

**Peter M. Mesard, P.E., P.G., C.E.G., C.Hg.  
Principal Engineer**

**Professional Profile**

Mr. Peter Mesard is a Principal Engineer in Exponent's Environmental Science practice in Oakland, California. Mr. Mesard has extensive experience as a hydrogeologist, engineering geologist, and civil engineer. His expertise includes design and implementation of environmental investigations; remediation system design, evaluation, and failure analysis; geologic hazard analysis; and construction defect assessment. His principal area of specialization is environmental release reconstruction and source identification (environmental forensics), including chemical-characteristic analysis (chemical fingerprinting), the dating of chemical releases, and chemical fate and transport.

Mr. Mesard has assisted his clients on various CERCLA, RCRA, and state-equivalent sites, to identify and quantify the contributions of specific sources, evaluate the technical appropriateness and costs associated with remedial actions, and assess the consistency with state and federal regulations—specifically the national contingency plan (NCP). Mr. Mesard also has expertise in quantifying the flux, timing, and extent of chemical releases for dose reconstruction estimates related to toxic tort claims. Mr. Mesard has written technical reports and/or testified as an expert in projects involving chlorinated solvents, perchlorate, petroleum hydrocarbon compounds, MTBE and other oxygenates, polycyclic aromatic hydrocarbons (PAHs), PCBs, dioxins and furans, various pesticides, and metals.

Mr. Mesard's areas of interest include risk management and decision analysis in assisting financial, legal, insurance, and commercial clients in quantifying and assessing the risks and costs associated with environmentally distressed properties, and in allocating environmental responsibilities and costs among responsible parties in cost-contribution and cost-recovery efforts.

**Academic Credentials and Professional Honors**

M.A.Sc., Geological Engineering, University of British Columbia, 1979  
B.S., Engineering and Geology, Fort Lewis College (*magna cum laude*), 1976

**Licenses and Certifications**

Registered Civil Engineer, California, #C47609; Professional Civil Engineer, Hawaii, #12036; Professional Civil Engineer, Nevada #018711; Professional Engineer, Colorado, #PE-43158; Professional Engineer, Utah, # 7280580-2202; Professional Geologist, California, #4311; Professional Geologist, Utah, #7280580-2250; Certified Engineering Geologist, California, #1473; Certified Hydrogeologist, California, #152; Certified Environmental Manager, Nevada, #1051

Forty-Hour Hazardous Waste Health and Safety Training Course; Eight-Hour Hazardous Waste Health and Safety Supervision Course

### **Publications and Presentations**

Mesard P, Murphy B, Graham D. Multi-pronged approach to establish the timing of releases from a UST system a decade after occurrence. Groundwater Resources Association of California, Symposium on Environmental Forensics in an Era of Emerging Diagnostic Methods, Irvine, CA, 2011.

Mesard PM, Deardorff TL. Stormwater management during construction—A technical perspective. American Bar Association- Toxic Tort Environmental Law Conference, Scottsdale, AZ, 2008.

Mesard PM. Physical and chemical constraints on chlorinated solvent distribution in the subsurface—For addressing investigation, remediation, and forensic questions. Association of Engineering and Environmental Geologists, Annual Meeting, Program, and Abstracts, Los Angeles, CA, 2007.

Mesard PM, Shock S. Assessing remedial investigations and remedial actions at DNAPL sites: The case for internally consistent conceptual site models. Groundwater Resources Association of California—Symposium DNAPL Source Zone Characterization and Remediation, San Francisco, CA, December 2005.

Mesard PM, McNab W. Anthropogenic perchlorate sources and associated groundwater chemistry. International Society of Environmental Forensics. Workshop—Focus on Perchlorate, Santa Fe, NM, September 2005.

Mesard PM, Martin R. Sources of perchlorate releases to the environment. In: Perchlorate, A Scientific, Legal, and Economic Assessment. Hagstrom E (ed), Lawyers & Judges Publishing Co., Inc., Tucson, AZ, 2004.

Hilton L, Mesard PM. Legal approaches and technical tools to assess water agency claims for damages. Groundwater Resources Association of California, Symposium on Perchlorate in California's Groundwater, Glendale, CA, 2004.

Mesard PM. Perchlorate: Source identification and release reconstruction techniques. International Society of Environmental Forensics. Overview and Applications of Environmental Forensics in Soil and Groundwater Workshop, San Diego, CA, 2003.

Mesard PM. Integrating geologic and hydrogeologic tools to develop a predictive conceptual model for contaminant transport in an anisotropic aquifer. Association of Engineering Geologists, Annual Meeting, Program and Abstracts, Reno, NV, 2002.

Mesard PM. Characterization analyses of complex chlorinated compounds—Examples of fingerprinting dioxins and pesticides. Groundwater Resource Association of California, Workshop on Environmental Forensics, Emeryville, CA, 2002.

Mesard PM, Meldrum J. Performance and reliability issues associated with regulatory control periods. 11<sup>th</sup> Annual Technology Information Exchange, Department of Energy, Las Vegas, NV, 1999.

Mesard PM. Unique groundwater protection and design considerations at the Lockwood regional landfill. Solid Waste Association North America, Reno, NV, 1998.

Mesard PM, Mudge AE. The Clean Water Act. The New Environmental Regulation Course. Business Development Associates, Inc., Las Vegas, NV, 1995.

Mesard PM. Engineering solutions to implementing the new EPA Subtitle D Requirements. Conference on EPA's New Landfill Regulations—Impacts on New Mexico, New Mexico Association of Commerce and Industry Meeting, Santa Fe, NM, 1992.

Mesard PM, Schroth BK. Groundwater chemistry associated with the Lockwood Regional Landfill. Nevada Groundwater Annual Association Meeting, Reno, NV, 1991.

Mesard PM, Godwin CI. Mineralization and alteration of the Poplar copper molybdenum porphyry deposit, West-Central British Columbia. Canadian Institute Mining and Metals. Special Volume on Mineral Deposits, 1985.

Mesard PM, Godwin CI. Geology, geochemistry and geostatistics of the Poplar copper molybdenum porphyry deposit, West-Central British Columbia. Geological Society of America Annual Meeting, Program and Abstracts, San Diego, CA, 1979.

Mesard PM, Godwin CI. Preliminary geology of the Poplar copper molybdenum porphyry deposit, West-Central British Columbia. British Columbia Ministry of Mines and Natural Resources, Fieldwork, 1978.

### **Prior Experience**

Vice President, Kennedy/Jenks Consulting Scientists and Engineers, 1986–1999

Senior Geological Engineer, Atlas Corporation, 1984–1986

Senior Geologist, Exxon Company USA, 1977 and 1980–1984

Geological Engineer, British Columbia Ministry of Mines & Petroleum Resources, 1977–1979

Geologist, U.S. Geological Survey (part-time), 1973–1977

### **Project Experience**

#### **Environmental Investigation/Design/Environmental Forensics**

##### ***Chlorinated Solvents and Dense Non-Aqueous-Phase Liquids (DNAPLs)***

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Undertook study of trichloroethylene (TCE) and its degradation products *cis*-1,2-dichloroethylene (*cis*-1,2-DCE) and vinyl chloride, in multiple aquifers at a former military installation in the Midwest to assess the locations and relative timing of releases of TCE to the environment. Extremely elevated concentrations of the halogenated volatile organic compounds (HVOCs)—up to low percentage levels in shallow soils—and the relatively aggressive degradation rates, were used in concert with an understanding of site history and operations to bracket the timing of the releases. Identified unusual anaerobic soil and groundwater conditions due to subsequent releases of petroleum and/or phenol compounds that commingled with the previously released TCE, which was the proximate cause of the intense degradation. Results of this work will be used in CERCLA §113 and state tort litigation, and subsequent allocation.

Assisted a client in assessing the technical correctness and cost of the remediation of a former dry cleaning site in the San Francisco Bay area as part of a response cost recovery dispute. Evaluated pre-remediation soil vapor, soil, and groundwater conditions to assess the proposed remedy (sub-slab depressurization, soil vapor extraction, and groundwater natural attenuation). Identified areas for cost savings and schedule acceleration. Bracketed release dates and locations by staining locations and patterns in the proximity of various Site features.

Assessed the fate and transport of PCE from a former dry cleaner in a shallow aquifer in northern California as part of a CERCLA §107 action. Assessing potential sources of PCE and other HVOCs, and the timing and impact of the HVOCs on groundwater production wells at a manufacturing facility. Used inverse numerical modeling techniques to establish approximate release dates. Detailed evaluation of degradation products (TCE, *cis*-1,2-DCE, vinyl chloride) led to the identification of at least one additional source on plaintiff's property (containing 1,1,-DCE) that is distinct from other sources.

Evaluated the five-year performance of an in-situ chemical oxidation (ISCO) program to remediate a recalcitrant TCE plume at a site in Silicon Valley by injection of sodium permanganate. The TCE concentrations were not decreasing as planned, and we were asked by the leasee of the building to examine the ISCO program. The resulting investigation and analysis indicated that the ISCO remediation effort had been designed inappropriately and conducted ineffectively—the spacing of the ISCO injection points and the volume of permanganate injected were insufficient to contact all the TCE in the source area, given the porosity, depth, and thickness of the TCE-affected aquifer zones. Ironically, the solution was much too concentrated (based on mass-balance calculations) to be consumed by the TCE in the limited areas in which it was injected, leading to a significant waste of the solution and its migration off site. Also, given the concentrations of dissolved TCE in the source area (greater than 200,000 µg/L), it was likely that the TCE existed in part as a dense non-aqueous-phase liquid (DNAPL), and the design of the system did not take the potential presence of DNAPL into account.

Provided a third-party review of a proposed enhanced reductive dechlorination (EDR) program to assess the feasibility of such a remediation effort to treat TCE in shallow groundwater at a site in northern California. The work plan included unsupported assumptions regarding background aquifer conditions (e.g., naturally occurring biological substrate, natural attenuation

parameters, etc.) and relied on the remediation consultant's expertise at unspecified "similar" sites to determine the locations and density of injection points to augment the biological community, and the type of substrate to be used. Recommended that site-specific natural attenuation parameters be collected, and that bench-scale and, if justified, pilot-scale studies be conducted using site-specific soil and groundwater with actual contaminant concentrations (indicative of local DNAPL). These recommendations were accepted.

Evaluated the lateral and vertical extent of TCE and other HVOCs at a site in southern California (Orange County) as part of CERCLA §107 and §113 actions. Used largely historical sampling results to assess potential sources and timing of releases. Was able to bracket the most likely dates of the release(s), and concluded that they were due to illicit dumping subsequent to client's vacating the Site. Reviewed and evaluated pilot tests and corrective actions by subsequent owner and plaintiff. Showed that costs associated with excavation and ex-situ soil venting were neither reasonable nor necessary, by demonstrating via mass balance calculations (based all on measurements and data collected by plaintiff), that the excavated soils contained no free product (DNAPL) and therefore, should not have been excavated. Concluded that *in situ* chemical oxidation by potassium permanganate injection was a preferable alternative (specifically, much more cost effective), which was subsequently demonstrated in the field.

Conducted an extensive geologic and hydrogeologic study of coupled fractured bedrock and alluvial aquifers to assess the location and movement of a TCE plume that had migrated beneath a residential community and high school. The driver of this dose-reconstruction study was to estimate potential historical (and cumulative) residential exposure to soil vapors emanating from the TCE plume. The evaluation consisted of creating a numerical groundwater model that would allow for estimation of TCE concentrations (and consequently, indoor air exposures) at specific residences at various times in the past. The lithologies of more than 450 borings and wells were re-examined for consistency and quality assurance purposes, and the resulting information was incorporated into a database to construct a three-dimensional groundwater model of the area, which consisted of three principal aquifer zones (deeper fractured bedrock, shallow fractured bedrock, and alluvium). The model was developed using the flow code MODFLOW-2000. However, while the amount of groundwater quality and piezometric data was voluminous, it went back in time only about five years. In addition, the plume had migrated from one groundwater basin into another that had significantly different characteristics. Therefore, to establish important groundwater flow parameters, such as dispersivity, the relative amounts and ratios of potassium and chloride ions (the concentrations of which occurred in groundwater in the two basins in inverse proportion), were used to establish a mixing model. This model calibrated well with observed conditions ( $R^2=0.98$ ), providing a high degree of confidence in predicted concentrations of TCE over time.

Investigated damage to a major Central Valley (California) municipality's water-supply aquifer from releases of HVOCs. Evaluated field notes, work plans, regulatory communications, boring logs, as-built drawings, and soil and groundwater sampling results to determine the mechanism of the contamination. Used environmental event reconstruction techniques (inverse plume modeling, mass-balance analyses, advective transport estimates, and chemical partition modeling between groundwater and soil gas), and evaluation of the hydrostratigraphy. Assisted the City, in consultation with the California Department of Toxic Substances Control, in

preparing the technical and regulatory elements of a proposed preliminary injunction directing the manner in which the PRPs were to conduct a National Contingency Plan (NCP)-compliant RI/FS/human health risk assessment (HHRA), and ecological risk assessment (ERA). Presented technical tutorial in Federal Court.

As part of a cost allocation effort, evaluated multiple HVOC groundwater plumes emanating from multiple source areas, including a former municipal and industrial dump located in the Central Valley of California. Focused on the sources of hazardous wastes that were disposed of in the former dump. Based on a very detailed review of documents, some more than 40 years old, determined that more than 98 percent of the specific hazardous constituents discovered in groundwater (TCE and its degradation products) came from one industrial source, and the remainder from two municipal sources. Prepared graphics that effectively communicated findings to the parties involved.

Provided technical support in a multi-party HVOC- and hydrocarbon-affected groundwater action in northern California. Technical work consisted of evaluating the technical feasibility, costs, schedule, and degree of regulatory compliance of past and present investigation and remediation technologies.

Provided technical and regulatory support to municipalities involved in a Superfund site in southern California that was a former landfill. Principal constituent of potential concern was a “soup” of various chlorinated and non-chlorinated solvents. Major technical services included the compilation of waste manifests from more than 150 parties over a period of 20 years, categorizing the nature and amounts of wastes deposited at the site, characterizing the leachate and groundwater chemistry, comparing that chemistry to other municipal and industrial landfills, reviewing and commenting on the costs and design of remediation systems, and allocating responsibility among the parties.

Assisted a client in the acquisition of a “brownfields” property in southern California that was a former solvent recycling facility, currently operating under a RCRA Post-closure Permit. Assisted in valuation of the property’s environmental liabilities, and developed cost estimates for long-term remediation of HVOC-affected soils and groundwater. Worked with the client and their business consultant to acquire environmental remediation insurance as part of the purchase, and developed alternatives for future investigation and remediation. Undertook a pilot study of the client’s existing 22-well multi-depth groundwater extraction and treatment system to optimize the system operations. The variables examined included volumetric recovery, area of hydraulic containment, mass removal, and treatment and O&M costs. Using both numeric and analytical modeling of the hydraulic capture zones, and historical HVOC-mass removal rates and costs, five separate extraction-well configurations (consisting of various subsets of the entire well field) were operated consecutively in isolation for up to 90 days, while operating parameters were collected for each configuration. Based on the results of the pilot study, recommended that approximately one-third of the site’s extraction wells be shut down, which resulted in substantial cost savings to the client while maintaining a hydraulic containment zone that is protective of downgradient receptors, with only a minor decrease in mass removal rates.

Managed remedial investigations/feasibility studies at two actively operating sites in northern California, owned by a major electronics manufacturer. At one of the sites, supervised the preparation of a remedial action plan (RAP) for cleanup of HVOC-containing soils and groundwater. The RAP included groundwater extraction and treatment by liquid-phase granular activated carbon (GAC), and extraction of soil vapor followed by vapor-phase GAC treatment to remediate soils at the source area.

Managed a multi-site environmental investigation and feasibility study at an international airport. The project included Phase I site assessments, asbestos and lead paint abatement studies, human health and environmental endangerment assessments, and Phase II and subsequent soil and groundwater investigations for petroleum hydrocarbon compounds (PHCs), HVOCs, and metals. The results of the investigation were used to develop a multi-tiered containment zone for the management of affected groundwater.

Led the remedial investigation/feasibility study of a transportation facility in northern California that included both separate-phase petroleum and dissolved HVOC contamination. The project included preparation of a RAP for extracting and treating HVOC-containing groundwater. Following remedial design, remediation was implemented and is currently operating. Work also included soil excavation and onsite bioremediation of petroleum hydrocarbon-affected soils. Regulatory closure of seven areas was obtained by the Regional Water Quality Control Board.

Designed a groundwater extraction system that utilized air stripping to remove HVOCs from groundwater at a site in the South San Francisco Bay area.

Planned and supervised a major investigation to evaluate the potential for deep aquifer contamination at a Superfund site in the South San Francisco Bay area. Principal CoPCs were chlorinated solvents. Used geophysical techniques, such as electromagnetic induction and ground-penetrating radar, to locate abandoned agricultural wells that were potential inter-aquifer conduits for contamination.

Conducted an investigation to assess the risk of inter-aquifer cross-contamination of HVOCs during the construction of deep foundation piers at a site in northern California.

Evaluated the completeness and technical correctness of a decade-old Phase I ESA, which was a critical issue in a due diligence dispute involving offsite migration of PCE in soil vapor and groundwater from a former dry cleaner to an apartment complex.

Provided on-call environmental risk-management services to a major insurance company that was evaluating large, complex remediation projects in North America, Asia, and Europe, to offer remediation cost-cap, and environmental indemnity and liability insurance policies to their clients seeking such coverage. Reviewed RI/FS documentation, interim remedial measure as-builts, HHRAs, and ERAs for a wide range of COIs in various media. Advised client on projects ranging up to \$50 million in corrective action costs. Quantitatively assessed completeness and quality of investigations, and advised the client on the current and potential future physical, chemical, and regulatory risks posed by the COIs. Evaluated the costs, feasibility, and performance of existing and proposed remedial alternatives (including remedial

technologies such as thermal desorption, *in situ* and *ex situ* fixation, catalytic oxidation, air sparging, reactive barrier treatment, and hydraulic containment). Also used statistical techniques (e.g., Monte Carlo simulations) to identify the most likely failure modes of the remedial systems.

***Petroleum Hydrocarbon Compounds, Fuel Oxygenates, and Polycyclic Aromatic Hydrocarbons (PAHs)***

Evaluated the geologic and hydrogeologic setting and conducted a forensic analysis distribution of to determine the source or sources of a significant (approximately 50,000 gallons) free-product gasoline plume, and to allocate the plume among two principal suspected sources (several underground storage tanks [USTs]). The investigation included evaluating free-product geochemistry and fingerprinting the composition of the free product by conducting a PIANO (paraffins, isoparaffins, aromatics, naphthenes, and olefins) analysis. In addition, analyzed results of ROST (rapid optical screening tool) geophysical boring data, undertook a detailed review of UST inventory data, and studied the relative behavior of free product in different soils. The results of this study indicated that all of the free-product gasoline came from only one source area.

Assessed the fate and transport of methyl tertiary butyl ether (MTBE), and other fuel oxygenates (tert-butyl ether [TBA], tert-amyl methyl ether, diisopropyl ether, and tert-amyl alcohol) at a site in southern California. MTBE and TBA migration in groundwater at the site occurred in a direction different from that of other fuel constituents, including PHCs—gasoline and diesel, and benzene, toluene, ethylbenzene, and xylenes (BTEX). The fate-and-transport evaluation was undertaken to assess claims that the environmental impact of MTBE was exacerbated and the extent of the MTBE plume was increased due to the alleged failure of a groundwater pump and treat and soil vapor extraction system at the site. Evaluation found that the MTBE/TBA plume was not adversely affected by the remediation systems, by rather, was due to releases of MTBE from an adjacent property and was not related to historical onsite releases, and the remediation system was not designed or operated improperly.

Undertook historical and forensic evaluation of MTBE and BTEX releases from a service station in the Central Valley of California to assess the timing of multiple releases and the impact of those individual releases on nearby MTBE-affected domestic water wells as part of a dose reconstruction analysis in a toxic tort dispute. Based on the analyses of compound concentration trends, compound ratios, compound mass-fractions, concentration time-decay trends, and historical groundwater elevations, concluded that at least two of the releases occurred after a change in ownership of the station. This finding was used in mediation among potentially responsible parties to settle part of a dispute, and was presented to the appropriate regulatory agency related to the modification of certain administrative orders.

Investigated technical and regulatory matters related to a release of Bunker C fuel oil mixed with diesel fuel from a tanker truck that was involved in a traffic accident adjacent to a protected salmon habitat in northern California. Initially met with five involved agencies (the Department of Transportation, the California Highway Patrol, the Regional Water Quality Control Board, the Department of Fish and Game, and the County Health Department) and developed an

emergency response plan. The plan included actions to remove the free product, build temporary structures to protect the river from further migration during free-product removal, remove petroleum-affected soils and asphalt, replace a storm culvert, repave the highway, and regrade the shoulder. Provided advice regarding the methodologies and the final cleanup level, and the documentation required to demonstrate that residual free product, particularly in inaccessible areas, would not pose a threat to human health or to terrestrial and aquatic ecological receptors. Using leachate designed to reflect ambient rainwater conditions, and samples of affected rocks and soil, evaluated the effect of COIs on aquatic biota and demonstrated to the regulatory agencies that the effect was below harmful levels. Following a four-month monitoring period, the regulatory agencies issued a letter of no further action.

Reconstructed the record of a spill and release of 6,700 gal of gasoline, from an overturned tanker, in a vineyard in Napa, California. Retained by counsel to defendant insurer, which was sued over terms of coverage. Researched federal, state, and local regulations relating to spill and cleanup, delineated cleanup levels, and established environmental damages.

Assisted a client in the evaluation of appropriate regulatory requirements involving the handling of California non-RCRA hazardous wastes—involved large quantities of used machine oils, and lubricants (including sorbents), and metal-treating wastes that were abandoned at a former manufacturing facility that had abruptly entered bankruptcy proceedings. Part of the assignment included an assessment of allocation of damages among a number of parties.

Managed a major fast-track underground storage tank (UST)-related design, construction management, and environmental investigation project at a large airport in northern Nevada. The project involved the closure and replacement of six (up to 20,000-gallon capacity) USTs with upgraded USTs or aboveground storage tanks, to comply with pending federal and state regulations. Three of the USTs were located in areas of active airport operations. Specific challenges included designing and scheduling the replacement of two USTs that fed emergency generators, so that a continuous fuel supply was guaranteed throughout the project; scheduling removal and installation of the USTs; and undertaking UST integrity tests and environmental investigations around active airport operations. Releases from some USTs and associated piping were confirmed. However, due to the major disruption to airport operations and potential adverse impact on operational safety if the 20,000-gallon UST and affected soil had to be excavated, successfully negotiated a “closure in place” with the lead regulatory agency after conducting a risk-based corrective action risk assessment. The project was completed 2 weeks before the regulatory deadline.

Provided technical services regarding the environmental impact of, and the methods and costs for, remediating a 5-million-gallon plume of floating petroleum product on shallow groundwater at a site in northern Nevada. Also assisted with cost allocation among the parties. Specific responsibilities included evaluating the effectiveness and offsite impact of multiple remediation systems, assessing the relative contributions of multiple sources, and determining the physical and environmental impact of the plume on sensitive downgradient receiving waters.

As part of a large litigation support effort for a major municipality in northern California, estimated the amount of refined petroleum products that would reach a municipal reservoir from

a release from a petroleum pipeline during a specific, but theoretical, seismic event. The estimate of product reaching the reservoir was based on site topography and drainage configuration, distance between the pipeline and the water, and the pressure in the pipeline and the estimated time it would take for the pipeline owner to recognize that a release was in progress and shut down the system. This assessment indicated that significant volumes of product could reach the reservoir and threaten water quality. The municipal client used the information to negotiate mitigation measures with the pipeline owner.

Assisted a county transportation agency located in northern California in developing stormwater monitoring plans and stormwater pollution prevention plans at three of their fueling facilities. Identified most likely release scenarios, and developed best management practices (BMPs) to protect against and mitigate any releases. At one fueling facility, undertook a two-year study, requiring automated sampling of three storm drains, which indicated that the BMPs and administrative actions substantially reduced the amount of PHCs and metals that entered the storm drains.

Currently assessing the fate and transport of gasoline containing MTBE to a residential well that has led to a toxic tort claim against the owner of a service station. Combining historical (inverse modeling) assessment of the plume's migration, including an evaluation of concentration-over-time data, to ascertain the period(s) and degree of potential exposure. Working with medical and toxicological team members to assess likelihood that claimed illness is due to ingestion of well water.

Provided technical and regulatory compliance assistance to a client seeking cost recovery from the Department of Defense (U.S. Navy), under a CERCLA §107 action. The southern California project site was a former Navy facility that had been turned over to a local municipality following cleanup and closure under the base realignment and closure program. During subsequent development, COIs, including lead and PAHs, interpreted to be associated with a former burn pit, were discovered in shallow soils, and were mitigated by the client's insured during a short-term removal action that cost over \$7 million. Services included determination of the earliest date the COIs were released, tracing land ownership and development milestones over 80 years of site activity, assessment of NCP compliance during short-term removal actions, verification of removal-action costs, and review and assessment of technical correctness and completeness of previous remedial and removal actions.

Conducted fast-track Phase I and Phase II environmental investigations and directed the remediation of an automobile recycling facility in Honolulu, Hawaii, to meet State regulatory requirements and to assist in cost-recovery efforts. COIs included light to heavy PHCs, BTEX, MTBE, and heavy metals in soil and groundwater. Determined that the COIs were unlikely to affect a local municipal well, or nearby ecological receptors. Following the investigations, developed a RAP, oversaw development of final design plans and specifications, and assisted with contract development and administration, contractor selection, and construction management to remediate the site. Remediation activities included removal of USTs, removal of chemically affected soil beneath a substantial portion of the property, closure of domestic and industrial waste collection and treatment systems, building demolition, regrading and paving, and construction of new stormwater runoff structures. Verified that the site met State regulatory

standards and received a notification of no further action from the State. Assisted in cost-recovery efforts.

Assisted in planning the construction of a commercial facility at a brownfields redevelopment site in Honolulu, Hawaii. The site is part of a large and complex multi-party environmentally distressed area. Assisted with both technical and regulatory issues regarding the Site. Technical issues included the source, movement, and risk of relatively high levels of methane (locally exceeding the lower explosive limit of methane)—discovered in both air and soil gas in the area—as well as other COIs. The most likely source of methane was determined to be the large volumes of degrading PHCs, both in soil and—as a separate phase—floating on the groundwater. Recommended construction of methane mitigation measures in all proposed structures, reviewed the feasibility of proposed site-wide methane mitigation measures, and assisted in obtaining recompense from the property lessor for the additional cost of the mitigation systems. Also advised client (lessee) on the potential risks posed by COIs likely remaining on site following removal actions.

Developed, on a fast-track schedule, a characterization plan, remediation alternatives, and associated costs for addressing the environmental impact of residuals from a major fire at a tire-storage and recycling facility in the Central Valley of California. Approximately 6 million tires were consumed in the fire. Wastes consisted of metal- and VOC-containing ash, pyrolytic oils, and sludges in soil, groundwater, and surface water impoundments. Volume measurements of multiple waste piles, and collection and analysis of environmental samples were used to evaluate potential environmental impacts and to develop selected remediation alternatives and costs.

Provided technical assistance in a cost-recovery action for a site in northern Nevada affected by PAHs, BTEX, and metals. Conducted a two-phased investigation to identify the extent and magnitude of the contamination, and assisted in the review of a remediation plan. Monitored the cleanup of the site to ensure compliance with the terms of the cleanup agreement, and reviewed and provided advice on the adequacy of work plans, sampling and analysis plans, quality assurance project plans, design specifications, and other construction documents. Also provided second-party construction and remediation monitoring.

Provided technical assistance related to the purchase of a property in a historic district of a small town in the Sierra Nevada Mountains of California. During due diligence, significant petroleum hydrocarbon contamination of groundwater and soils was discovered. Two responsible parties were identified and undertook investigative and remediation activities. Assisted with technical review and advice regarding the work plans, regulatory agency liaison, and the results of the ongoing cleanup.

Performed a fast-track (3-week) due diligence review of a brownfields property in downtown Honolulu, Hawaii, that was still undergoing remediation for PAHs, PHCs, and BTEX. Evaluated past RI and corrective action performance data, discussed the status of the site with regulatory agency oversight personnel, and worked with the current owner's consultants to develop a schedule and cost estimate to complete remedial actions to the satisfaction of the

State. Assisted in selection of a local long-term remediation contractor, and assisted in negotiating a contract with the contractor.

Provided geological/hydrogeological expertise in a \$35-million environmental litigation on the Big Island of Hawaii. Managed expedited soil and groundwater investigation in a very sensitive habitat; conducted groundwater monitoring and modeling, which included assessing the influence of strong tidal fluctuations on separate and dissolved petroleum phases; used forensic chemistry to ascertain the age and nature of degraded PHCs; and managed the development of remedial actions and their costs. Drafted the technical elements of the final settlement agreement between the parties.

Designed and supervised geological, surface geophysical, and geochemical evaluations of a residential area located on the site of a large former oil storage facility in the Central Valley of California.

Managed a fast-track site investigation to assess the potential for and extent of hydrocarbon and pesticide contamination of a shallow groundwater aquifer near Honolulu, Hawaii, for a \$10-million property transaction.

### ***Perchlorate***

Assisted a client in evaluating alternative technologies for remediation of a perchlorate release to groundwater in Southern California.

Assisted a client in southern California in identifying, prioritizing, and evaluating potential sources of perchlorate to a municipal well field as part of a CERCLA §113 action. Services included historical and regulatory records research, field investigations, assessment of selected industrial production practices, and development of an offsite sources groundwater investigation workplan to verify potential releases. Identified a number of potential offsite sources of perchlorate.

Providing technical consulting services to a client in central California to assess the causes of a commingled groundwater plume of perchlorate and quantify the relative contributions of multiple potential sources.

Evaluated state-of-the-art perchlorate treatment technologies and conducted an alternatives analysis of a number of technologies to treat perchlorate-affected groundwater at a large municipal water supply system. Technologies evaluated include biological fluidized bed reactors, reverse osmosis, various types of ion exchange, and GAC. Evaluation criteria included implementability, cost effectiveness (including both capital and operations and maintenance costs), and technical effectiveness. The systems evaluated were sized and developed to treat groundwater containing perchlorate in concentrations of up to 3000 µg/L to levels below current analytical detection limits. Results of our analysis indicated that biological fluidized bed reactor is a significantly superior technology over the other alternatives for the 30-year life of the system.

Assisted a major insurance company who was seeking to quantify technical, financial, and regulatory risks associated with a former manufacturing site in northern Oregon, in order to provide environmental cost-cap and third-party liability insurance as part of a property transaction. Specifically, Exponent evaluated potential source areas and developed an assessment of the risk of perchlorate migration to both surface water and groundwater. In addition, we contacted relevant state agencies to assess their understanding of the “emerging” issues related to perchlorate and what standards they propose to implement with regard to perchlorate cleanup (e.g., federal, another state’s, such as California, or develop their own). The information provided allowed the client to make informed, risk-based decisions on the types and structures of the insurance policies they were willing to offer to their client.

### ***Polychlorinated Biphenyls (PCBs), Dioxins, Furans***

Providing multiple environmental, regulatory, and litigation support services regarding a CERCLA §107 cost recovery litigation on the Island of Oahu, Hawaii. The site is a former wood treatment facility, and COIs include chromium, arsenic, copper, pentachlorophenol (PCP), and polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans (PCDDs/Fs). Reviewed NCP compliance of previously performed remedial investigations, and evaluated the feasibility and cost of recommended preliminary remedial alternatives and previously completed removal actions. Performed chemical characteristic analysis (fingerprinting) using the 17 most common congeners of PCDD/F to evaluate potential multiple sources of those COIs. Used an optimization process to better estimate the volume of soils that would require corrective actions, depending on a range of potential cleanup levels, site uses, and land-use restrictions, and remedial alternatives to minimize the cost of final remediation. Prepared a condensed alternatives analysis (the State equivalent of a feasibility study under CERCLA).

Managed the development of a RAP for the closure and remediation of a former natural gas production and transport facility in southern California affected by PCBs. The RAP included the completion of an initial study under the California Environmental Quality Act, which successfully led to a mitigated negative declaration. On completion of the RAP, the project continued with the final remedial design action.

Supervised field work and reviewed technical data, including shallow seismic geophysics, for an in-situ bedrock permeability testing program for the design of a slurry-wall containment system as a final remedial measure at an operating lumber site in northern California. COIs were PCP, dioxins, hexavalent chromium, copper, and arsenic. Dioxins were the drivers for corrective action.

Supervised a fast-track groundwater investigation of a PCB-contaminated Superfund site in northern California using cone penetrometer and BAT-probe sampling techniques to verify site conditions during Record of Decision negotiations between the client and EPA.

Supervised the remedial investigation of an electronics production facility site in the southeastern U.S., where PCBs were the major chemicals of concern. Of particular interest at this site was the occurrence of chlorinated HVOCs, which greatly enhanced the mobility of the PCBs. Defined the lateral and vertical extent of PCB and HVOC migration. Results indicated

that HVOCs had reached local municipal wells. Interim remedial measures were implemented to mitigate erosion of PCB-affected soils.

### ***Pesticides***

Evaluated potential sources of 1,2,3 trichloropropane (1,2,3-TCP) at a site in the Central Valley of California. Evaluation focused on the number and location of 1,2,3-TCP detections in municipal wells. Conducted a detailed hydrogeologic assessment and a statistical analysis comparing site-specific data to 1,2,3-TCP detections throughout the Central Valley. Demonstrated that the municipal wells in question at the Site were strongly anomalous in 1,2,3-TCP detections — both temporally and spatially— when compared to the pattern of detections in other wells, indicating a previously unrecognized potential source area on the Site.

Managed a fast-track project that included the characterization of shallow soils on a 13-acre site for pesticide contamination (DDT, DDD, DDE) that exceeded state hazardous waste criteria, and developed a plan for expedited excavation and disposition of contaminated soils. Working closely with four government agencies, the project team was able to meet the client's aggressive schedule to transfer the property and begin construction of a freeway interchange.

### ***Metals***

Assessed historical and current site conditions at a former alumina production facility in the U.S. Virgin Islands which was the focus of CERCLA §106, §107 and §113 cost recovery and cost contribution claims. Over 3,000 documents were reviewed to develop a sound conceptual site model for the facility. Principal COIs associated with “red mud” releases include metals (arsenic, cadmium) and high pH, which are all associated with the Bayer alumina extraction process. Determined that adequate site information existed to support a finding of divisibility of harm to the environment— and consequently, response costs could be apportioned and reasonably allocated among the parties. The six “Gore Factors” were applied at the site. Amount of waste generated and cooperation with regulatory agencies were the two principal differentiating Gore Factors. Used historical production records, as a surrogate for the amount of hazardous material generated by each party, and reviewed regulatory enforcement records to develop a quantitative record of regulatory infractions during the tenure of each party, to allocate response costs among those parties. Specific tasks included review of both soil and groundwater RI/FS reports, development of cost estimates for alternative remedial actions, review and assessment of the Bayer process for determining various waste streams, and quantification of site information to support a defensible allocation among the parties.

Assessed the response actions and costs of a cement kiln dust (CKD) and battery debris at a site near Seattle, WA. Various metals and pH were the principal drivers for cleanup. The assessment included the reconstruction of potential release events, and the resulting impact to groundwater and soils. Evaluated the technical appropriateness and costs of remediation, and the degree to which the response action was compliant with regulatory agency standards and practice.

Consulted on a port authority in California in a CERCLA §107 cost recovery action related to a \$5-million time-critical removal action. Used various analytical techniques to determine when dredged fill material containing elevated concentrations of lead was deposited. Historical aerial photographs were enhanced electronically, and then, by obtaining historical tidal and celestial information (going back to the 1940s), and compiling consecutive structural changes to facilities and the waterfront, was able to determine conclusively when a significant portion, if not all, of the lead-affected material was placed. Also reviewed the corrective actions undertaken to ascertain the degree to which they were consistent with the NCP.

Led an investigation of alleged metals impact from a highway to an urban Lake in San Francisco, CA. Lead, copper and zinc were the principal COIs. The investigation included a detailed evaluation of historical activities in the watershed to the Lake; identification of various metal sources, estimation of runoff patterns and historical flow rates based on precipitation records going back almost 100 years. Researched pre- and post-lead ban emission and deposition levels from a number of studies to estimate the historical (since the late 1930s) relative contributions of these metals from the highway and from nearby residential, military, and industrial land uses. Quantified the amount of lead present in the lake and annual and total contributions from other sources to establish an allocation based on the amount of hazardous substances released to the Lake. Also, conducted an NCP compliance evaluation of the RI/FS, and evaluated the technical correctness and costs associated with the proposed remedy, and developed alternative remedies that were lower in cost and more readily implemented than the proposed remedy.

Led an investigation to evaluate the causes of a release of selenium-containing particulate matter in furnace gasses from a glass-manufacturing facility. Also inspected, collected, and tested external finishes of automobiles to assess the degree and type of damages to the cars' finishes due to the release. Inspected the baghouse, plenum, and stack of the facility to ascertain whether the release was due to design, operations, and/or maintenance failure. Based on a detailed review of maintenance and operating records, determined that the most probable failure mode was poor performance of the coating of filter bags (in turn, most likely due to operating the furnace at levels below the dewpoint of the flue gas). An inspection of the automobile finishes indicated that the damage to the paint was surficial (i.e., did not penetrate through the paint to the metal), and was readily ameliorated by standard body-shop buffing practices.

### **Solid Waste**

Evaluated the potential contribution of metals to municipal solid waste (MSW) landfill leachate from hospital incinerator ash at a CERCLA site in northern California. The study included comparing leachate results from samples collected in wells within and downgradient of the landfill to metals concentrations associated with hospital incinerator ash, MSW incineration ash, and typical MSW leachate from an extensive literature review. In addition, evaluated the effect of the hospital incinerator ash on the pH of the leachate, and the effect of the incinerator ash on the activity of dechlorinating bacteria and consequently on the presence of vinyl chloride in the leachate.

Managed a major expansion of a solid waste landfill utilizing draft requirements of RCRA's Subtitle D and new state and local waste management plans. The project included conducting siting studies; performing groundwater, surface water, and air quality studies; developing operating and design plans; and preparing closure and post-closure maintenance plans for acceptance by the enforcement agency.

Managed the detailed compliance, operations, and siting review for a client (lessor) to assess the performance of an operator (lessee) in operating and maintaining a municipal solid waste landfill in northern California. Compliance issues include the recently promulgated Title 23, Article 5, groundwater monitoring requirements by the California State Water Quality Control Board.

Supervised a project team that developed the conceptual design of a liquid waste treatment facility to solidify and treat waste streams that were disposed of at a client's municipal solid waste landfill. The project included statistically sampling numerous local liquid waste sources, characterizing the wastes into treatability groups, and performing bench-scale tests to develop final treatability options.

Provided regulatory compliance and permitting assistance to a client who operated three municipal solid waste landfills. Current emphasis involved liquids and sludge management issues in light of then-recent changes in state and federal regulations.

Led a team that rewrote a county's solid waste and hazardous waste management regulations. A detailed process for issuance and approval of both special use permits and waste management facilities permits was developed. As part of the submittal, the regulatory process was flow-charted, which indicated permitting milestones, review and submittal deadlines, and fee requirements.

Prepared a county waste management plan for approval by the state and local enforcement agencies.

Managed a project to close, fill, and grade five sewage treatment ponds in accordance with state and local regulations. An innovative component of the project, accepted by the state, was to use the sludge as a soil amendment during concurrent construction activities. The final use of the land is as a golf course.

### **Stray Current**

Undertook a detailed geologic, hydrogeologic, and geophysical study of a major basin in Utah to ascertain the subsurface behavior of direct current (DC) from a major power plant and to assess allegations of stray current. The study included an extensive literature review, verified by field observations, of specific geologic units and lithologies to depths up to 11,000 ft below ground surface, groundwater chemistry and the distribution of aquifer zones, and the resistivity and induced polarization characteristics of local soils and rock. Results of the evaluation indicated that there was no preferential geologic or hydrogeologic pathway for current to flow from the power plant to distant farms. Separately, using resistivity and current-density

relationships, also demonstrated that the levels of stray current allegedly measured at distant farms could not be associated with the power plant.

### **Water Resources and Geologic Hazards**

As part of a CERCLA case, conducted a detailed evaluation of two deep, high capacity-industrial water supply wells at a manufacturing facility in Sacramento, California, to assess the timing and potential pathways of alleged chlorinated solvent (perchloroethylene, or PCE) contamination, which caused the wells to be shut down. Evaluation of historic concentration trends and inverse groundwater modeling were used to identify the sources and the relative contributions of the PCE from those sources. A preliminary evaluation of the well design was conducted to develop various mitigation measures to inhibit or prevent further PCE migration to other wells.

Evaluated the hydrogeologic and geologic characteristics of a residential area within a small city in northern California to assess the technical appropriateness of both setback requirements of individual wastewater treatment systems (IWTs or septic systems) from tributaries that drain into a major drinking-water reservoir. Assessed surface and subsurface flow conditions, reviewed current literature regarding the fate of pathogens (particularly viruses) in the subsurface, and regional guidelines from other county and local agencies, as well as the state. Researched and tabulated failures of IWTs in the area, which supported a moratorium on construction of new systems, in addition to the setback requirements.

Conducted a geologic and hydrogeologic assessment of a proposed new well field in the Southern Central Valley of California, which included aquifer pumping tests, to assess the optimum and maximum well yields from the proposed new field. Developed preliminary designs of wells to extract groundwater from at least three aquifer zones at depths up the 250 ft below ground surface. Also assisted the client in assessing various conveyance routing options.

Conducted an evaluation of an existing well field, owned and operated by a municipal utility in the San Francisco Bay area. Findings from the evaluation indicated additional wells could be added to the field, in selected areas, to increase overall yield without significant impact to existing wells. Prepared preliminary-level designs for two new wells.

Conducted a basin-wide assessment of the occurrence and transport of perchlorate contamination in a major well field in Southern California. The well field covered about 50 square miles and included dozens of wells. A number of wells in one part of the basin had been shut down to prevent serving impacted groundwater to customers, and to minimize continued spreading of the perchlorate plume. Our assessment identified the likely sources, the hydrologic pathways, and the long-term behavior of the plume under various pumping scenarios.

Conducted a historical hydrologic and hydrogeologic review of a property in the East San Francisco Bay Area to ascertain whether stormwater runoff that crosses the property was exacerbated by county-owned public works, and also to determine whether a retaining wall, installed to mitigate a landslide, affected the hydraulics of a major creek in such a way that a variance to a county setback requirement should be granted for development. The study

involved review of historical aerial photographs (back to 1928) and topographic maps (back to 1897), review of county public works ordinances, and geologic and hydrogeologic studies. Then results of the study showed that the retaining wall had only a negligible effect on creek hydraulics, that the property was the concentration point for a 20-acre drainage area going back to at least the late 19<sup>th</sup> century, and that no county activities had affected that surface flow.

As part of an inverse condemnation claim, studied the surface and subsurface hydraulics of a major drainage basin in northern California, particularly during flooding events in 2002 and 2005. The purpose of the study was to ascertain whether the failure of a privately owned floodwall was due to deficiencies in the design of a retention basin and its discharge structure (flap-gates), and whether the floodwall was designed and built in accordance with county requirements. The study included a detailed survey of the floodwall and retention basin; excavation of the floodwall's foundation in a number of locations; testing the density, spacing, and orientation of rebar within the wall; and examination of historical photographs during and after the wall failures; and interviewing a number of witnesses to the floodwall failure. Results of the evaluation indicated that the retention basin and discharge structures behaved as designed, and that the floodwall was not designed as required by the county, nor was it built as designed. Both of those deficiencies resulted in failure of the floodwall.

Evaluated a rural groundwater supply, conveyance, and treatment system on behalf of a client who was a defendant in an action related to the conditions of the system at the time that a property, located in San Benito County, California, was purchased. The system served 13 properties, and consisted of two wells, three equalization tanks, and more than 10,000 ft of conveyance. Services were related largely to the causes of, and mitigation measures (and costs) to address, periodic bacteriological blooms in the system. Tasks included a site inspection of the system, evaluation of as-built drawings, assessment of the system's compliance with local and state permits and regulations, and determination of the most likely sources and causes of the biological growths (e.g., *E. coli*). Developed mitigation measures and costs, developed estimates of damages, and evaluated plaintiff's expert's findings and conclusions.

Evaluated the water conveyance system and the water quality of an agricultural well at a large winery near Santa Barbara, California. The winery was experiencing significant clogging problems in their irrigation system. Our evaluation concluded that the agricultural well was affected by certain types of bacteria (iron-related, sulfate-reducing, and slim-forming), but that the most proximate cause of the clogging is from a combination of carbonate and iron hydroxide precipitation in certain portions of the irrigation system. Recommended mitigating the problem by relocating and/or deepening the well, and treating the water by ion exchange.

Evaluated and assessed construction procedures and documentation to assist a client in evaluating the failure of a containment system designed and installed to prevent mobility of certain COIs during the remediation of affected soils at a former wood-preserving site in western Washington. The soils are located within the inter-tidal zone, and the containment system was to prevent migration of metals, and both light and dense non-aqueous phase liquids (light, nonaqueous-phase liquids and DNAPLs, respectively) into the bay, and to prevent migrating marine organisms from entering the site.

Assessed claims that construction dewatering of a trench used to install a 96-inch force main near Sacramento, California, led to soil consolidation and settlement that resulted in alleged damages to residential structures along the alignment of the excavation. Using construction records—including well logs, pumping records, survey elevation data, and geotechnical characteristics of the relevant soils—determined that, while the groundwater drawdown created by the dewatering wells did affect nearby soils, the maximum extent of soil consolidation was less than 0.1 inch over the extent of the property, which would not have led to any structural impact, even at the residences closest to the excavation.

Investigated and analyzed a \$7-million construction claim on a new \$190-million high-rise office building in downtown Honolulu. Provided technical review and analysis related to the effects of, and potential mitigation measures against, artesian groundwater flow conditions during the installation of rock anchors used to prevent hydraulic uplift of a five-level underground parking garage.

When a slope failure in a residential neighborhood destroyed and damaged a number of homes, conducted a hydrogeologic analysis of the potential effects of seepage from a municipal reservoir, and the potential role of the seepage in the slope failure.

Managed a project to ascertain the degree of environmental impact to a municipal drinking-water reservoir from a hypothetical release from a fuel transmission pipeline due to a potential seismic failure. The results of the study identified the most likely routes of surface transport, degree of infiltration and runoff, and effects on surface water from the release.

### **Professional Affiliations**

- Geological Society of America
- Association of Engineering Geologists
- National Groundwater Association
- California Groundwater Resources Association
- American Society for Testing Materials—ASTM

### **Deposition/Trial Testimony**

A list of cases in which Mr. Mesard has testified is available on request.