predicted using generic SQGs.

Ward Cove Sediment Investigation, Alaska—Led ERA on the effects of ammonia, sulfide, and 4-methylphenol on benthic macroinvertebrate communities near a pulp mill in Ward Cove. Used TIEs to demonstrate that sediment toxicity was the result of natural degradation products of organic matter and that thin layer placement, rather than containment capping, was an appropriate remedy.

Harris Lake Ecological Evaluation, Michigan—Managed ERA on the effects of metals on benthic macroinvertebrates, fishes, and aquatic-dependent wildlife in Harris Lake. Documented that remediation was warranted only in the littoral zone, because the profundal zone was adversely affected by hypoxia on an annual basis.

Ecological Risk Assessment, Texas—Directed an ERA on the effects of metals on benthic macroinvertebrates, fishes, and aquatic-dependent wildlife in a bayou system near Orange,

Texas. Documented that metals were not bioavailable in most parts of study area and that remediation was warranted only near the discharge point.

Baseline Ecological Evaluation, New Jersey—Managed ERA on the effects of metals, PAHs, and PCBs on benthic macroinvertebrates in Gold Run. Documented that only a small portion of the site required additional assessment.

Evaluation of Effects of Mine Releases, Alaska—Served as technical lead for ERA on the effects of mine discharges on benthic macroinvertebrate communities in Gold Creek. Demonstrated that a previous fish kill was the result of stream drawdown by the City of Juneau rather than mine releases.

Natural Resource Damage Assessment

Injury Assessment for Freshwater Communities, New York—Led an NRDA to evaluate potential injuries to water, sediments, plankton, benthic macroinvertebrates, fishes, and aquatic-dependent wildlife in Onondaga Lake. Documented that the hypereutrophic conditions in the lake were more detrimental to most of the resident ecological communities than chemical releases.

Injury Assessment for Benthic Macroinvertebrates, New York—Directed an NRDA on the effects of PCBs on benthic macroinvertebrates in the Hudson River and prepared a critical evaluation of the sediment effect concentrations (SECs) for PCBs. Documented that adverse effects were not found at PCB concentrations that exceeded the SECs by a substantial margin.

Injury Assessment for Fishes, Montana—Served as technical lead for an NRDA on the effects of mining wastes on the trout fishery in the Clark Fork River. Documented that the services provided by the fishery were strongly limited by physical alterations of the river, rather than chemical releases.

Injury Assessment for Benthic Macroinvertebrates, Idaho—Directed an NRDA on the effects of metals and mine tailings on benthic macroinvertebrates in the Coeur d'Alene River. Documented that the physical effects of the mine tailings were more detrimental to the benthic communities than metals concentrations.

Injury Assessment for Benthic Macroinvertebrates, New York—Conducted NRDA evaluations on the effects of PCBs and PAHs on benthic macroinvertebrates in the St. Lawrence River. Conducted a detailed critical evaluation of the validity of the SECs for PCBs as part of this effort.

Injury Assessment for Marine Communities, California—Directed an NRDA on the effects of DDT and PCBs on benthic macroinvertebrates and demersal fishes offshore from Los Angeles for the National Oceanic and Atmospheric Administration (NOAA).

Other Kinds of Ecological Assessments

Evaluation of Chromium Bioavailability, New Jersey—Directed a focused field study to evaluate the toxicity and bioavailability of chromium associated with chromite ore processing

residue using a concentration-response approach in the Hackensack River. Developed a site-specific no-effect level for chromium that was more than three times greater than the sediment criterion used by the State of New Jersey.

Onondaga Lake Feasibility Study—Developed a SQG quotient approach using site-specific SQGs to integrate the potential effects of 44 chemical of concern and delineate areas for sediment remediation and MNR in Onondaga Lake. The approach was calibrated using site-specific toxicity data and broke a long-term stalemate with the State of New York as to how to effectively address the large number of chemicals of concern identified at the site.

Commencement Bay Remedial Investigation/Feasibility Study, Tacoma, Washington—Directed studies of benthic macroinvertebrates and fish ecology/pathology for the Commencement Bay RI/FS; codeveloped the AET approach for developing SQGs, and helped to develop the sediment management standards for the Washington State Department of Ecology.

Puget Sound Estuary Program Technical Support (EPA Region 10), Washington—Directed studies of benthic macroinvertebrates and fish ecology/pathology for the Urban Bay Action Programs for Elliott Bay and Everett Harbor. Directed development of the Puget Sound protocols, conducted field evaluations of candidate sediment toxicity tests for use in Puget Sound, developed reference area performance standards for Puget Sound, evaluated effects of sediment storage time on sediment toxicity tests, and directed a study of PCB bioaccumulation in Puget Sound harbor seals.

PUBLICATIONS AND PRESENTATIONS

Becker, D.S., J.E. Sexton, and L.A. Jacobs. (In prep.). Use of thin layer placement for sediment remediation in Ward Cove, AK (USA): Results after seven years of ecological recovery. *Environ. Toxicol. Chem.*

Becker, D.S., J.E. Sexton, L.A. Jacobs, B. Hogarty, and K. Keeley. 2009. Biological responses to sediment remediation based on thin layer placement near a former pulp mill in Ward Cove, AK (USA). *Environ. Monitor. Assess.* 154:427-438.

Becker, D.S., and P.R. Paquin. 2009. Sediment toxicity in the Upper Columbia River, Washington in relation to acid volatile sulfide and simultaneously extracted metals. Platform presentation at the 2009 Society for Environmental Toxicology and Chemistry Conference in New Orleans, Louisiana. Integral Consulting Inc., Mercer Island, WA.

Becker, D.S., and T.C. Ginn. 2008. Critical evaluation of the sediment effect concentrations for polychlorinated biphenyls. *IEAM* 4(2):156-170..

Becker, D.S., J.E. Sexton, and L.A. Jacobs. 2008. Use of thin layer placement for sediment remediation in Ward Cove, AK (USA): Results after seven years of ecological recovery. Platform presentation at the Fifth International Conference on Remediation of Contaminated Sediments, Jacksonville, Florida. Integral Consulting Inc., Mercer Island, WA.

Becker, D.S., L.A. Jacobs J.E. Sexton, B. Hogarty, and K. Keeley. 2007. Biological responses to thin layer capping of organically enriched sediments near a former pulp mill in Ward Cove, Alaska. Platform presentation at the Fourth International Conference on Remediation of Contaminated Sediments, Savannah, Georgia. Integral Consulting Inc., Mercer Island, WA.

Becker, D.S., E.R. Long, D.A. Proctor, and T.C. Ginn. 2006. Evaluation of toxicity and bioavailability of chromium in sediments associated with chromite ore processing residue. *Environ. Toxicol. Chem.* 25(10):2576-2583.

Becker, D.S. 2005. Evaluation of the toxicity of chromium in sediments of the Hackensack River, New Jersey. Presentation at the Eighth International *In Situ* and Onsite Bioremediation Symposium, Baltimore, MD. Exponent, Inc., Bellevue, WA.

Becker, D.S., and G.N. Bigham. 1995. Distribution of mercury in the aquatic food web of Onondaga Lake. *Water Air Soil Pollut.* 80:563–571.

Becker, D.S., and T.C. Ginn. 1995. Effects of storage time on toxicity of sediments from Puget Sound, Washington. *Environ. Toxicol. Chem.* 14(5):829–835.

Becker, D.S., C.D. Rose, and G.N. Bigham. 1995. Comparison of the 10-day freshwater sediment toxicity tests using *Hyalella azteca* and *Chironomus tentans*. *Environ. Toxicol. Chem.* 14(12):2089–2094.

Becker, D.S., T.C. Ginn, and G.R. Bilyard. 1990. Comparisons between sediment bioassays and alterations of benthic macroinvertebrate assemblages at a marine Superfund site: Commencement Bay, Washington. *Environ. Toxicol. Chem.* 9:669–685.

Pastorok, R.A., and D.S. Becker. 1990. Comparative sensitivity of sediment toxicity bioassays at three Superfund sites in Puget Sound. pp. 123–139. In: Aquatic Toxicology and Risk Assessment: Thirteenth Volume, ASTM STP 1096. W.G. Landis and W.H. van der Schalie (eds.). American Society for Testing and Materials, Philadelphia, PA.

Barrack, R.C., H.R. Beller, D.S. Becker, and T.C. Ginn. 1989. Use of the apparent effects threshold (AET) approach in classifying contaminated sediments. In: Contaminated Marine Sediments—Assessment and Remediation, National Academy Press, Washington, DC.

Becker, D.S. 1988. Relationships between sediment character and sex segregation in English sole, *Parophrys vetulus*. *Fish. Bull.* 86:471–479.

Becker, D.S., and J.W. Armstrong. 1988. Development of regionally standardized protocols for marine environmental studies. *Mar. Pollut. Bull.* 19:310–313.

Becker, D.S., and K.K. Chew. 1987. Predation on *Capitella* spp. by small-mouthed pleuronectids in Puget Sound, Washington. *Fish. Bull.* 85:471–479.

Becker, D.S., T.C. Ginn, M.L. Landolt, and D.B. Powell. 1987. Hepatic lesions in English sole (*Parophrys vetulus*) from Commencement Bay, Washington (USA). *Mar. Environ. Res.* 23:153–173.

EXHIBIT C

ARCADIS

Education
MS/Geochemistry, University of Chicago, 1983
BS/Chemistry, Cook College at Rutgers University, 1981

Years of Experience
With ARCADIS Since 2002
25 Years Overall

Professional Registrations
Licensed Geologist, WA
Licensed Geologist, OR

Professional Qualifications
American Chemical Society
Western Dredging Association
Society of Environmental Toxicology and Chemistry

Philip A. Spadaro, LG

Principal Scientist/Senior Vice President

Mr. Spadaro, a leading international expert in sediment cleanup and waterfront redevelopment, is a senior vice president of ARCADIS and senior scientist in the Waterfront and Sediment Division. Technically based in environmental chemistry with strong proficiency in hydrogeology, geology, regulatory affairs, and remediation, Mr. Spadaro has more than 25 years of experience applying his expertise and management skills to projects where sediment quality is a prominent issue. As a senior technical reviewer, Mr. Spadaro has extensive expertise in the siting, design, permitting, and construction of confined disposal facilities and in the fate and transport of contaminants in estuarine, riverine, and marine aquatic environments. He is an expert advisor to ARCADIS's sediment remediation team and discipline coordinator for international sediment management and remediation projects in Europe. In addition, Mr. Spadaro provides litigation support for construction claims and cost-recovery actions and other matters related to sediment remediation.

The successful execution of highly complex sediment remediation projects demands meticulous planning, strong scientifically sound technical approaches, and credibility with regulatory authorities. Mr. Spadaro's international reputation for designing and implementing inventive, appropriate, and cost effective waterfront solutions is anchored in these qualities and in his commitment to seek out and respect the unique needs of every project and client.

Experience

Peer Review of Proposed Remediation Plans
Haifa Chemical Corporations, LTD Haifa, Israel
2009
The Kishon River Authority proposed a removal action based on historic effluent discharges. Reviewed existing information and proposed remediation plans. Prepared critical review of site characterization and remedial action plans.

Litigation Support, Yosemite Creek Time-Critical Removal Action
Yosemite Creek PRP Group, San Francisco, California
2008 - Ongoing
USEPA has proposed time-critical removal action of over 20,000 cubic yards of contaminated sediment in this highly urbanized embayment within the San Francisco bay. Currently serving as

senior technical advisor in negotiations with USEPA to improve removal action design and address community concerns regarding quality of life issues.

Litigation Support, Portland Harbor Superfund Site
Oregon Department of Justice, Portland, Oregon
2009-Ongoing
Currently providing expert analysis, advice, and testimony related to Portland Harbor Superfund Site. Key issues revolve around potential contributions from state-maintained roads and other facilities. Also analyzed potential contributions from State owned lands. Project includes extensive field studies as well as evaluation of available technical data from the RI/FS process.

Review of Corporate Contaminated Sediment Issues
Confidential Client, Arnhem, the Netherlands
2008
Provided training to high level corporate environmental staff in a two-day workshop dealing exclusively with contaminated sediment management. Reviewed contaminated sediment management policies and practices at numerous sites and provided suggestions for technical studies and negotiation strategies to improve outcomes.

Peer Review of Confined Disposal Facility Design and Management
US Army Corps of Engineers, New Orleans, Louisiana
2009
As part of restoration efforts following damage caused by Hurricane Katrina, ARCADIS was retained by the Corps to evaluate the disposal of contaminated dredge material from the Industrial Harbor Navigation Canal in a nearby confined disposal facility (CDF). Serving as overall technical advisor to the project team conducting peer review of CDF design, community safety, and long-term maintenance and monitoring. Assisting Corps in addressing community concerns about short- and long-term risks of CDF operation as well as the potential for catastrophic failure.

Litigation Support and Removal Action Design
Confidential Client, Passaic River, Newark, New Jersey
2000 - Ongoing
Long-term strategic technical advice on this complex and dynamic superfund site. Work has included evaluation of stormwater and CSO inputs, review of USEPA and consultant work products, and most recently preparation of design documents for Phase I and Phase II non-time-critical removal actions of 200,000 cubic yards of highly contaminated sediment. Serves as technical advisor for multi-disciplinary team performing studies of sediment quality, dredging, sediment processing, transport and disposal, water quality, hydrodynamics, community health and safety, and confined disposal facility siting and design.

EE/CA for Non-time-Critical Removal Action
Confidential Client, Portland, Oregon
2009-Ongoing
Serving as technical advisor to multi-disciplinary team performing engineering evaluation/cost analysis for DDT-contaminated sediments. Work includes negotiation with USEPA and conceptual design of sediment removal and possible confined disposal facility. Preparation of engineering evaluation/cost analysis is underway.

Sediment Removal Action Evaluation and Design
3M Corporation, East Cove, Cottage Grove, Minnesota
2007 - Ongoing
Provided strategic advice for negotiation of removal action with Minnesota Pollution Control Agency. Evaluated conceptual removal action design. Provided technical oversight for proposed design-build approach to remove sediments contaminated with fluorinated compounds in a cove adjacent to the Mississippi River.

Control of NAPL Seeps, Pine Street Canal Superfund Site
Green Mountain Power, Burlington, Vermont
2006 - Ongoing
An existing sand cap that was designed by others to physically isolate chemical contaminants from the overlying water has failed, and nonaqueous-phase liquid (NAPL) is seeping through the cap and entering the water column. ARCADIS has been retained to evaluate NAPL controls that will eliminate seepage into the canal and can be readily and economically implemented as partial replacement for the existing sand cap. Serving as principal in charge for this evaluation, design, and construction effort, with responsibility for ensuring that activities are consistent with project goals and that technical work products meet quality assurance standards.

Sediment Removal Action
3M Corporation, Sayerviille, New Jersey
2008
Assisted client with review of proposed removal action at Horseshoe Road Superfund Site on Raritan River. Evaluated capping, removal, and natural recovery.

Evaluation of Proposed Removal Action
Ford Motor Company, River Raisin, Michigan
2008
Evaluated the USEPA-proposed removal action for contaminated sediments in this highly industrialized river drainage. Advised client on removal action costs and benefits. Evaluated potential for additional PRP involvement. Performed limited sampling to refine agency proposed removal action design.

Contaminated Sediment Management and Remedial Design
Confidential Client, Rada di Augusta, Sicily, Italy
2005 - Ongoing
Working to define an overall strategy regarding 9,000,000 cubic yards of contaminated sediments in Rada di Augusta, a 25-square-kilometer bay. Initially asked to review the Italian government's investigation results and cleanup plan, which revealed extensive enrichment in mercury from a local chloralkali plant, as well as petroleum hydrocarbon contamination. The government's plan calls for large-scale dredging and construction of a confined disposal facility. Since performing the initial data review, ARCADIS has conducted focused sampling to evaluate conditions in the in the bay and is currently working with the Ministry of the Environment and its oceanographic research division to refine the proposed design and larger site strategy. An engineering evaluation is under way to assess remediation alternatives based on a multi-technology approach appropriate to this enormous and complex site.

Contaminated Sediment Management and Remedial Design
Confidential Client, Navassa, North Carolina
2006 - Ongoing
Prior investigation results indicated the presence of lead and other metals in the nearshore sediments adjacent to this former fertilizer plant on the Cape Fear River. Initially asked to review the existing engineering evaluation/cost analysis (EE/CA) as an expert on the remediation of contaminated sediments. Following the EE/CA review, the client tasked ARCADIS with additional responsibilities. Now leading pre-design sampling of sediment and wetlands soils to support the design of a remedy.

Litigation Support for a Construction Claim
Confidential Client, Tacoma, Washington
2006 - 2007
Led a team that provided expert support regarding the validity of a contractor's claim that its own failure to perform on schedule resulted from a purportedly inadequate dredging design. Responsible for supervising engineers who reviewed the design, plans, and specifications and assisting the client's attorneys in developing their litigation strategy.

Design of Engineered Containment Facility for Contaminated Sediments
Hamilton Port Authority, Hamilton, Ontario
2004 - Ongoing
The Hamilton Port Authority, Environment Canada, and the Ontario Ministry of the Environment are planning to construct an engineered containment facility in the Randle Reef area of Hamilton Harbour, where sediments are contaminated as the result of a coal-tar spill in the 1980s. Serving as the environmental studies task manager and overall technical advisor for this multidisciplinary project. Critical factors for design include contaminant transport and fate, short-term and long-

term water quality, and effluent treatment. The basis of design report and final design have been completed and accepted by the multi-agency consortium sponsoring the project. Construction is anticipated in 2010.

Litigation Support, Gashouse Cove Marina
Pacific Gas and Electric Company (PG&E), San Francisco, California
2004 - Ongoing
Gashouse Cove Marina is located at the site of a former manufactured gas plant (MGP) once operated by PG&E. Sediments in the vicinity are contaminated with polycyclic aromatic hydrocarbons from multiple sources, including the MGP. Working with PG&E's legal department to evaluate the City of San Francisco's proposed plan for redevelopment of the marina - the plan calls for dredging, which has the potential to expose contaminated sediments - and the City's claim against PG&E for partial cost of the redevelopment. In addition to litigation support, the team is conducting source evaluation and engineering analysis to help ensure that PG&E's level of responsibility is accurately assessed.

Due Diligence Investigation
Port of Tacoma, Tacoma, Washington
2006 - 2007
Serving as a consultant to the Port's environmental, real estate, and legal departments as they work to evaluate the Port's responsibilities and liabilities should it decide to purchase a large, contaminated property. The effort involves evaluating extensive environmental documentation reaching back to a 1970s-era cleanup, as well as the site's 100-year industrial history, its multi-agency regulatory history, and large-scale soil, groundwater, and sediment contamination with chlorinated solvents and caustics.

Litigation Support for Insurance Cost Recovery
Nadler Law Group and Confidential Puget Sound Port Authority, Washington
2005
Retained to serve as expert for a complex insurance cost recovery matter involving numerous waterfront properties. The key element of this case involved cost-recovery claims for construction of a confined disposal facility to contain contaminated sediments.

Upland Source Control Investigation and Remediation
Port of Portland, Portland, Oregon
2004 - 2005
Served as the principal in charge on this 5-year contract to evaluate and clean up multiple Port terminals and other properties along the Willamette River. The work involved review of historical and current site information and ongoing investigation consistent with agreements between the Port and Oregon Department of Environmental Quality.

EE/CA for Non-Time-Critical Removal Action
Port of Portland, Portland, Oregon
2003 - 2005
Served as project manager for a 3-year contract to provide technical assistance for the removal of contaminated sediments adjacent to Terminal 4. ARCADIS's responsibilities included managing characterization of contaminated Willamette River sediments, preparation of an engineering evaluation/cost analysis (EE/CA) in accordance with the Administrative Order by Consent between the Port and U.S. Environmental Protection Agency (USEPA) Region 10, and preparation of associated work plans and technical reports. Coordinated with the Port to integrate data and decision making for Terminal 4 with work at the larger Portland Harbor Superfund Site and to incorporate upland source control strategies now under development into removal alternatives for Terminal 4. The EE/CA was reviewed by the USEPA and accepted without comment.

Elliott Bay Water Quality Monitoring and Sediment Sampling
US Army Corps of Engineers, Seattle, Washington
2003 - 2004
The Pacific Sound Resources Superfund site, located on Elliott Bay, has long been a source of hazardous substances associated with former wood-treating operations. Cleanup actions included removing about 700 treated wood pilings, dredging 10,000 cubic yards of contaminated nearshore sediments, and placing a clean sediment cap over about 58 acres of contaminated sediments. ARCADIS supported the construction effort by monitoring water quality during dredging and cap placement and by conducting verification sampling to confirm the integrity and thickness of the engineered cap. Served as the officer in charge for ARCADIS's responsibilities, which included writing the sampling, monitoring, and quality assurance plans, mobilizing in the field to collect water quality and vibracore sediment samples, and coordinating laboratory analysis and data validation. Prior to cap placement, ARCADIS also coordinated physical and chemical testing of the import material to ensure it was suitable for use.

Sediment Sampling Program at Marine Transfer Stations
New York City Department of Sanitation, New York Harbor, New York
2003 - 2004
Working on behalf of the prime contractor, ARCADIS executed an initial sediment sampling program related to the conversion of eight former marine transfer stations operated in New York Harbor by the New York City Department of Sanitation. Conversion of the solid waste facilities involves demolishing several structures, removing old piles, repairing bulkheads, and dredging to increase navigational depths. Served as technical specialist for ARCADIS's sediment sampling program, which was designed to provide preliminary sediment and water quality data to aid in determining the engineering controls needed to limit contaminant releases to surface water during construction, as well as to identify handling, transportation, and disposal options for the dredged sediment.

Litigation Support for Insurance Cost Recovery
Short, Cressman, and Burgess and Confidential Puget Sound Port Authority, Washington
2002
Retained as an expert to review extensive documentation and current site conditions at multiple facilities owned by a mid-sized port authority. The sites included a shipyard, a boatyard, a landfill, and other types of active and unused facilities. Activities included extensive interaction with the port's attorneys, review of reports, site visits and interviews, preparation of expert opinions, and depositions. The port prevailed in its complaint and received a settlement in keeping with its expectations.

North Channel Confined Disposal Facility
Port Authority of Venice, Venice, Italy
2001 - 2002
The Port of Venice is contemplating construction of a large confined disposal facility to contain contaminated dredge materials. Retained by the Port as a special consultant to address contaminant mobility issues associated with facility construction. Short- and long-term issues are under consideration.

Sediment Treatment Technology Evaluation
State of Washington
2001
Served as project manager and senior scientist to evaluate several contaminated sediment treatment technologies for their effectiveness, implementability, and cost under three DNR-specified scenarios - two were particular to Bellingham Bay, where a multiagency group is working to establish a model process for selecting disposal sites; the third was more widely applicable to contaminated sediments from throughout Puget Sound. Together, the three scenarios form a natural progression for the development of sediment treatment technology in the region.

Removal Action at the Olympic View Resource Area
City of Tacoma, Tacoma, Washington
2001 - 2002
The USEPA approved a removal action at the Olympic View Resource Area (OVRA) to address approximately 2.2 acres of contaminated marine sediments within the 12.4-acre OVRA site. ARCADIS designed the removal action - including the development of design and construction documents, design methods, assumptions, and evaluations - and documented quality assurance methods in a construction quality assurance plan. In addition, ARCADIS was involved in the performance of an engineering evaluation/cost analysis for the removal action that summarized investigation results and evaluated remedial alternatives in accordance with the National Contingency Plan. Following public comment and USEPA review, a preferred remedial alternative was selected. The design team's analysis report presented design criteria and

regulatory requirements for the preferred alternative, rationales for design decisions, and a detailed construction cost estimate. Served as senior technical review scientist for the project.

Metal Bank Superfund Site Remediation
PRP Group, Philadelphia, Pennsylvania
1998 - 2001
At this former metals recycling facility located on the banks of the Delaware River, river sediments and upland areas are contaminated with polychlorinated biphenyls from the recycling of 1970s-era transformers and transformer oils; the design team was responsible for remediation of the river sediments. Provided senior technical review during development of the preliminary design submittal to USEPA Region III.

Design of Hylebos Waterway, Phase I Dredging, Slip 1 Disposal
Port of Tacoma, Tacoma, Washington
1999 - 2002
Cleanup of the outer Hylebos Waterway will be the third major cleanup in the Commencement Bay Nearshore Tideflats since the bay was declared a Superfund site. Served as project manager for all three design projects. In this cleanup, contaminated sediments at the mouth of the waterway will be dredged and deposited in a confined disposal facility being constructed in Slip 1 at the Blair Waterway. While serving as project manager, responsibilities included senior technical review and oversight of all project elements, including design of both the dredging plan and the containment facility.

Hylebos Waterway, Area 5106 Dredging and Disposal Project
Port of Tacoma, Tacoma, Washington
1999 - 2002
Provided the Port with technical oversight as it developed plans for the dredging, treatment, and disposal of approximately 50,000 cubic yards of sediments heavily contaminated with volatile organic compounds. Plans called for hydraulic dredging followed by thermal treatment of the sediments at an upland treatment plant and disposal of the treated sediments in a confined disposal facility to be constructed in Slip 1 of the Blair Waterway. Responsible for reviewing all technical documents on behalf of the Port, including studies of fate and transport and the engineering evaluation/cost analysis.

Ross Island CAD Cells Assessment
Port of Portland, Portland, Oregon
1998 - 2000
From 1992 to 1998, sediments dredged by the Port of Portland were disposed of under permit at five capped aquatic disposal (CAD) cells in Ross Island Lagoon (Willamette River), where sand and gravel mining is ongoing. In 1999, the Port asked the design team to initiate a comprehensive site investigation to evaluate regulatory and environmental issues associated

with use of the CAD cells, including such components as contaminant fate and transport, geotechnical stability, and ecological and human health risks. Served as program manager and provided senior technical review for the investigation, which incorporated extensive sampling of soil, sediments, and groundwater; a thorough review of the mining and disposal history, including a detailed permit review; biological surveys; risk assessments; and an analysis of lagoon bathymetry and groundwater flow and gradient. Evaluation of the investigation results will in part be used by the Oregon Department of Environmental Quality to determine whether this type of confined disposal will continue in Oregon. The investigation results demonstrated conclusively that capped aquatic disposal can be accomplished in an environmentally safe manner and that these CAD cells in particular are functioning as intended to isolate Port dredged material from the environment.

Thea Foss and Wheeler-Osgood Waterways Pre-Remedial Design
City of Tacoma, Tacoma, Washington
1994 - 2003
Served as project manager for the sediment remedial design component of this large-scale waterway redevelopment. The 8,000-foot-long waterway receives considerable storm drainage, as well as direct discharges from adjacent industries. Because of the variety of inputs, including impacts from operation of a former manufactured gas plant, there are several inorganic and organic constituents of interest in the sediments, such as oils, tars, polycyclic aromatic hydrocarbons, phthalates, and PCBs. Technical elements of the remedial design included an evaluation of source control measures, a natural recovery analysis, an evaluation of potential disposal sites, a hydrographic survey, and the development of habitat mitigation plans. The remedial design included natural recovery in the mouth of the waterway, enhanced natural recovery in its middle section, and more active remediation at the head of the waterway. Several alternatives were considered for the active remediation, including capping the contaminated sediments in place or removing them to a confined aquatic, nearshore, or upland disposal site. The pre-remedial design process concluded in 2000, and the remediation plan has received USEPA approval. The remedy will incorporate the dredging of approximately 700,000 cubic yards of sediments and the capping of 36 acres, including thin-layer and thick-layer caps, as well as an innovative hybrid sorbent cap that will combine the traditional function of isolation with a treatment component for oily seeps. In addition, managed the design of a confined disposal facility in the adjacent St. Paul Waterway, where the dredged sediments will be placed. Also assisted the city in a related effort to proportionately allocate cleanup costs among numerous non-City potentially responsible parties and to recover the City's costs from its insurers.

Contaminant Mobility Investigation and Dredging Feasibility Study
Confidential Client, Massachusetts
1998 - 2000
Served as technical specialist for issues of contaminant mobility and remedial alternatives in the evaluation of an historical manufactured gas plant. The site is regulated under the

Massachusetts state cleanup program. Assisted the owners and prime consultants in their assessment of oil-releasing sediments; key to investigation was an evaluation of nonaqueous phase transport from upland areas to sediments, from sediments to the water column, and through the water column offsite to nearby estuaries. To accomplish this analysis, evaluated existing data, proposed additional data gathering to close gaps, and assisted in the development of a focused feasibility study for remedial action at site. Evaluated several technologies, including dredging to remove oil-containing sediments, capping, natural recovery, and control of nonaqueous phases, both to determine the best available technical approach and to control potential costs. Ultimately, provided the client, a potentially responsible party, with the information necessary to negotiate a financial settlement relieving it of future liability for the site. Cleanup is now under the authority of the State of Massachusetts.

Grand Calumet River/Indiana Harbor Ship Canal Remedial Options Assessment
PRP Group, East Chicago/Gary/Hammond, Indiana
1997 - 1999
On behalf of the potentially responsible parties (PRPs), assessed remedial options for sediments in this system under a Natural Resource Damage Assessment action brought by the Natural Resource Trustees, which included the USEPA, the U.S. Fish and Wildlife Service, and the Indiana Department of Natural Resources. Acted as technical specialist for the evaluation of remedial alternatives. Assisted the project team by identifying gaps in the existing data set; defining the need for further technical studies; interpreting existing chemical and physical testing data; establishing the history of dredging and sediment deposition in the waterways; and providing strategic guidance to the PRP group. On the basis of this evaluation, the PRPs have made a settlement offer to the regulatory agencies that is under consideration.

Island End River MGP Site Evaluation
Eastern Enterprises, Weston Massachusetts
1998 - 2001
Retained by the potentially responsible parties to evaluate the feasibility of reconfiguring a confined disposal facility (CDF) proposed to contain sediments contaminated with polycyclic aromatic hydrocarbons at this Boston Harbor site of a former manufactured gas plant. In addition, assessed methods for managing sheen-producing sediments that will remain outside the CDF's boundaries. Provided senior technical review for these evaluations, with particular emphasis on oil seepage and innovative approaches to the management of oily sediments.

Brooklyn Navy Yard Confined Disposal Area Feasibility Study
Brooklyn Navy Yard Development Corporation, Brooklyn, New York
1998 - 2000
Faced with the necessity of dredging to accommodate ongoing vessel maintenance, evaluated the feasibility of constructing a bermed, nearshore confined disposal facility (CDF) at the head of the Wallabout Channel to contain up to 450,000 cubic yards of dredged material. In addition, the

feasibility study examined other disposal alternatives, such as constructing an upland CDF, using the dredged material as landfill cover, or removing the material for offsite disposal under a mine reclamation program. In support of the feasibility study and other efforts, provided senior technical review, with particular emphasis on the assessment of chemical fate and transport and contaminant mobility. Other elements of the project included development of a conceptual design for the CDF and an evaluation of the regulatory structure and key permitting requirements.

Fox River Dredging
Fort James Corporation, Green Bay, Wisconsin
1998 - 2000
As a result of historical discharges to the river system, bottom sediments in the lower Fox River are impacted by PCBs. As one potentially responsible party (PRP), Fort James Corporation had a keen interest in the selection of appropriate, technically sound, and cost-effective remediation and restoration actions. During early planning for a possible remedial action, assisted Fort James in assessing issues broadly associated with its liability. After a demonstration dredging project undertaken by the state and the Fox River Group, a PRP organization, failed to meet expectations and attain cleanup goals, Fort James elected to independently redesign and complete the project as a full-scale removal. For that more recent work, managed technical oversight of the dredging design. Careful engineering of the dredge prism was a key issue; because capacity at the disposal site was limited, cleanup goals had to be achieved while limiting the removal to 50,000 cubic yards. Following the removal action, verification sampling showed that the design team's engineering had successfully met both objectives, resolving Fort James' obligations at the site.

Claremont Channel Deepening
Hugo Neu Schnitzer East (HNSE), Jersey City, New Jersey
1997 - 2002
This project, a public-private partnership among the State of New Jersey, the City of Jersey City, HNSE (a major metal recycling firm), and Liberty National Development Corporation, incorporated several phases, all associated with improvements in the Claremont Channel. Key elements of the proposed effort included dredging 1.25 million cubic yards of contaminated sediments and beneficially using the dredged material to create 5 acres of intertidal habitat, as well as to cap two former upland industrial properties and grade a new golf course. Dredged material employed at the upland sites and in the golf course will be amended with PROPAT®, a product manufactured by HNSE from auto shredder residue, a recycled material. Served as a technical specialist regarding matters of dredging design, CDF design, bench-scale and pilot-scale mixing studies, permitting, and project funding, which will include state bond funds and funds designated for demonstrating the efficacy of new remediation technologies.

Nearshore Confined Disposal Facility
River Terminal Development Corporation, New Jersey
1996 - 1999
Served as a technical specialist for permitting and conceptual design of the first nearshore confined disposal facility in the New York-New Jersey area proposed for construction specifically to contain contaminated sediments. In the early project stages, responsibilities included negotiating with the Corps of Engineers and regional regulators (including the New Jersey Department of Environmental Protection) to secure the necessary permits. Also led discussions with local environmental groups to develop support for the remediation of severely contaminated sediments, which would lead to some habitat destruction, as well as to redevelop an important waterfront facility. Participation included assessments of contaminant mobility and habitat mitigation requirements.

Remedial Investigation/Feasibility Study (RI/FS) of Shipyard Sediment Operable Unit
Confidential Client, Seattle, Washington
1994 - 2000
Served as project manager for work undertaken on behalf of a potentially responsible party. Reviewed the USEPA's remedial investigation/feasibility study documents, developed supplemental remedial investigation strategies, and negotiated the statement of work and Administrative Order on Consent with the USEPA. Technical aspects of the preremedial design studies included surface and subsurface sediment sampling, biological evaluations, and natural recovery analysis. Involvement continued through design analysis and development of a preliminary remedy design that included limited dredging and capping. As a result of this work, the design team was successful in demonstrating to the USEPA that large-scale active remediation was unnecessary, thus reducing the projected costs of remedial action by more than a factor of 10.

Litigation Support for Blair, Sitcum, and Milwaukee Waterways Cost-Recovery Action
Attorneys for the Port of Tacoma, Tacoma, Washington
1995 - 1997
In support of litigation and cost-recovery actions, investigated the origins of sediment contamination in the waterways and adjacent upland properties and developed dredging and sediment contamination chronologies. To this end, implemented a methodology structured to capture all available literature and documentation, including such sources as Port contract records, Corps of Engineers files, previous investigations, aerial photographs, and personal interviews. Once gathered, the historical information was then correlated with sediment contamination profiles to provide technical grounds for legal action against insurers and other potentially responsible parties. The work culminated with testimony as an expert technical witness.

Sitcum Waterway Remediation
Port of Tacoma, Tacoma, Washington
1991 - 1995
Served as project manager for this complex, long-term remediation, the largest sediment remediation ever undertaken by USEPA mandate. One purpose of the project was to increase container terminal space by filling approximately 70 percent of the Milwaukee Waterway with 1.6 million cubic yards of fill sediments taken from the Blair Waterway (where redevelopment plans called for removing sediments to expand Port facilities) and the Sitcum Waterway (where sediment removal was a component of the CERCLA cleanup). The project began with a conceptual design in the early 1980s and progressed to encompass sediment quality testing, geotechnical engineering, hydrogeologic evaluations, and pre-remedial design and remedial design phases. Conceptualized specialty services executed by the design team that included elutriate, leaching, and settling tests; natural recovery modeling; and dredge and disposal water quality modeling. In addition, managed environmental permitting issues and ensured compliance with CERCLA and Clean Water Act mandates.

Mercury Contamination Source Evaluation Middle Waterway
Foss Maritime, Tacoma, Washington
1990 - 1993
Served as project manager for this investigation of the source of mercury contamination in sediments. Conceptualized and oversaw focused sampling of seeps, upland soils, and sediments to assess ongoing source control measures. This project required a comprehensive review of historical sources of mercury deposited in the waterway, which in turn led to subsequent development of an expanded PRP list. Components of the pre-remedial design included natural recovery modeling and an assessment of the feasibility of various alternatives for confined disposal.

Sediment Assessment of Blair Waterway, Slip 2 Nearshore Fill
Port of Tacoma, Tacoma, Washington
1987 - 1990
This logistically complex project called for expanding the land area of Terminal 3 and constructing Terminal 4 by dredging adjacent offshore sediments and using the dredged material to fill Slip 2. As project manager, oversaw the collection of sediment samples using hollow-stem augers, impact coring, and vibracoring through 40 to 60 feet of water and to 20 to 40 feet below the mud line. Able to significantly reduce the sampling and analysis requirements through negotiations with regulatory agencies. In addition, and of considerable benefit to the client, initial assessment of sediment chemistry was so thorough that when the Port altered its original plan, it was not necessary to negotiate the chemistry requirements.

Open-Water Disposal Permit for Sitcum Waterway Maintenance Dredging
Port of Tacoma, Washington
1987 - 2000
As project manager for Puget Sound Dredge Disposal Analysis (PSDDA) compliance, negotiated with regulatory agencies to develop technically sound and cost-effective sampling plans, oversaw and managed sampling and chemical analyses, and provided senior review of technical studies. Successfully obtained PSDDA-related permits.

Open-Water Disposal Permit for Everett Marina Project
Port of Everett, Washington
1989
As project manager for Puget Sound Dredge Disposal Analysis (PSDDA) compliance, negotiated with regulatory agencies to develop technically sound and cost-effective sampling plans, oversaw and managed sampling and chemical analyses, and provided senior review of technical studies. Successfully obtained PSDDA-related permits.

Open-Water Disposal Permit for Hylebos Facility Project
Lone Star NW, Washington
1990
As project manager for Puget Sound Dredge Disposal Analysis (PSDDA) compliance, negotiated with regulatory agencies to develop technically sound and cost-effective sampling plans, oversaw and managed sampling and chemical analyses, and provided senior review of technical studies. Successfully obtained PSDDA-related permits.

Open-Water Disposal Permit for West Blair Terminal Project
Port of Tacoma, Washington
1995
As project manager for Puget Sound Dredge Disposal Analysis (PSDDA) compliance, negotiated with regulatory agencies to develop technically sound and cost-effective sampling plans, oversaw and managed sampling and chemical analyses, and provided senior review of technical studies. Successfully obtained PSDDA-related permit.

Open-Water Disposal Permit for SeaLand Pier Extension Project
Port of Tacoma, Washington
1989
As project manager for Puget Sound Dredge Disposal Analysis (PSDDA) compliance, negotiated with regulatory agencies to develop technically sound and cost-effective sampling plans, oversaw and managed sampling and chemical analyses, and provided senior review of technical studies. Successfully obtained PSDDA-related permits.

Open-Water Disposal Permit for Pier 7D
Port of Tacoma, Washington
1988
As project manager for Puget Sound Dredge Disposal Analysis (PSDDA) compliance, negotiated with regulatory agencies to develop technically sound and cost-effective sampling plans, oversaw and managed sampling and chemical analyses, and provided senior review of technical studies. Successful obtained PSDDA-related permits.

Open-Water Disposal Permit for Terminal 3
Port of Tacoma, Washington
1987
As project manager for Puget Sound Dredge Disposal Analysis (PSDDA) compliance, negotiated with regulatory agencies to develop technically sound and cost-effective sampling plans, oversaw and managed sampling and chemical analyses, and provided senior review of technical studies. Successfully obtained PSDDA-related permits.

Selected Publications and Presentations

PIANC Environmental Commission. 2009. Dredging Management Practices for the Environment: A Structured Selection Approach. PIANC WG 100 (ex EnviCom 13. 2009). Member of the International Working Group 100.

Dunn, S.M., B.L. Kellems, and P.A. Spadaro. 2009. Long-Term Recontamination Modeling at a Sediment Remediation Site. In Proceedings of the 5th International Conference on Remediation of Contaminated Sediments. Jacksonville, Florida, February 2-5, 2009.

Parmelee, R., B.L. Kellems, S.M. Dunn, P.A. Spadaro. 2009. Evaluation of NAPL migration mechanisms at the Pine Street Canal Superfund Site. In Proceedings of the 5th International Conference on Remediation of Contaminated Sediments. Jacksonville, Florida, February 2-5, 2009.

Dunn, S.M., B.L. Kellems, and P.A. Spadaro. 2008. Recontamination Analysis at a Sediment Remediation Site. In Proceedings of the Western Dredging Association, Twenty-eighth Technical Conference and Thirty-ninth Texas A&M Dredging Seminar. June 8-11, 2008, St. Louis, Missouri.

Spadaro, P.A. 2007. Sediment remediation technologies presented at the Environmental Law Education Conference, Washington Environmental Cleanup Conference, Seattle, Washington, June.

Spadaro, P.A., and C. Vogt. 2007. Innovation in Dredging through Collaboration – A Worldwide Connection, chaired the WEDA Environmental Commission Panel at WODCON XXVIII Global Dredging Congress, Lake Buena Vista, Florida. May/June.

Spadaro, P.A. 2006. Preparing infrastructure for cargo: Outside the gates. Panel participant, American Association of Port Authorities Conference on Harbors, Navigation, and Environment, Vancouver, British Columbia, June.

Spadaro, P.A. 2006. Program summary of Day 1 and introduction of Day 2, The Harbors and Sediments Conference of the International Society of Environmental Forensics, Honolulu, Hawaii, April.

Fabian, K., and P.A. Spadaro. 2006. The role of confined disposal facilities in contaminated sediment remediation, given at the Third European Conference on Contaminated Sediments, Budapest, Hungary, March.

Spadaro, P.A. 2006. The construction phase of the project, presented at the Environmental Law Education Center Advanced Sediment Conference, Seattle, Washington, September.

Spadaro, P.A. et al. 2003. Hydrogeologic assessment of the north channel CDF, Porto Marghera, Venice, Italy. Proceedings, International Conference on Remediation of Contaminated Sediments, Venice, Italy, September.

Spadaro, P.A., and L. Rosenthal. 2003. The concept of adversarial legalism as applied to waterfront cleanup. Proceedings, International Conference on Remediation of Contaminated Sediments, Venice, Italy, September.

Spadaro, P.A., and M.L. Henley. 2003. Thea Foss Waterway remedial design-Observations for future projects. Poster presentation, International Conference on Remediation of Contaminated Sediments, Venice, Italy, September.

Spadaro, P.A. 2003. Analysis of technical considerations for nearshore CDF design. Poster presentation, International Conference on Remediation of Contaminated Sediments, Venice, Italy, September.

Spadaro, P.A. 2003. Capping of NAPL-containing sediments, presented at the Environmental Law Education Center Seminar on Contaminated Sediments, Portland, Oregon, September.

Mohan, R., and P.A. Spadaro. 2003. State-of-the-art design for capping NAPL-containing sediments. Presentation, Western Dredging Association Twenty-Third Annual Meeting, Chicago, Illinois, June.

Mohan, R., P.A. Spadaro, and D. Ludwig. 2003. Habitat design considerations for in situ caps. Presentation, Electric Power Research Institute workshop on in situ capping of contaminated sediments, Cincinnati, Ohio, May.

Spadaro, P.A. 2003. Guest instructor, environmental dredging short course, Texas A&M University, College Station, Texas, January.

Spadaro, P.A. 2002. Guest lecturer, theory of adversarial legalism relative to dredging and waterfront redevelopment projects, Goldman School of Public Policy, University of California Berkeley, Berkeley, California, November.

Kellems, B.L., and P.A. Spadaro, R. McGinnis, J. Morrice, and M. Lear. 2002. Design of sorbent cap for control of seepage and sequestration of coal-tar NAPL and PAHs. Presentation, Third Specialty Conference on Dredging and Dredged Material Disposal, COPRI/ASCE, Orlando, Florida.

Moore, R.F., and P.A. Spadaro, and S. Degens. 2002. Ross Island Lagoon - A case study for confined disposal of contaminated dredged material, Portland, Oregon. Presentation, Third Specialty Conference on Dredging and Dredged Material Disposal, COPRI/ASCE, Orlando, Florida.

Graalum, S.J., P.A. Spadaro, and M.L. Henley. 2002. Thea Foss Waterway remediation and St. Paul Waterway nearshore fill design. Presentation, Third Specialty Conference on Dredging and Dredged Material Disposal, COPRI/ASCE, Orlando, Florida.

Spadaro, P.A. 2001. Sequential risk mitigation in contaminated sediment management at the Thea Foss Waterway Superfund site, Tacoma Washington, USA. Presentation, International Conference on Remediation of Contaminated Sediments, Venice, Italy.

Spadaro, P.A., R. Moore, and S. Degens. 2001. Confined dredged material disposal investigation, Ross Island Lagoon, Portland, Oregon. Presentation, Twenty-First Western Dredging Association Annual Meeting and Conference and the Thirty-Third Texas A&M University Dredging Seminar, Houston, Texas.

Spadaro, P.A. 2000. Evaluation of five capped aquatic disposal cells in Portland, Oregon. Presentation, Conference on Dredged Material Management: Options and Environmental Considerations, Massachusetts Institute of Technology, Cambridge, Massachusetts.

Graalum, S.J., P.A. Spadaro, and M.L. Henley. 2000. Thea Foss Waterway remediation: Design status report. Presentation, Western Dredging Association XX and Texas A&M Thirty-Second Annual Dredging Seminar, Providence, Rhode Island.

Spadaro, P.A., S. Garbaciak, R.G. Fox, D.W. Matthews, and R.M. Weaver. 1999. Site characterization and remedial design issues for contaminated sediments associated with historical manufactured gas plants. Presentation, Characterization and Treatment of Sediments (CATS 4) Conference, Antwerpen, Belgium.

Garbaciak, S., P.A. Spadaro, T.M. Thornburg, and R.G. Fox. 1997. Sequential risk mitigation and the role of natural recovery in contaminated sediment projects (preprint), given at the International Conference on Contaminated Sediments, Rotterdam, The Netherlands.

Spadaro, P.A., M.L. Henley, and J.R. Verduin. 1997. Interim status report: Thea Foss and Wheeler-Osgood Waterways cleanup. Presentation, Western Dredging Association, Eighteenth Annual Meeting.

Verduin, J.R., P.A. Spadaro, and T. Wang. 1996. A general framework for consideration of a nearshore CDF: Contaminated sediment confinement and upland creation. Presentation, Western Dredging Association, Seventeenth Annual Meeting.

Templeton, D.W., and P.A. Spadaro. 1996. The role of natural recovery in contaminated sediment. Presentation, Western Dredging Association, Seventeenth Annual Meeting.

Spadaro, P.A. 1995. Sediment remediation: Puget Sound case studies. Presentation, Law Seminars International's West Coast Conference on Contaminated Sediments.

Spadaro, P.A., D.W. Templeton, G. L. Hartman, and T.S. Wang. 1993. Predicting water quality during dredging and disposal of contaminated sediments from the Sitcum Waterway in Commencement Bay, Washington. Water Science Technology, Vol. 28, No. 8-9, p. 237-254.

Templeton, D.W., P.A. Spadaro, and R. Gilmur. 1993. The role of natural recovery in sediment remediation projects. Proceedings, the International Conference on Contaminated Sediment Remediation, Milwaukee, Wisconsin.

EXHIBIT D

ARCADIS

Education
BS, Chemical Engineering, Clarkson University, Potsdam, NY, 1982

Years of Experience
Total - 27
With ARCADIS - 21

Professional Registrations
Professional Engineer, IL, since 2000
Professional Engineer, KY, since 1995
Professional Engineer, MI, since 2000
Professional Engineer, NJ, since 2000
Professional Engineer, NY, since 1990
Professional Engineer, PA, since 2000
Professional Engineer, SC, since 2008
Professional Engineer, TN, since 2000
Professional Engineer, TX, since 2000

Professional Associations
National Society of Professional Engineers (NSPE)
Western Dredging Association (WEDA)
American Institute of Chemical Engineers (AIChE)

J. Paul Doody, PE

Senior Vice President

Mr. Doody has more than 27 years of professional experience most of which specializing in environmental engineering, remedial design activities, construction projects, RI/FS activities, treatability studies, and risk assessments. While specializing in managing and remediating impacted aquatic systems, Mr. Doody's experience also includes engineering services at manufacturing plants and other industrial facilities.

Project Experience

Remedial Design (RD) for Dredging
Confidential Client,Northeast United States
Lead design engineer for remedial design for dredging, processing, transport, and disposal of PCB-containing sediment from a major waterway. This has included overseeing and being in charge of development of work plan; development and implementation of work plans for engineering data collection, habitat delineation and assessment, and treatability studies; development of preliminary design, intermediate design, and final design (i.e. design reports, plans, specifications) packages; review and comment on performance standards; and review and comment on agency reports regarding siting of sediment processing facility.

Remedial Investigations/Assessments/Remedial Action
Confidential Client, Russellville, Kentucky
Ongoing
Project manager for ARCADIS' activities relative to Rockwell's former die casting facility. The primary project activity has been related to investigating and remediating the Town Branch Creek, which included executing remedial investigations in 1990, 1999, and 1995; developing risk assessments; developing remediation work plans; developing remedial design documents; performing remediation oversight and management; and attending meetings with the Kentucky Department of Environmental Protection (KDEP). Remediation of 3.5 miles of creek and associated floodplain soils was implemented by ARCADIS. Also involved remedial investigation of 65 miles of Mud River.

In addition to Town Branch activities, responsible for design and installation of wastewater treatment system for removal of PCBs from die cast wastewater; investigation and cleanup within the die cast facility; design and installation of spring collection and treatment; and litigation support (designated expert) related to third party lawsuits for environmental issues.

Remedial Design (RD) for Restoration

Schlumberger Technology Corporation, Twelvemile Creek, South Carolina

Ongoing

Lead engineer for the planning and design for removal of about 400,000 cubic yards with on-site disposal (including design of an on-site sediment management unit), removal of two former hydroelectric dams, and restoration of the stream channel. The restoration work is being completed under a consent decree for settlement of Natural Resource Damages associated with the Lake Hartwell/Twelvemile Creek CERCLA site.

Remedial Investigation/Feasibility Study (RI/FS)

Confidential Client, Northern New York

1995

Project manager for the completion of a remedial investigation/feasibility study (RI/FS) at a large PCB-impacted river site. The RI involved preparing a work plan for the second phase of the RI, sampling and analysis, and developing the RI report. Negotiated a Non-Time Critical Removal Action (NTCRA) for the removal of sediment containing the highest PCB levels at the site. Also managed the preparation of bid documents (i.e., performance specifications), an engineering evaluation/cost analysis (EE/CA), and environmental monitoring plan (EMP) for the NTCRA, along with managing the EMP implementation as an independent quality assurance team. Information from monitoring activities associated with the NTCRA was used in the FS for the site.

Remedial Investigation/Feasibility Study (RI/FS)

Confidential Client, Wisconsin

Prepared and submitted a draft alternatives array document (AAD) to the U.S. Environmental Protection Agency (USEPA) Region 5 for the remediation of a river system Superfund site in the Great Lakes Region. Required by the USEPA Region 5 for Superfund RI/FS activities, the AAD presents the initial phases of the FS (i.e., initial technology screening and development of remedial alternatives).

Remedial Investigation/Feasibility Study (RI/FS)

Monroe County, Rochester, New York

Managed an RI/FS for a site on the Genesee River impacted by coal tar residuals. Activities included soil, groundwater, and sediment sampling; engineering evaluation of potential remedial scenarios; and developing an RI/FS report for submittal to the New York State Department of Environmental Conservation (NYSDEC). Affected media at the site includes soils, groundwater (with nonaqueous phase liquids [NAPLs]), and sediment.

Remedial Investigation/Feasibility Study (RI/FS)

PH Glatfelter, Wisconsin

1993, Project Cost: $200,000

Project manager for the completion of an RI/FS for Lower Fox River sediment deposit in Little Lake Butte des Morts. Reviewed draft reports for the RI/FS and assisted the client in creating its strategy and positions, and preparing formal comments for submission to the Wisconsin Department of Natural Resources (WDNR). Managed the consolidation of RI/FS efforts previously performed by the WDNR into one comprehensive RI/FS document consistent with the National Oil and Hazardous Substances Contingency Plan. All data previously collected by the WDNR was reviewed for data quality and augmented with the collection of additional data. The entire RI/FS was completed in six months and submitted to the WDNR for review.

Remedial Design

Confidential Client, New York

1995

Managed the implementation of treatability studies for PCB-containing soil, sediment, and sludge at a large Superfund site. Developed and negotiated the work plan, coordinated sample collection and study execution (studies performed by treatment contractors), and developed a final report for submittal to the USEPA. Studies were performed as part of the RD at the site with evaluation of biological treatment, solvent extraction, thermal extraction, and incineration. Also coordinated several aspects of RD activities at a large Superfund site. Managed the development of an RD work plan, a comprehensive sampling and analysis plan, and a Request for Modification of Treatment Threshold Requirements. Documents were submitted to the client for review, and then to regulatory agencies.

Remedial Design/Remedial Action and Project Oversight

Tennessee Gas Pipeline Company, New York

1996

At two compressor stations, served as project manager preparing contract documents, plans, and specifications for remediation of impacted soil and drainlines; negotiating the RD with the NYSDEC; performing site oversight during the RA; and completing the documentation report. Served as the primary New York State contact for the four compressor stations at which ARCADIS conducted investigation and remedial efforts.

Excavation and Containment

Confidential Client, Wisconsin

1992

Prepared an operations plan for the excavation and containment of river sediment containing PCBs. The plan described the methods to be used for accessing various sediment deposits, dredging or armoring the sediment, as well as transportation and placement of dredged materials into a confined treatment facility. Other activities described in the plan include decontamination procedures and monitoring.

Engineering Evaluation/Cost Analysis

Confidential Client, Michigan
Provided technical review for the EE/CA prepared for the Manistique River and Harbor. The EE/CA evaluated the effectiveness, implementability, and cost associated with six remedial alternatives. The alternatives included no action, in-place containment, and sediment dredge, cap, treatment, and disposal.

Technical Attachments to Comments on Proposed Plan to Dredge
Confidential Client, New York
2001
Managed development of information for several key technical attachments to a client's comments on a USEPA proposed plan to dredge PCB-contaminated sediment from a large river system. The attachments included an environmental impact assessment, logistics of the dredging operations, assessment of resuspension issues, and realistic clarification of sediment dredging at other sites.

Technical Attachments for Proposed Plans for Two Operable Units
Confidential Client, New York
1990
Prepared technical attachments for a client's comments to the USEPA's proposed plans for two operable units of a large PCB Superfund site. The technical attachments covered topics such as PCB health effects, PCB fate and transport, in-place sediment containment, dredging limitations, innovative PCB treatment technologies, mobile incineration issues, and groundwater remediation.

Evaluation of Remedial Alternatives
Confidential Client, Northern New York
1990
Evaluated alternatives (including the development of detailed cost estimates) for the remediation of approximately 750,000 cy of soil and sediment containing PCBs at a Superfund site (aluminum foundry). Based on the nine CERCLA criteria, developed costs and provided recommendations to the client.

Evaluation of Dredging Options
Mercury Marine, Cedarburg, Wisconsin
1995
As part of an RI/FS program, developed cost estimates for hydraulic dredging and dewatering of 7,500 cy of sediment from Ruck Pond.

Design, Installation, Operation, and Maintenance of Systems Used to Recycle Deionized Rinse Water
East Fishkill, New York
1986

Responsible for the design, installation, operation, and maintenance of several systems used to recycle deionized rinse water from semiconductor manufacturing operations. Dilute rinses (typically second and/or third rinses) were collected, treated, and reused in several buildings at a large semiconductor manufacturing facility. Treatment consisted of cation/anion and mined bed deionization, reverse osmosis, granular-activated carbon, and cartridge filtration.

Site Assessment
Confidential Client, Kentucky
1991
Prepared a work plan for the site assessment of a 46-acre compressor manufacturing facility. The work plan included a site description, description of potential issue areas, and proposed investigations associated with each issue area.

Design and Construction of an Air Meteorological Tower and Air Monitoring Stations
East Fishkill, New York
Managed the design and construction of an air meteorological tower and air monitoring stations, which required approval of the NYSDEC and town planning and zoning boards. The air meteorological tower and instrumentation were installed to allow use of more site-specific information in air dispersion modeling.

Testing of Waste Drain Piping and Tanks
East Fishkill, New York
1986
Managed the testing of all waste drain piping and tanks at an industrial facility. Designed and prioritized testing schemes, and coordinated the shutdown of all facilities to enable televisual inspection and hydrostatic/pressure testing. Based on results of the inspection and testing, developed conceptual designs for, and justified implementation of, overhead "contained" gravity drains to replace all underground chemical waste drains.

Spill Response
East Fishkill, New York
1986
Previously served as spill response team leader for a major U.S. company. Developed hazardous material handling procedures, conducted training programs, and developed a spill response document that established guidelines for spill cleanup action. Confirmed that all chemical spills adversely affecting the environment were properly remediated.

Installation of Temporary Biological Treatment System
East Fishkill, New York
1982

Designed and coordinated the installation of a temporary biological treatment system consisting of bioreactors, chemical feed systems for nutrient addition and pH adjustment, and an extensive in-situ lagoon aeration system for treatment of an ethylene glycol spill. The glycol-contaminated wastewater, which had been diverted into a 1.5-million gallon emergency holding lagoon, was treated by the system and discharged to the existing sanitary waste treatment without violating the existing State Pollutant Discharge Elimination System (SPDES) permit.

Conceptual Design Alternatives for Remediation
East Fishkill, New York
1986
Developed conceptual design alternatives for the remediation of well water contaminated with volatile organic compounds (VOCs) and bacteria at a major industrial facility. Technologies evaluated included ultraviolet (UV) irradiation, ozonation, chlorination, activated carbon adsorption, and air stripping. Developed cost estimates and recommended a treatment strategy, consisting of a pilot study followed by design and construction of a full-scale system.

Landfill Characterization and Cleanup
East Fishkill, New York
1986
Coordinated the characterization and cleanup of a former landfill area contaminated with VOCs. The cleanup involved: excavating approximately 3,000 cy of soil and debris; separating large debris, manually and through use of front end loaders and backhoes; placing contaminated soil into 20-ton trailers; and disposal of the material as hazardous waste.

Implementation of Soil Removal and Disposal
Confidential Client, Hopewell, New Jersey
Managed project in which the soil was contaminated with low-level radium 226, VOCs, and metals (primarily copper). Continued activity includes investigating and remediating a separate parcel containing similar constituents.

Waste Piping and Exhaust Systems
Confidential Client, Colorado Springs, Colorado
Managing, planning, and decommissioning of waste piping and exhaust systems at a semiconductor fabrication facility.

Treatability Studies
Confidential Client, Wisconsin
1992
Managed bench-scale treatability studies using several innovative technologies for potential treatment of PCB-containing sediment from a river system Superfund site in the Great Lakes Region.

Spill Prevention Control and Countermeasure (SPCC) Plan
Confidential Client, Upstate New York
Reviewed, revised, and certified plan for a large foundry facility.

Hazardous Waste Reduction Plan
Confidential Client, New York
Evaluated requirements for the HWRP at a foundry facility and prepared the client's response to the NYSDEC regarding the plan. Based on the source of hazardous waste and discussions with the NYSDEC, it was determined that an HWRP was not required for the facility.

Remedial Recommendations
Confidential Client, Eastern Massachusetts
1995
Managed the preparation of recommendations for remediating an 1800s-era manufacturing facility. Project included reviewing existing data on site, developing and evaluating several remedial alternatives, and recommending the most pragmatic alternative.

Selected Publications

Doody, J.P., and B.S. Cushing. 2002. An evaluation of environmental dredging for remediation of contaminated sediment. In Handbook of Complex Environmental Remediation Problems, McGraw-Hill Handbooks.

Presentations

Doody, J.P. 2001. "Defining the Effectiveness of Environmental Dredging." Presented at the WEDA XXI-Plan C Session, 27 June, Houston, Texas.

Doody, J.P. 2001. "Evaluation of the Effectiveness of Environmental Dredging at Contaminated Sites." Presented at the USEPA Forum on Managing Contaminated Sediments at Hazardous Waste Sites, 31 May, Washington, D.C.

Doody, J.P. 2000. "Environmental Dredging Effectiveness: Completed Projects." Presented at the Society of Environmental Toxicology and Chemistry Conference (SETAC) 2000, 15 November, Nashville, Tennessee.

Doody, J.P. 2000. "Environmental Dredging Effectiveness: Case Studies and Lessons Learned." Presented at the University of Massachusetts Contaminated Soils Conference, 16 October, Amherst, Massachusetts.

Doody, J.P. 2000. "Pros and Cons of Potential Remedial Technologies for Contaminated Sediment." Presented at the University of Massachusetts Contaminated Soils Conference, 16 October, Amherst, Massachusetts.

Doody, J.P. 2000. "Environmental Dredging: An Evaluation of Its Effectiveness in Controlling Risks." Presented at the 32nd Annual Mid-Atlantic Industrial and Hazardous Waste Conference RPI, Rensselaer Polytechnic Institute (RPI), 27 June, Troy, New York.

Doody, J.P. 1999. "Effectiveness of Sediment Removal: An Analysis of EPA Region V's Claims." Presentation to the National Academy of Sciences/National Research Council Panel, September, Green Bay, Wisconsin.

Doody, J.P. 1998. "Practical Issues Associated with Management of Contaminated Sediment." Presented at the 14th Annual Conference on Contaminated Soils, University of Massachusetts, 21 October, Amherst, Massachusetts

Doody, J.P. 1998. "Overview of Sediment Remediation Technologies." Presented at the NCASI Contaminated Sediment Workshop, 14 July.

Doody, J.P., R. Romagnoli, H.M. VanDewalker, and W.A. Ackner. 1998. "The Future Challenges of Environmental Dredging." Presented at the 15th World Dredging Conference, 1 July, Las Vegas, Nevada.

Doody, J.P., and J.A. Goebel. 1998. "Remediation and Third Party Litigation: Town Branch Creek, Russellville, Kentucky." Presented at the Sediment Management Seminar 1998, 10 February, New Orleans, Louisiana.

Doody, J.P., D.S. Foster, and R. Romagnoli. 1995. "Sediment Remediation: How Much Does It Really Cost?" Presented at the Superfund XVI Conference & Exhibition, 6-8 November, Washington, D.C.

Doody, J.P., R.K. Goldman, and R.E. Carpenter. 1994. "Practical Issues Associated with Management of PCB-Contaminated Sediment." Presented at the New York State Water Environment Association, June.

Messur, S.D., J.P. Doody, and D.S. Foster. 1993. "The Sheboygan River and Harbor: A Case Study." Presented at the 1993 PCB Forum, March.

Doody, J.P., D.S. Foster, and D.E. Penniman. 1991. "A Summary of the Treatability of Sediments Using Innovative Technologies." Presented at the Hazardous Materials Control 91 (Formerly Superfund), December.

EXHIBIT E

ARCADIS

Education

MA/Economics, University of Michigan, Ann Arbor, MI

BA/Economics and Mathematics, Brandeis University, Waltham, MA

Years of Experience

With ARCADIS for 9 Years

Professional Qualifications

Employee Award, ARCADIS, 2009

Employee Recognition Award, Blasland, Bouck and Lee, 2004

Employee Recognition Award, Triangle Economic Research, 2002

Joseph & Ida Butman Award for Scholarship and General Leadership, 1999

Sidney S. Cohen Award in Economics, 1999

Summa Cum Laude, Senior Honors Thesis, Brandeis University, 1999

Phi Beta Kappa, Brandeis University, 1999

Wien International Scholarship, 1995-1999

Maggie Cooks Prize for Minority/Community Service, 1998

Member, American Economic Association

Poh Boon Ung

Principal Economist

Mr. Ung is a Principal Economist who specializes in environmental economics and environmental business consulting related issues. His experience spans a broad range of different areas and issues. Some of his recent work includes serving as a technical advisor to the US Army Corps of Engineers on the New Orleans Inner Harbor Navigation Canal hurricane protection project, evaluating the economic impacts of the Alaska Gasline Inducement Act (AGIA) for the State of Alaska, and estimating potential environmental liabilities for several confidential oil and gas companies and utility companies.

Mr. Ung manages projects related to water and air regulatory programs and has extensive experience in Section 316(b) assessments of the Clean Water Act. Mr. Ung has prepared Section 316(b) cost-benefit assessments for various power generating stations, including those on a major US waterway in the Northeast, the Delaware Estuary, and in the Midwest. These assessments involve various components of costs (engineering and potential power impacts) and benefits (commercial and recreational fishing). Mr. Ung has also developed models that incorporate uncertainty within a Monte Carlo framework when estimating the net benefits of various fish protection technologies being considered.

In addition, Mr. Ung manages projects involving different environmental regulations. These have included the costs and benefits of alternative emissions standards for various off-road engines, proposed emissions standards in California, and environmental/external costs of air emissions from power plants. These assessments often involve evaluation of potential health effects from proposed regulations and power generating stations. Prior to joining ARCADIS, Mr. Ung was a consultant at NERA Economic Consulting's Environmental Group where he managed similar assessments.

Mr. Ung is also skilled in the application of quantitative decision analysis (QDA), probabilistic and risk modeling techniques. He has applied these tools to develop QDA and multi-criteria decision analysis (MCDA) models to identify optimal strategic decisions under uncertainty for various industrial clients. Some of the models include assessment of dredging and remediation sites, environmental liability estimation, and cost-cap insurance feasibility. He applies a combination of Monte Carlo simulation techniques, decision tree analysis, and mathematical optimization techniques to develop these decision analysis models. The results of these models are often used to facilitate strategic planning for environmental projects. Mr. Ung also facilitates framing meetings to uncover and identify pertinent information. The information collected is then used to

support the modeling and decision-making efforts.

Mr. Ung has experience in natural resource damage assessments (NRDAs) and has been involved in evaluating trustee's NRDA valuation estimates and developing independent valuation estimates. His NRDA experience includes developing random utility models (RUMs) to estimate angler satisfaction with respect to fish consumption advisories and gains from compensatory restoration projects. Mr. Ung has also developed habitat equivalency analysis (HEA) and resource equivalency analysis (REA) spreadsheet models to determine the appropriate scale of compensatory restoration actions for losses of natural resource and ecological services. He has also managed the collection and evaluation of existing information on the characteristics and use of recreation areas. Mr. Ung is familiar with the literature on groundwater and wetlands valuation studies.

Mr. Ung's survey design, development and administration experience includes developing and administering recreational surveys, environmental health and safety (EHS) surveys and client satisfaction surveys. He has also been involved in training and monitoring counters for recreation-related surveys.

Experience

Probabilistic Cost Models
Confidential Client, various locations in South Carolina
Ongoing
Developing probabilistic cost models to evaluate soil and sediment impacts at former chemical manufacturing plants. Cost model results will be used to better understand range of potential remedial costs and identify key cost drivers at sites.

Quantitative Decision Analysis: Former Terminal Remediation
Confidential Client, Oregon
Ongoing
Assessing various remedial options and potential costs to remediate soil and sediment impacts at a former terminal. Monte Carlo simulation methods being used to quantify cost uncertainties, cost drivers and understand potential risks of different remedies.

Quantitative Decision Analysis: Terminal Remediation
Confidential Client, New Jersey
Ongoing
Assessing various remedial options, potential costs and uncertainties at a former terminal. Assessment uses Monte Carlo simulation methods to quantify cost uncertainties and understand potential risks and likelihood of meeting remedial objectives.

Probabilistic Cost Model
Confidential Client, North Carolina
Ongoing
Developing probabilistic cost model to evaluate potential remedial costs at a former chemical manufacturing plant.

Quantitative Decision Analysis: Remedial Strategy Assessment
Confidential Client, California
Ongoing
Assessing various remedial strategies at a contaminated manufacturing facility using decision analysis techniques. Assessment uses Monte Carlo simulation methods and decision tree framework to evaluate cost uncertainties, quantify potential risks associated with the various strategies and understanding impacts of different sequence of events or pathways.

Environmental Life-Cycle/Reserve Estimation
Confidential Client, Various Locations
Ongoing, Project Cost: $100,000
Developing potential environmental life-cycle costs/reserve estimates for a large portfolio of sites in Latin America. Results of assessment are being used to evaluate risks of portfolio for divestiture considerations. Assessment incorporates statistical models using limited available information for a subset of sites. Analysis also incorporates Monte Carlo simulation techniques to address uncertainties.

Statistical Evaluation/Data Analysis
Confidential Client, Various Location
Ongoing, Project Cost: $350,000
Managing and assessing large portfolio of sites including service stations, terminals, and pipelines for a confidential oil and gas client. Assessment includes data evaluation, assessment of historical remediation costs, and estimating potential future costs and future liabilities.

Natural Resource Damage Assessment: Recreational Fishing Assessment
Confidential Client, Massena, New York
Ongoing, Project Cost: $680,000
Developing random utility models (RUMs) to estimate angler satisfaction with respect to fish consumption advisories and gains from potential compensatory restoration projects. Part of the analysis involved developing and managing a large dataset of fishing sites and characteristics for modeling fishing losses from fish consumption advisories on several water bodies. Also collected and evaluated existing information on the characteristics and use of recreation areas.

Environmental Life-Cycle/Reserve Estimation
Confidential Client, Various Locations
Ongoing, Project Cost: $50,000

Developing potential environmental life-cycle costs/reserve estimates for a large portfolio of sites. Results of assessment are being used for portfolio divestiture. Assessment applies statistical models using limited available information for a subset of sites. Analysis also incorporates Monte Carlo simulation techniques to capture and quantify uncertainties.

Portfolio Model of Potential Life-Cycle Costs
Confidential Client, Various Locations
Ongoing, Project Cost: $600,000
Developing portfolio model of potential life-cycle costs of more than 2,000 sites. Part of the assessment involved developing web-based tools to collect data and statistical models to analyze data to identify cost reducing strategies. Manages annual database system of lifecycle cost data. Goal is to help client measure business unit performance and to develop strategies for reducing costs.

Data (Cost) Analysis
Confidential Client, Various Location
2009
Managed and assessed historical costs of large portfolio of service stations. Results of assessment were used to better understand and identify cost differences/drivers within the portfolio.

Quantitative Decision Analysis: Site Clean-up Assessment
Confidential Client, Arizona
2009
Assessing various clean-up strategies at a contaminated site using decision analysis techniques. Assessment uses Monte Carlo simulation methods to evaluate cost uncertainties related to excavation methods, property management options and clean-up standards.

Source Selection Evaluation Board (SSEB) Advisor
US Army Corps of Engineers, New Orleans
2008
Member of technical advisory team supporting the SSEB. Primary responsibility was to ensure a comprehensive cost/schedule/risk evaluation of each submission in response to the Request for Proposal for the Inner Harbor Navigation Canal Hurricane (IHNC) Protection Design-Build Project. The design-build scope of work included all architectural, engineering, construction, project management, quality control and other related services to design and construct a line of defense that would provide hurricane protection from surges and waves at the 100-year level. The areas to be protected included areas along the IHNC in Orleans and St. Bernard Parishes, Louisiana. Design-build value estimated at $600 million.

Redevelopment Evaluation: Decision Tree Framework Analysis

Confidential Client

2008

Developed decision tree model to help client evaluate various redevelopment options for its large idle manufacturing plant. Decision tree model considered remediation cost uncertainties, potential future liabilities, and the impact of potential revenue from sale of the property under various redevelopment scenarios. The various pathways through the decision tree were combined within a Monte Carlo simulation framework to comprehensively understand and quantify risks and associated risk drivers.

Multi-Criteria Decision Model: Sediment Removal Strategy

Confidential Client, New Jersey

2008

Developed multi-criteria decision analysis (MCDA) model to evaluate different sediment removal options for a contaminated river. The MCDA model considered various aspects of the removal process including sediment removal options, sediment excavation and transport alternatives, water treatment and sediment management options. The different combinations of feasible alternatives were evaluated within the MCDA model and evaluated using a number of different criteria (e.g. long-term effectiveness and permanence, safety, human health risks, costs, carbon footprint, public acceptance) and corresponding weighting factors within a probabilistic framework. Model results were used to finalize dredge design and support decision-making process to management and regulators.

Section 316(b) Cost Evaluation

Confidential Client, New Jersey

2008

Evaluated potential costs of several cooling water intake alternatives for a confidential utility client.

Economic Impact Assessment

Confidential Client, Texas

2008

Evaluated potential economic impacts (employment, local/state taxes) of a uranium in-situ recovery project. Analysis involved development of an IMPLAN model and the results were used to evaluate potential costs and benefits of the project.

Multi-Criteria Decision Model: Twelvemile Creek, South Carolina Dam Removal and Restoration Option Evaluation

Schlumberger, South Carolina

2008

Developed multi-criteria decision analysis (MCDA) model to help Schlumberger identify the optimum approach in removing several dams and performing restoration at Twelvemile Creek to

address natural resource damages from historical PCB releases. The MCDA model helped to evaluate uncertainties in terms of sediment volume and impact on project effectiveness, timeframe and duration of various options, and potential public and worker safety associated with different options. The model considered these different criteria and uncertainties and facilitated a structured and sound decision-making process for the project team.

Probabilistic Cost Model
Confidential Client, Europe
2008. Project Cost: $20,000
Developed probabilistic cost model to evaluate various remediation strategies for a large remediation site in Western Europe. Costs were evaluated within a Monte Carlo uncertainty analysis framework.

Tunnel Risk Analysis
City of Columbus, Department of Public Utilities, Division of Sewerage and Drainage
2008
Facilitated risk analysis workshop to identify, classify and evaluate various risk items related to construction of a series of underground tunnels.

Health and Safety Benchmarking Study
Confidential Client, New Jersey
2008. Project Cost: $20,000
Managed and develop on-line survey to collect various health and safety information for benchmarking study. Key aspect of the study was to evaluate different driving practices and accident rates among participants.

Environmental Reserve Estimation
Confidential Client, Various Locations
2008
Evaluated and estimated environmental reserves for a portfolio of sites for a confidential utility client. Evaluation applied probabilistic techniques and methods to capture risks and uncertainties for the entire portfolio. Assessment results were used for financial reporting.

Economic Impact Assessment
State of Alaska
2008
Developed IMPLAN model to evaluate and estimate potential employment impacts in Alaska from proposed construction of liquefied natural gas (LNG) plant and natural gas pipeline. Assessment was part of an evaluation of the Alaska Gasline Inducement Act, AGIA, Alaska's law designed to advance construction of a natural gas pipeline from the North Slope to a market where the gas would be sold. AGIA passed in August 2008 (House Bill 3001) making it the

largest construction project in the history of North America.

Probabilistic Environmental Cost Estimation
Confidential Client, New York
2008 Project Cost: $100,000
Managed and developed probabilistic environmental remedial cost models for a number of manufactured gas plant (MGP) sites. The cost models applied a Monte Carlo simulation approach to account for uncertainties in capital costs, operations and maintenance costs, and investigative costs. In addition, the models also incorporated potential future liability events and associated costs. Model results were used for rate case review and insurance cost recovery.

User Charge System Evaluation
Confidential Client, New Jersey
2007-2008. Project Cost: $80,000
Managed the review and assessment of proposed revisions to a user charge system model for a sewer treatment system. Also evaluated the impacts of the revisions to the different user classes.

Probabilistic Cost Model and Cost-Benefit Analysis
Confidential Client, Canada
2007. Project Cost: $50,000
Developed probabilistic cost model to evaluate range of costs for large remediation site in Canada. Costs were evaluated within a Monte Carlo uncertainty analysis framework. In addition, assessment evaluated potential costs and benefits of several alternative designs and comparing incremental costs and benefits within a cost-benefit framework.

Economic Impact Assessment
Confidential Client, Wyoming
2007
Evaluated potential economic impacts of several proposed mining sites. Analysis involved application of IMPLAN model and data to estimate impacts on employment and local/state taxes. Results were applied to evaluate potential costs and benefits of mining sites.

Multi-Criteria Decision Model: Redevelopment Evaluation
Confidential Client, Michigan
2007
Developed quantitative multi-criteria decision analysis model to evaluate different remediation options and redevelopment alternatives for a large automotive company. Criteria evaluated in the model included potential environmental remediation costs, revenue, cash flow, media attention and economic impacts. Assessment also involved development of weighting factors of the criteria for evaluating the strategic alternatives. Model incorporated combination of survey

techniques and Monte Carlo uncertainty analysis.

Probabilistic Remediation Cost Model
Confidential Client, New Jersey
2007. Project Cost: $1,753,226
Developed probabilistic model of potential remediation costs associated with a contaminated property. Results were used to determine costs of remediation for use in negotiating purchase price of property. Model combined use of Monte Carlo and decision tree framework.

Probabilistic Liability Cost Assessment
Confidential Client, Various Locations
2006, 2007, Project Cost: $25,000
Assessed potential liability costs associated with a substandard building product. Developed probabilistic cost model to estimate product liability costs associated with a substandard building product. Results of the model are used for financial reporting of a class action suit and non-class action liabilities.

Probabilistic Insulation Assessment
Confidential Client, Various Locations
2006, Project Cost: $14,000
Developed probabilistic model to estimate product liability costs associated with a substandard building product. Results of the model are used for financial reporting of a class action suit and non-class action liabilities.

Risk Analysis and Statistics
Confidential Client
2006
Developed risk analysis and related statistics for various chemicals of concern based upon exposure units. Information was used for human health and ecological risk assessment purposes.

Summary Statistics and Information Development
Confidential Client, Lawrenceville, Illinois
2006
Developing summary statistics and information for various chemicals of concern based upon exposure units. Information was used for human health and ecological risk assessment purposes.

Multi-criteria Decision Analysis: Airport Deicing Alternatives
Confidential Client, Oregon
2006-2007, Project Cost: $100,000
Developed multi-criteria decision analysis model to evaluate different deicing alternatives at a

large airport terminal. Cost assessment and other criteria factors were evaluated within a Monte Carlo uncertainty analysis framework. Results were used to assist with selection of final alternative.

Cost-Benefit Analysis: Alternative Intake Technology Assessment
PSEG, New Jersey
2006, Project Cost: $800,000
Managed the Alternative Intake Technology Assessment (AIT) and assisted with the Comprehensive Demonstration Study (CDS) preparation of PSEG's 2006 Salem Nuclear Generating Station (Delaware River Estuary) NJPDES filing in relation to Section 316(b) of the Clean Water Act. The AIT assessment involved developing both cost-benefit and cost-cost assessments of several potential fish protection alternatives including sound deterrent system, seasonal flow reduction alternatives, fish intake modifications and closed-cycle cooling retrofit. The analyses involved evaluation of potential costs (capital, operations and maintenance, power impacts) and potential benefits (recreational, commercial, non-use). Also developed Monte Carlo model that evaluated the uncertainties related to both costs and benefits.

Societal Benefits of Fluoropolymers and Fluorotelomers
DuPont (E. I. du Pont de Nemours), Wilmington, Delaware
2006, Project Cost: $300,000
Managed the evaluation of societal benefits of fluoropolymers and fluorotelomers. These substances, which have special properties that have many important manufacturing and industrial uses, are made (or byproducts) using PFOA (perfluorooctanoic acid or "C8"). The USEPA is currently investigating PFOA properties and its potential risk to human health and the environment over the long-term.

Emissions Standards Evaluation
Confidential Client
2006
Evaluated various alternative emissions standards for off-road engines. Assessment involved cost-effectiveness and cost-benefit analyses.

Alternative Resource Plan
Nevada Power Company and Sierra Pacific Power Company, Nevada
2006, Project Cost: $400,000
Managed the assessment of potential environmental costs and economic benefits (economic impacts) of alternative utility resource plans for submission to the Public Utilities Commission (PUC) of Nevada on behalf of the clients (both subsidiaries of Sierra Pacific Resources). Assessment involved evaluation of potential external costs (health effects) and economic impacts of 10 alternative resources plans being considered in 2006 Integrated Resource Plan. Results of the assessment were submitted to PUC as an expert report.

Probabilistic Model

Confidential Client, Italy

2006, Project Cost: $224,000

Developed probabilistic model of potential remediation costs associated with site.

Automobile Emissions Standards Evaluation

Confidential Client, California

2006

Evaluated effects of proposed California automobile emissions standards.

Terminal (Engineering Evaluation/Cost Analysis) Multi-Criteria Decision Analysis

Confidential Client, Oregon

2005, Project Cost: $120,000

Conducted framing session and developed multi-criteria decision analysis model to evaluate different removal alternatives of contaminated sediments at terminal. The goal of the model was to select the optimum remedial alternative in terms of evaluation criteria and project uncertainties. The evaluation criteria included short-term costs, long-term costs, revenue generation, agency acceptance, community acceptance, human health risks, and site disruption costs. Cost assessment and other criteria were developed within a Monte Carlo uncertainty analysis framework. The model results were used to convince upper-level management, regulatory agencies and various project stakeholders that the best, most cost-effective and protective alternative was selected. The alternative identified by the model has been accepted by the USEPA for implementation.

Cost-Benefit Analysis: Section 316(b) Assessment

Dynegy Northeast Generation, Inc., New York

2005, Project Cost: $300,000

Managed cost-benefit assessment of various fish protection alternatives at Danskammer Generating Station located on the Hudson River. Assessment was related to NPDES permit associated with Section 316(b) of the Clean Water Act. The results of this assessment were presented within a pre-filed testimony and also in a rebuttal testimony submitted to the New York State Department of Environmental Conservation (NYSDEC). Analysis involved evaluation of the potential costs and benefits of closed cycle cooling towers and NYSDEC draft permit conditions. Cost components analyzed included capital costs, operations and maintenance costs, and power-related impacts while the benefits components included commercial and recreational benefits.

Benefits Assessment of Potential Fish Protection Alternatives
Confidential Client, Midwest United States
2005, Project Cost: $40,000
Managed the development of potential benefits related to potential fish protection alternatives at a confidential power plant in the Midwest. Assessment was part of NPDES permitting.

Assessment of Potential Costs and Benefits of Fish Protection Alternatives
Confidential Client, New York
2005, Project Cost: $100,000
Involved in the assessment of the potential costs and benefits of different fish protection alternatives at a confidential generating station located on the Hudson River. Assessment was related to NPDES permit associated with Section 316(b) of the Clean Water Act. Evaluated potential costs (capital, operations and maintenance, power impacts) and benefits (commercial and recreational) from various alternatives.

Groundwater Contamination Natural Resource Damage Assessment (NRDA)
Confidential Client, New Mexico
2005, Project Cost: $853,000
Critiqued NRDA groundwater contamination for the South Valley Superfund site. Reviewed and replicated plaintiffs' spreadsheets. Evaluated and critiqued plaintiffs' analyses. Also assisted with the development and analyses of affirmative report of potential losses. Prepared trial exhibits and support materials for trial.

Remedial Assessment
Confidential Client, Northeast United States
2005, Project Cost: $700,000
Used a combination of decision tree analysis and Monte Carlo simulation techniques to develop cost model to identify key alternatives for large dredging project on a major waterway. Model was used to identify range of costs for different alternatives and key cost drivers of the project.

EHS Risk Management Survey
Confidential Client, Various Locations
2005, Project Cost: $224,000
Developed, implemented and administered environmental health and safety (EHS) surveys for worldwide production sites. Surveys were deployed via on-line tools. Also analyzed survey results and identified potential high-risk sites.

Wetlands Evaluation

Confidential Client, Harrison, New Jersey

2005, Project Cost: $40,000

Evaluated potential benefits of wetlands and recreational activities from development of waterfront area.

Cost Cap Insurance Evaluation

Confidential Client, Pittsburgh, Pennsylvania

2004, Project Cost: $32,000

Developed probabilistic model to evaluate costs of remediation for purchasing cost-cap insurance. Results of the model were used to estimate the feasibility of purchasing cost-cap insurance under various scenarios.

Externality Assessment

WE Energies, Milwaukee, Wisconsin

2003, Project Cost: $415,000

Assessed potential health-related damages from the proposed Elm Road generating station facilities. Applied damage-cost approach to evaluate potential health impacts from air emissions (particulate matter, nitrogen oxide, sulfur dioxide). Results were presented in rebuttal testimony.

Count Study of Ocean Recreators

Wood Tatum Sanders & Murphy and Fowler, Rodriguez & Chalos (counsel), Coos Bay, Oregon

2002, Project Cost: $550,000

Developed and supervised a count study of ocean recreators on the U.S. West Coast. Supervised and trained a total of seven part-time employees hired through local employment agency. Also prepared count and administration protocols. Analyzed data and used it to estimate recreation damages to evaluate potential diminution in the value of the Oregon coast from remnants of the New Carissa shipwreck. Results of the study was later presented in trial proceeding.

Selected Publications

Ung, P. B., et al. 2008. Alaska Natural Gas Pipeline: Employment Impacts Modeling. Prepared for State of Alaska, Department of Natural Resources, Division of Oil and Gas, May.

Ung, P.B., et al. 2006. Environmental Costs and Economic Benefits of Electric Utility Resource Selection. Prepared for Nevada Power Company, June.

Ung, P.B., et al. 2006. Societal Benefits Assessment for Fluoropolymers and Fluorotelomers. Prepared for DuPont Fluoroproducts and DuPont Chemical Solutions Enterprise, April.

Ung, P.B., et al. 2006. Assessment of Alternative Intake Technologies: Costs and Benefits of Fish Protection Alternatives at the Salem Facility. Prepared for Public Service Electric & Gas Incorporated, January.

Ung, P.B., et al. 2005. Values for Wetlands and Recreational Open Space Relevant to the Harrison, New Jersey Waterfront Site. Prepared for AKRF, Inc., October.

Selected Presentations

Ung, P.B., S. Suthersan, K. Beil and A. Troschinetz. 2010. "Greening" Decision-Making: Application of Economic and Decision Analysis Techniques towards Greener Cleanups." Presented at the 2010 Green Remediation Conference, June, Amherst, Massachusetts.

Gattenby, J. K. Beil, A. Troschinetz and P.B. Ung. 2010. "The BalancE3 Tool –Quantifying Sustainability in a Common Currency for Remedy Selection and Corrective Action Optimization." Presented at the Battelle Seventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds, May, Monterey, California.

Ung, P.B. 2009. "Environmental Liability Estimation." Presented at Palisade Energy Risk Analysis Forum, May, Houston, Texas.

Ung, P.B., D.J. Fergusan, P. Doody, and C. Moody. 2009. "Using Multi-Criteria Decision Analysis (MCDA) to Identify the Optimum Approach for Dam Removal and Stream Restoration in Twelvemile Creek, South Carolina." Presented at the Fifth International Conference on Remediation of Contaminated Sediments, February, Jacksonville, Florida.

Ung, P.B. and L. Hostetter. 2008. "Applying Probabilistic Methods to Quantify Uncertainties in the Request for Proposal (RFP) Process." Presented at Palisade User Conference North America, November, Jersey City, New Jersey.

Ung, P.B. and T. Havranek. 2007. "Environmentally Impaired Property Transaction Analysis: Combining Decision Trees and Monte Carlo Simulation." Presented at Palisade User Conference North America, October, Miami Beach, Florida.

Ung, P.B. and M.A. Wilson. 2007. "Accounting for Ecosystem Goods and Services in Coastal Estuaries." Presented at Challenges of Natural Resource Economics and Policy (CNREP 2007): the 2nd National Forum on Socioeconomic Research in Coastal Systems, May, New Orleans, Louisiana.

Ung, P.B. and D. Mac Nair. 2007. "Trade-Off Analysis for Valuing Socio-economic and

Ecosystem Impacts." Presented at Challenges of Natural Resource Economics and Policy (CNREP 2007): the 2nd National Forum on Socioeconomic Research in Coastal Systems, May, New Orleans, Louisiana.

Ung, P.B., and D. MacNair. 2003. "A Simplified Approach for Estimating the Aesthetic Impact of a Shipwreck: Combining RP and SP Data." Presented at Camp Resources XI, August, Wilmington, North Carolina.

Ung, P.B., R. Dunford, G. Mauseth, and J. Cook. 2003. "Challenges in Using Habitat Equivalency Analysis for Scaling Compensatory Restoration." Presented at the International Oil Spill Conference, April, Vancouver, British Columbia.

Contributions to Testimony in Regulatory and Judicial Proceedings

Pre-filed Direct Testimony of David Harrison, Jr., Before the Public Utilities Commission of Nevada, on behalf of Sierra Pacific Power Company, Application for Approval of Thirteenth Amendment to its 2005-2024 Integrated Resource Plan, July 14, 2006.

Pre-filed Direct Testimony of David Harrison, Jr., Before the Public Utilities Commission of Nevada, on behalf of Nevada Power Company, Application for Approval of the 2007 - 2026 Integrated Resource Plan, June 30, 2006.

Testimony of David Harrison, Jr., Ph.D., in the Matter of Central Valley Chrysler Jeep, Inc. et al. v. Witherspoon, on behalf of the Alliance of Automobile Manufacturers, May 2, 2006.

Rebuttal Testimony of David Harrison, Jr., Ph.D., in the Matter of the Renewal/Modification of the State Pollution Discharge Elimination System Permit of Dynegy Danskammer Generation Station, on behalf of Dynegy Northeast Generation, Inc., November 7, 2005.

Direct Testimony of David Harrison, Jr., Ph.D., in the Matter of the Renewal/Modification of the State Pollution Discharge Elimination System Permit of Dynegy Danskammer Generation Station, on behalf of Dynegy Northeast Generation, Inc., October 17, 2005.

Direct Testimony of William Desvousges, Ph.D., in the Matter of Application of Wisconsin Electric Power Company; Wisconsin Energy Corporation; W.E. Power, LLC for a Certificate of Public Convenience and Necessity for Construction of Three Large Electric Generation Facilities, the Elm Road Generating Station, and Associated High Voltage Transmission Interconnection Facilities to be Located in Milwaukee and Racine Counties, Docket No. 05-CE-130, September 8, 2003.

Direct Testimony of Richard Dunford, Ph.D., in the Matter of State of Oregon v. Taiheiyo Kaiun

Co., Ltd., et al., Circuit Court of the State of Oregon for Coos County, Case No. 01 CV 0383, on November 6, 2002.

Direct Testimony of Richard Dunford, Ph.D., in the Matter of State of New Mexico v. General Electric Company. et al. U.S. District Count for the District of New Mexico, Case No. CIV 99-1254, Case No. CIV 99-1118 (Consolidated by Order on June 14, 2000), on February 26, 2002.

Direct Testimony of William Desvousges, Ph.D., in the Matter of State of New Mexico v. General Electric Company. et al. U.S. District Count for the District of New Mexico, Case No. CIV 99-1254, Case No. CIV 99-1118 (Consolidated by Order on June 14, 2000).

EXHIBIT F

ARCADIS

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Matthew K. Butcher

Principal Scientist

Mr. Butcher has 29 years of experience as a consulting scientist and statistician, specializing in data analysis for environmental contamination projects, ecological risk assessments and natural resources damage assessment (NRDA). He has experience in a wide variety of statistical methods, including the statistical design of sampling programs, regression and variance analyses, multivariate analyses (including fingerprinting methods), kriging and other spatial statistics, bootstrapping, time series analysis, nonparametric statistics, and graphical data reduction.

Mr. Butcher has participated in NRDAs based on monetary, services and resources claims in both cooperative and litigation settings, in all phases of the NRD process, including sampling design and field work; statistical and other quantitative analyses (including estimation of resource losses and mortality, community impacts, habitat equivalency analysis (HEA)); and presentations and negotiations with clients and Trustees.

Mr. Butcher is also trained as an aquatic ecologist and has extensive experience in collecting and identifying aquatic macroinvertebrates in southeastern, midwestern and northwestern United States. He has conducted aquatic habitat and macroinvertebrate community assessments for clients in locations throughout the United States. He managed a biological field laboratory in South Carolina, and has managed ecological risk assessments in Ohio, Washington, and Alaska.

Spills

CITGO Refinery Oil Spill
CITGO, Louisiana
Participated in the spill response in the Calcasieu River in June 2006, when approximately 4 million gallons of slop oil was released into the River during a storm event. Lead SCAT teams, coordinated with Trustees during response.

Report on Ohio River Mussel Populations
Elkem Metals Company, Ohio
Provided an expert report on the estimation of mortality of certain mussel species in response to a chemical spill in the upper Ohio River as part of a NRDA. The opinions in the report were based on ecological models and biometry.

Mt. Erie Oil Spill NRDA
Marathon Oil, Illinois
Participated in meetings with Trustees, developed sampling plans, managed field sampling, and conducted NRDA analyses.

Marine Oil Spill
Confidential client, California
Used multivariate statistical methods in taxonomic identification of oiled birds resulting from the September 1999 spill of bunker oil from the Dredge M/V Stuyvesant.

Reinhard Tanker Spill
Reinhard Petroleum, Washington
A tanker truck crashed, leaking gasoline into a wetland containing a State Sensitive species. Conducted analyses to determine the extent and volume of the spill; negotiated with State Trustees regarding damages; provided summary report.

Pt. Wells Oil Spill
Chevron, Washington
Responder to spill in December 2003, in which approximately 4,000 gallons of bunker oil spilled during refilled at the Pt. Wells Terminal. Collected “neat” samples at scene of spill, participated in SCAT, collected sediment and water samples, and participated in subsequent bivalve tissue sampling projects.

Ecological Studies

Wildlife Population Studies
BP, Alaska
With BP researchers, co-authored three publications in the refereed literature regarding population characteristics of the caribou, common eider, and snow goose in Alaska.

Clark Fork River Ecological Risk Assessment
ARCO, Montana
Used regression analysis in a phytotoxicity study of selected metals in soil to estimate the root uptake factors and biomass reduction rates for these metals; data for ancillary variables were combined with the metals data in nonlinear regression relationships. Principal component analysis was used in conjunction with the results of the multiple regression analyses to reduce the number of variables required to model the phytotoxic functions.

Everglades Mercury Study
Confidential Client, Florida
Using a non-linear multiple regression model and kriging in a two-phased approach, estimated mercury concentrations in fish as a function of sediment and water column chemical concentrations.

NRDA

Whitmarsh Landfill NRDA
Chevron, Washington
A former landfill on the Puget Sound was pursued as a NRD site, with the State of Washington as the lead Trustee. Provided technical input and review to the potentially liable parties Group during the remedial investigation, and strategic guidance to Chevron and their counsel on potential NRD claims.

Castro Cove NRDA
Chevron, California
Used statistical models to relate site-specific bioassay data to benthic macroinvertebrate community injuries. Used these injury assessments to equate natural resource damages to restoration options in an economic framework using habitat equivalency analyses. Presented these results in meetings and report letters to the State of California and other Trustees. Used an ecological risk assessment framework to assess potential for NRD to waterfowl and wading birds.

Numerous Projects
Chevron, Texas
For a number of projects in the Port Arthur area, provided strategic input to valuation of past future injuries and benefits in negotiation with Trustees. Conducted habitat equivalency analyses for both injuries and potential restorations in mitigation.

Greens Bayou NRDA
Tierra, Texas
Participated in negotiation meetings with Trustees and provided expert review of valuation calculations using habitat equivalency analyses.

Confidential NRDA
Confidential client, Montana
Participated in a preliminary NRDA in a river of Montana, where the chemicals of concern (PCBs, PAHs) were thought to have an effect on the macroinvertebrates of the river.

Taylor Way Facility Restoration
ATOFINA, Washington
Conducted HEAs and evaluations of options in restoration projects as part of the strategy for offsetting NRD claims at the ATOFINA facility. Presented these results to the client and NOAA personnel in meetings using analytical and graphical representations.

Clark Fork River Superfund Site NRDA
ARCO, Montana
Provided statistical support at the site. Conducted time series analyses of flow data, identifying instinct flow regimes and estimating flow values throughout the years of available data. These analyses were combined with water and sediment chemistry data for metals to estimate starting conditions for surface water modeling. Estimated frequencies of exceedance of water quality criteria from the modeling results using a probabilistic approach.

Aquatic Macroinvertebrate Ecology

Hudson River Macroinvertebrate Community Analyses
Confidential Client, New York
Provided statistical analyses of macroinvertebrate data to detect community changes along the upper Hudson River. Also wrote a briefing document on the macroinvertebrate communities present in the upper Hudson River, their importance to natural resource damage assessment and their toxicity response to certain chemicals.

Macroinvertebrate Community Analysis
PacifiCorp, Oregon
As part of a relicensing application for a hydroelectric production facility, managed a project to characterize macroinvertebrate communities in the Rogue River watershed in Oregon. Designed the study, collected the samples, and wrote the interpretative report.

Macroinvertebrate and Fish Community Analysis
Various Clients, Various Locations in U.S.
Applied a variety of statistical techniques in the characterization of macroinvertebrate communities in freshwater systems throughout the United States. These techniques included the use of a multivariate classification system, cluster analysis, multidimensional scaling, principal components analysis, and graphical methods.

Sampling Design

Dioxin Characterization
Briggs Nursery Inc., Olympia, Washington
Designed sampling programs for the characterization of dioxin in surface soils, street runoff, water, and sediments in the vicinity of the nursery. Using these data and data from the literature, demonstrated that dioxins in ponds on the nursery property resulted from nearby streets' runoff, and not other possible sources arising from nursery activities.

Offshore Monitoring Program
Chevron Corp. and ExxonMobil, Angola
Developed sampling strategy for a monitoring program for discharges from petroleum activities off the northern coast of Angola. The monitoring program is a proactive response to environmental regulations promulgated by the Republic of Angola. The program approach included compilation for existing information, a pilot study, and evolutionary management of the design. The pilot sampling approach was based on a statistical methodology (analysis of variance).

Statistical sampling and analysis
US Air Force, Alaska
Developed sampling strategies and analyzed data for the definition of soil contamination at Eielson AFB in Fairbanks, Alaska. Much of this work was conducted on site, with sampling layouts and analytical approaches being adaptively modified during the field sampling event.

Wood Treatment Facility Characterization
Union Pacific Railroad, The Dalles, Oregon
Developed sampling strategies, wrote sampling plans, and analyzed data for the definition of soil contamination at a wood treatment facility. In addition, conducted statistical analyses comparing CLP Level 3 analytical data to less expensive field laboratory data. The results were used to demonstrate the validity of inclusion of field data in the remedial investigation.

Creel Survey
Duke Energy, North Carolina
Designed a fish-catch survey for a joint effort between an industry and the State of North Carolina. Sampling events were coordinated for the 1-year study to optimize efficiency of the sampling crews while maintaining statistical validity.

Project Management

Big Mountain RRS RI/FS and Moses Point RI/FS
Department of Defense and Federal Aviation Administration, Alaska
Managed ecological risks assessments at abandoned Department of Defense and Federal Aviation Administration facilities in remote areas of Alaska. Both aquatic and terrestrial communities were considered in the assessments. Participated in all aspects of the assessments, including study design, field work, and data analysis and reporting.

Mammal Tissue Sampling
Federal Aviation Administration, Alaska
Served as project manager/ecological risk assessor. Designed and conducted a sampling program at Moses Point near Elim, Alaska to determine the potential for accumulation of certain metals in small mammals located around former FAA facilities.

Briggs Nursery RI/FS
Briggs Nursery Inc., Olympia, Washington
Served as task manager for an RI/FS conducted at a former nursery. Was responsible for supervision of field investigations, ecological risks assessments, work plan and report preparation, interpretation of the regulations of the state, and negotiations with the Washington State Department of Ecology, City of Olympia, and Grays Harbor County.

Cambridge Vanadium Smelter River Ecological Risk Assessment
SMC, Ohio
Served as task manager for an ecological risk assessment based on aquatic macroinvertebrate communities. The result of the study was the demonstration of effects of vanadium in sediments on macroinvertebrate communities. Participated in all aspects of the assessment, including study design, field work, and data analysis and reporting.

Thermal Equilibrium Study
National Science Foundation (NSF), Eastern U.S.
Managed a field laboratory as part of a multi-year NSF project for the Stroud Water Research Center (then part of the Academy of Natural Sciences of Philadelphia). The laboratory was responsible for collecting, rearing, identifying, and analyzing aquatic insects.

Dioxin Fingerprinting

Expert Technical Review of Spatial and Fingerprinting Analyses
Confidential Client, Washington
Served as statistician and provided expert technical review of spatial and fingerprinting analyses conducted on sediment chemical data from the Duwamish River.

Ward Cove Pulp Mill Dioxin Fingerprinting
Ketchican Pulp Company, Alaska
Analyzed PCDD/PCDF data from a variety of media and locations in the vicinity of a pulp mill near Ketchikan, Alaska to determine the source of individual roof-catchment drinking water systems near the mill. Using discriminant analysis, successfully demonstrated that the sources of dioxins within the project area did not arise from the mill.

Refinery Effluent Dioxins Fingerprinting
Tosco Refining Company, California
Petroleum refining has been identified as a potential source of PCDD/PCDFs. Applied principal components analysis to homologue profiles of data from sources within the facility and other stormwater outfalls in San Francisco Bay to provide a cost-effective approach for identifying PCDD/PCDF sources in the vicinity.

Spatial Analysis

Onondaga Lake RI/FS
Confidential Client, New York
Provided statistical analysis support to components of the RI/FS. Estimated total anthropogenic mercury in lake sediments by kriging the mercury flux in sediments.

Eagle Harbor Superfund Site RI
USEPA, Bainbridge Island, Washington
Analyzed sediment, groundwater, and spatial data collected at the site. Used kriging to estimate sediment chemical concentrations and detect sources of those chemicals under surface sediments.

Bartlesville RI/FS
National Zinc, Bartlesville, Oklahoma
Using kriging and other spatial analyses, developed a method to identify “hot spots” of high metals concentrations in residential yards at the site. The technique detected yards that were likely to have localized high concentrations by using a single composite sample from a given yard collected during the remedial action. Kriging results were also used to develop different zones within the site that were addressed differently in remediation sampling.

Community Arsenic Kriging Analysis
ARCO, Montana
Analyzed patterns of arsenic concentrations in soil samples in the region surrounding Butte, Montana using kriging. For this effort, the kriging algorithm incorporated site-specific details such as topography and wind patterns that affected the spatial correlations within the data.

Risk Analysis

Probabilistic Risk Analysis
National Institutes of Health, Stony Brook, New York
While on sabbatical, participated in a NIH research project on probabilistic methods in risk assessment.

Ecological Risk Screening Assessment at Olympic View Sanitary Landfill
Waste Management, Washington
Conducted an ecological risk screening assessment to determine the potential for risk to the ecological communities in the vicinity of the landfill. Site conditions were considered in the identification of potentially complete exposure pathways to ecological receptors. The process included the selection of exposure pathways, receptor species, exposure models, and model assumptions. A semi-aquatic species (the muskrat) was selected as the representative receptor species for this risk assessment.

Monte Carlo Analyses
Various Clients
Performed Monte Carlo simulations for risk assessments and the estimation of error propagation. Used the Monte Carlo simulations to estimate the uncertainties associated with sediment quality criteria calculated by the USEPA.

Site Characterization

Michoud Facility RI/FS
Martin Marietta, Louisiana
Analyzed data, using kriging and graphics, from a close support laboratory in near real time at the Michoud Facility. Also provided daily recommendations to field crews in the location of samples.

Oil Well Statistical Analysis
ARCO, Alaska
Provided statistical analysis of large data sets (observations from about 100 wells) to determine the extent and nature of contamination from drilling and operation of oil wells in Alaska.

Lake Okeechobee Water Chemistry Analysis
South Florida Water Management District, Florida
Analyzed a historical database of water chemistry data. Developed numerical and graphical methods to characterize temporal and spatial changes in water quality in Lake Okeechobee.

Groundwater Recovery Analysis
Reichold Chemical, Inc., Tacoma, Washington
Analyzed time series and spatial data to evaluate test performance of a groundwater recovery system for this RCRA site. Also developed an experimental design approach for optimizing a groundwater treatment system.

Selected Publications

Noel, L.E., M.K. Butcher, M.A. Cronin and B. Streever. 2007. Assessment of effects of an oil pipeline on caribou movements in arctic Alaska. Rangifer.

Noel, L.E., S.R. Johnson, G.M. O'Doherty, and M.K. Butcher. 2005. Common eider (Somateria mollissima v-nigrum) nest cover selection and depredation on central Alaskan Beaufort Sea Barrier Islands. Arctic.

Noel, L.E., S.R. Johnson, and M.K. Butcher. 2004. Snow Goose nesting and brood-rearing distributions in the Sagavanirktok River Delta, Alaska, 1980-2002. Waterbirds 27:388-395.

Peek, D.C., M.K. Butcher, W.J. Shields, L.J. Yost, and J.A. Maloy. 2002. Discrimination of aerial deposition sources of polychlorinated dibenzo-p-dioxin and polychlorinated dibenzofuran downwind from a pulp mill near Ketchikan, Alaska. Envl. Sci. & Tech. 36(8): 1671-1675.

Moore, M.L., M.K. Butcher, K. Connor, D.J. Paustenbach, and D.B. Mathur. 1999. Fingerprinting analysis of PCDD/PCDF sources in a surface water outfall near a petroleum refinery. Organohalogen Compounds. 40: 219 - 222.

Pastorok, R.A., M.K. Butcher, and R.D. Nielsen. 1996. Modeling wildlife exposure to toxic chemicals: trends and recent advances. Hum. Ecol. Risk Assess. 2(3):444-480.

Pastorok, R.A., R.D. Nielsen, and M.K. Butcher. 1996. Future directions in modeling wildlife exposure to toxic chemicals. Hum. Ecol. Risk Assess. 2(3):570-579.

Schoof, R.A., M.K. Butcher, C. Sellstone, R.W. Ball, J.R. Fricke, V. Keller, and B. Keehn. 1995. An assessment of lead absorption from soil affected by smelter emissions. Environ. Geochem. Health. 17:189-199.

PROOF OF SERVICE

I am a resident of the State of California, over the age of eighteen years, and not a party to the within action. My business address is DLA Piper LLP (US), 401 B Street, Suite 1700, San Diego, California 92101-4297. On July 19, 2010, I served the within documents:

NON-EXPERT WITNESS DESIGNATION OF DESIGNATED PARTY BAE SYSTEMS SAN DIEGO SHIP REPAIR INC.;

EXPERT WITNESS DESIGNATION OF DESIGNATED PARTY BAE SYSTEMS SAN DIEGO SHIP REPAIR INC.; AND

DECLARATION OF MICHAEL S. TRACY IN SUPPORT OF DESIGNATED PARTY BAE SYSTEMS SAN DIEGO SHIP REPAIR INC.'S FIRST EXPERT WITNESS DESIGNATION

☒ by transmitting via e-mail the document(s) listed above to the recipient(s) set forth below on this date

See attached Service List

I am readily familiar with the firm's practice of collection and processing correspondence for mailing. Under that practice it would be deposited with the U.S. Postal Service on that same day with postage thereon fully prepaid in the ordinary course of business. I am aware that on motion of the party served, service is presumed invalid if postal cancellation date or postage meter date is more than one day after date of deposit for mailing in affidavit.

I declare under penalty of perjury under the laws of the State of California that the above is true and correct.

Executed on July 19, 2010, at San Diego, California.

Nathine Nelson

Service List

In re Shipyard Sediment Site Cleanup Project and
Tentative Cleanup & Abatement Order No. R9-2010-0002

Catherine Hagan, Esq.
California RWQCB, San Diego Region
9174 Sky Park Court, Suite 100
San Diego, CA 92123-4340
chagan@waterboards.ca.gov
T: (858) 467-2958
F: (858) 571-6972

Robert M. Howard, Esq.
Kelly E. Richardson, Esq.
Latham & Watkins LLP
600 W. Broadway, Suite 1800
San Diego, CA 92101-3375
robert.howard@lw.com
kelly.richardson@lw.com
T: (619) 236-1234
F: (619) 696-7419
Counsel for National Steel & Shipbuilding Company (NASSCO)

Michael McDonough, Esq.
Bingham McCutchen LLP
355 South Grand Avenue, Suite 4400
Los Angeles, CA 90071 -3106
michael.mcdonough@bingham.com
T: (213) 680-6600
F: (213) 680-6499
Counsel for BP West Coast Products LLC

Brian Ledger, Esq.
Gordon & Rees LLP
101 West Broadway, Suite 1600
San Diego, CA 92101
bledger@gordonrees.com
T: (619) 230-7729
F: (619) 696-7124
Counsel for City of San Diego

Christopher McNevin, Esq.
Pillsbury Winthrop Shaw Pittman LLP
725 South Figueroa Street, Suite 2800
Los Angeles, CA 90017-5406
chrismcnevin@pillsburylaw.com
T: (213) 488-7507
F: (213) 629-1033
Counsel for Chevron USA, Inc.

Christian Carrigan, Esq.
Senior Staff Counsel
Office of Enforcement, State Water Resources Control Board
P.O. Box 100
Sacramento, CA 95812-0100
ccarrigan@waterboards.ca.gov
T: (916) 322-3626
F: (916) 341-5896

Marco A. Gonzalez, Esq.
Coast Law Group LLP
1140 South Coast Highway 101
Encinitas, California 92024
T: 760-942-8505 ext 102
F: 760-942-8515
marco@coastlawgroup.com
Counsel for Environmental Health Coalition & San Diego Coastkeeper

Jill Tracy, Esq.
Senior Environmental Counsel
Sempra Energy
101 Ash Street
San Diego, CA 92101
jtracy@sempra.com
T: (619) 699-5112
F: (619) 699-5189
Counsel for San Diego Gas & Electric

Leslie FitzGerald, Esq.
Deputy Port Attorney
San Diego Unified Port District
PO Box 120488
San Diego, CA 92112
lfitzger@portofsandiego.org
T: (619) 686-7224
F: (619) 686-6444

Laura Hunter, Esq.
Environmental Health Coalition
401 Mile of Cars Way, Suite 310
National City, CA 91950
laurah@environmentalhealth.org
T: (619) 474-0220
F: (619) 474-1210

Service List

In re Shipyard Sediment Site Cleanup Project and
Tentative Cleanup & Abatement Order No. R9-2010-0002

Tom Stahl, Esq.
AUSA Chief, Civil Division
Office of the U.S. Attorney
880 Front Street, Room 6293
San Diego, CA 92101-8893
thomas.stahl@usdoj.gov
T: (619) 557-7140
F: (619) 557-5004

James Handmacher, Esq.
Morton McGoldrick, P.S.
PO Box 1533
Tacoma, WA 98401
jvhandmacher@bvmm.com
T: (253) 627-8131
F: (253) 272-4338
Counsel for Marine Construction & Design Co. and Campbell Industries, Inc.

Sharon Cloward
Executive Director
San Diego Port Tenants Association
2390 Shelter Island Drive, Suite 210
San Diego, CA 92106
sharon@sdpta.com
T: (619) 226-6546
F: (619) 226-6557

Nate Cushman, Esq.
Associate Counsel
U.S. Navy
SW Div, Naval Facilities Engineering Command
1220 Pacific Hwy
San Diego, CA 92132-5189
nate.cushman@navy.mil
T: (619) 532-2511
F: (619) 532-1663

Gabe Solmer, Esq.
Legal Director
San Diego Coastkeeper
2820 Roosevelt Street, Suite 200A
San Diego, CA 92106-6146
gabe@sdcoastkeeper.org
T: (619) 758-7743, ext. 109
F: (619) 223-3676

William D. Brown, Esq.
Brown & Winters
120 Birmingham Drive, Suite 110
Cardiff By The Sea, CA 92007
bbrown@brownandwinters.com
T: (760) 633-4485
F: (760) 633-4427
Counsel for San Diego Unified Port District

Sandi Nichols, Esq.
Allen Matkins
3 Embarcadero Center, 12th Floor
San Francisco, CA 94111
snichols@allenmatkins.com
T: (415) 837-1515
F: (415) 837-1516
Counsel for San Diego Unified Port District