



Exponent®
Engineering & Scientific Consulting

Elizabeth Lu, P.E.

Senior Managing Engineer | Health Sciences
Houston
+1-832-325-5714 tel | ELu@exponent.com

Professional Profile

Ms. Lu has over twenty years of professional experience, the first half primarily in environmental remediation and occupational health consulting, and the latter half in management consulting with a focus on health, environment and safety (HES)-related programs. She has and continues to support clients within the oil and gas industry in a variety of capacities including as project manager, organizational change manager, IT design lead, and subject matter expert for training and communications teams.

Known amongst her clients as an effective and objective facilitator who quickly comes up to speed on a project, Ms. Lu can translate a vision into the specific deliverables and outcomes that define success. She has been in a leadership capacity for several global deployments of new and revised business processes and supporting IT tools.

Ms. Lu's projects cover a broad range of HES-related subjects including management of change, serious injury and fatality prevention, incident investigation/loss prevention, contractor health, environment and safety management, occupational safety, environmental compliance, and end-state vision for remediation projects. Her most recent work has involved updating a major oil company's operational excellence/health, environment and safety management system, and developing the workflow and governance processes supporting a client's digital transformation efforts. Ms. Lu has facilitated client working groups in topics ranging from health and safety, environmental remediation, public relations and communications, and technology development.

In her work at Exponent, Ms. Lu has applied her management skills to integrating work products from multidisciplinary team members for large-scale projects. Ms. Lu has also applied her technical research skills assisting clients in the fields of occupational and environmental health. Examples of such projects include analysis of work-related injury trends, assessment of public health risks during electric power outages, and evaluation of asbestos and mold exposures.

Prior to joining Exponent, Ms. Lu was a Senior Engineer at Geomatrix Consultants in Oakland, California, where she was responsible for the development, design and implementation of environmental investigations and remediation systems. She applied her knowledge of environmental forensics, risk-based decision-making, regulatory compliance, and her understanding of clients' business goals to bring together landowners, developers, construction crews, and the regulatory community to prioritize health and safety risks and resolve environmental and public health issues in a cost-effective and timely manner.

Academic Credentials & Professional Honors

M.S., Geotechnical Engineering, University of California, Berkeley, 1993

B.S., Civil Engineering, University of California, Berkeley, 1990

Licenses and Certifications

Professional Engineer Civil, California, #52522

Prior Experience

Senior Engineer, Geomatrix Consultants, Inc., 1991-2000

Professional Affiliations

American Society of Civil Engineers

American Association for the Advancement of Science

Publications

Kelsh MA, Fordyce TA, Lau EC, Mink PJ, Morimoto LM, Lu ET, Yager JW. Factors that distinguish serious versus less severe strain and sprain injuries: An analysis of electric utility workers. *Am J Ind Med* 2009; 52:210-220.

Fordyce TA, Kelsh MA, Lu E, Sahl JD, Yager JW. Thermal burn and electric shock injuries among electric utility workers 1995-2004. *Burns* 2007; 33:209-220.

Hicks JB, Lu ET, De Guzman R, Weingart M. Fungal types and concentrations from settled dust in normal residences. *J Occup Environ Hyg* 2005; 2:481-492.

Kelsh MA, Lu ET, Ramachandran K, Jesser C, Fordyce T, Yager JW. Occupational injury surveillance among electric utility employees. *J Occup Environ Med* 2004; 46:974-984.

Paustenbach DJ, Finley BL, Lu ET, Brorby GP, Sheehan PJ. Environmental and occupational health hazards associated with the presence of asbestos in brake linings and pads (1900 to present): A "State-of-the-Art" review. *J Toxicol Environ Health (Part B)* 2004; 7:33-110.

Park G, Lu E, Lester M, Pye J, Sullivan R, Riccio G. Technology survey and assessment for the U.S. Army's Objective Force Warrior Program. *Proceedings, 8th Annual International Conference on Industrial Engineering, Theory, Applications, and Practice, Las Vegas, NV, November 10-12, 2003.*

Presentations

Hicks JB, Lu ET. Culturable fungi in settled dust from normal residences. Presented at the 2005 American Industrial Hygiene Conference and Exposition, Anaheim, CA, May 21-26, 2005.

Kelsh MA, Lu ET, Fordyce T. EPRI Occupational health and safety database (OHSD): Update of ongoing 2004 activities. Invited presentation at EPRI Occupational Health and Safety Area Council Meeting, Boston, MA, September 30, 2004.

Kelsh MA, Lu ET, Ramachandran K, Jesser C, Fordyce T, Yager JW. Occupational injury surveillance among electric utility employees. Poster presentation at the 37th Annual Meeting of the Society for Epidemiologic Research, Salt Lake City, UT, June 15-18, 2004.

Sheehan, P.J., Finley BL, Lu ET, Brorby GP. Environmental and occupational health hazards associated with the presence of asbestos in brake linings and pads (1900 to present). Invited presentation at the Society of Automotive Engineers (SAE), 21st Annual Brake Colloquium and Exhibition, Hollywood, FL, October 19-21, 2003, and at the SAE 2004 World Congress, Detroit, MI, March 8-11, 2004.

Robert L. von Tersch, Ph.D., MSS, COL; Emily Skow, Ph.D.; Elizabeth T. Lu, P.E.; Edward B. Teague, Ph.D., COL; Steven C. Hart, COL, West Point Proximity Logging Limited User Test: User Feedback on a Wearable Technology. Presented at the Military Health System Research Symposium, Kissimmee, FL, Sep 12-15, 2022.

Scott McLean, Ph.D., Chris Eschbach, Ph.D., Elizabeth T. Lu, P.E., Framework for Wearable Sensor Data Characterization and Validation in Naturalistic Real-World Military Settings. Presented at the Military Health System Research Symposium, Kissimmee, FL, Sep 12-15, 2022.

Project Experience

Operational Excellence/Health, Environment and Safety Management System

Technical content developer for materials supporting the launch of client's updated operational excellence/health environment and safety management system. This project included the development and vetting of content, ranging from company-wide communications to detailed process documentation, explaining what the management system update means to the client's business units, key roles impacted, and success vision. Materials developed used in coordinated communications and presentations to client's top 200 leaders and made available on the intranet for broad consumption within the client's organization.

Deployment of HES processes and IT tools

Project manager for deployment of a behavior-based system to prevent and reduce losses to a client's downstream workforce in over 100 countries. Responsibilities included developing the deployment plan, verifying that the training content was integrated and aligned with that produced by other ongoing corporate initiatives, training the deployment team, ensuring training was delivered by project personnel in a standardized manner, managing communications, developing tools to improve team performance, and liaising with the internal IT team responsible for developing the data capture application. Initially, this project was focused only on the marketing and retail division of the organization, but project success warranted expanding the deployment scope in two additional phases to include the other downstream divisions.

Deployment project manager for an IT tool supporting client's behavior-based/loss prevention tool. Responsible for team of 20+ staff during client's reorganization. Responsible for training of deployment team, project updates to management responsible for project's governance, handling communications within and external to the team, overseeing the project's budget, monitoring and measuring training effectiveness and user acceptance of the new application. Liaised between the deployment team and internal IT application development/support teams. Customer feedback on training effectiveness, quality of training and support materials, and session length and value was extremely positive (i.e., more than 85% of all responses in each category were ratings of 4 or 5 out of a scale of 1 to 5).

Organizational change manager for an IT tool supporting client's management of change process. Responsibilities included the following: engaging with stakeholders to identify and document design requirements for the IT tool; working with the vendor to ensure design requirements were implemented; preparing the deployment plan based on the client's state of readiness; developing the training materials (including computer-based training materials); preparing project communications; structuring and

developing the content for and subsequent analysis of the results from field tests and user acceptance testing; and leading train-the-trainer sessions for the client. Deployed IT tool to client's shipping organization and received an internal client award recognizing efficient planning and preparation efforts, understanding of organization's business needs, tailoring training to be relevant, and conducting effective training sessions.

IT design lead for an IT tool supporting client's contractor health, environment and safety management process. Responsibilities included facilitating a workshop to develop the requirements that served as the basis for the IT tool; working with the vendor to design the IT tool; leading several design workshops with key stakeholders; developing training content addressing the IT tool's functionality; structuring and developing the content for and analyzing the results from field tests, and user acceptance testing sessions; training the trainers; and conducting training sessions at six of the client's organizations. Feedback consistently acknowledged effective, fit-for-purpose training and recognized subject matter expertise in the training content (100% feedback on training effectiveness and session length and value reflected ratings of 4 or 5 out of a scale of 1 to 5).

Environmental Project Management

Facilitator for multidisciplinary team with environmental, legal and community/public affairs subject matter experts charged with assisting project teams in identifying the best end uses for client's environmental assets with a long-term goal of improving organization capability in developing end-state visions. In addition to meeting facilitation, identified best practices and lessons learned from individual projects for sharing across the organization. In its first year, the team spent ~\$600,000, but saved the business unit \$6 million. Team's work has led to the creation of a permanent standing peer-assist team whose function is to review the end-state vision and regulatory framework components of environment projects with significant reserves.

Managed a portfolio of environmental projects for a major oil company that were along a former crude oil pipeline right-of-way. Led a team of five technical staff members in evaluating data to identify regulatory requirements and estimate the client's potential liability, negotiating with regulatory agencies (California Department of Toxic Substances Control, San Joaquin County Public Health Services, Contra Costa County Health Services Department, and the California Regional Water Quality Control Board — Central Valley Region) to implement risk-based corrective action, coordinating and overseeing environmental consulting services, and handling community relations. Successfully obtained 11 regulatory closure letters in three years, allowing third parties to develop contaminated properties and thereby mitigating lawsuit potential from third parties. Prepared and implemented post-remediation management plans regarding handling impacted soils and groundwater encountered during construction activities. This protocol was also applied to residential developments. Served as a member of a client's high-level decision analysis study team that evaluated the business strategy implemented on this \$2 million/year environmental program.

Assisted the California Public Utilities Commission (PUC) in a large-scale evaluation of the relative public health and safety risks of more than 9,000 businesses seeking an exemption from rotating power outages in California. Specifically, worked with the PUC in the development and implementation of a web-based application and a risk-based decision model to generate a numerical risk score and qualitative modifying factors for each applicant. These data were used in conjunction with a load analysis to develop a prioritized list of applicants based on critical public health and safety needs.

Environmental Safety and Compliance

Served as in-house project manager for a major oil company and was responsible for a \$350,000+ program to improve environmental health and safety compliance at more than 40 bulk terminal facilities and 500+ service stations located in 17 states. Tasks included identifying and prioritizing gaps in the existing compliance program, soliciting input from stakeholders, identifying applicable best practices from other operating companies within the client organization, managing the development and implementation of a user-friendly database of pertinent regulatory and company policy information that tied into pre-

existing platforms (SAP-PM), overseeing a 12+ member contractor team, and coordinating a training workshop for the 30+ users of the database.

Performed an assessment of environmental regulations in 43 countries across North America, Europe, and Asia on batteries, heavy metals/toxic material content, and recycling/recovery/end-of-life disposal requirements. The survey was conducted to identify existing and/or proposed regulations that potentially impacted the client's products, including documentation requirements for instruction sheets/product manuals, packaging, and labeling requirements, and information on available collection/recycling organizations and companies. Work product served as a baseline for the client in tracking battery-related regulations affecting product distribution.

Performed several Phase I site assessments for various property transactions. These included properties designated for office buildings in large commercial parks, retail stores in industrial and commercial settings, and a 30-mile pipeline used for transporting treated wastewater. Site assessment activities included reconnoitering sites and surrounding areas to identify potential environmental concerns, reviewing historical documents and regulatory agency files, and preparing reports documenting work.

Occupational and Environmental Health

Served as a team member in asbestos friction material litigation project involving claims that auto/brake mechanics were exposed to asbestos during repair of asbestos-containing brake linings and pads. Responsibilities included: conducting and preparing a review of when asbestos-related diseases were recognized in workers engaged in manufacturing friction products and installing and repairing brake linings/pads; and describing how concerns for associated occupational hazards were balanced with vehicle performance and safety requirements and the resulting federal and state regulatory actions. Prepared the exhibits and materials used by brake experts for litigation cases.

Managed project where client requested an evaluation of the potential human health effects associated with the presence of stainless-steel particles in food/beverage products, as well as identification of the root cause of the presence of the particles. Results of the human health evaluation were used by the client to successfully negotiate that a product recall by US Food and Drug Administration was not necessary and that there were no significant risks to human health.

Identified and evaluated injury and illness trends based on data in a standardized occupational health surveillance database that was established by EPRI, formerly known as the Electric Power Research Institute, for the electric utility workforce. Responsibilities also included recruiting utilities to participate in the surveillance project and preparing the annual report. Conducted a nested case-control to identify what factors are associated with serious sprain/strain injuries versus less severe (i.e., non-lost time) sprain/strain injuries.

Conducted an exposure assessment study of background fungi levels in settled dust from carpeting and furnishings in 26 normal residences (i.e., not mold impacted). These residences were pre-screened by interviews with the owners, physical inspection, and air sampling to limit the surface dust collection to structures in which there was no history of water intrusion, flooding, plumbing leaks, signs of mold growth, or evidence of unusual airborne fungal spore types or concentrations.

Environmental Site Remediation

For a former metals recycling facility in Santa Rosa, California, prepared a feasibility study developed in accordance with National Contingency Plan requirements by comparing various remediation technologies and developing conceptual engineering designs, design-life cost estimates, and implementation schedules. Oversaw construction of a groundwater treatment system designed to remediate volatile organic compounds at the former metals recycling facility. Provided ongoing operations and maintenance support, including monitoring and sampling program coordination, system performance tracking/optimization, maintenance team training, monitoring of analytical data, regulatory compliance reporting, and implementation of preventive maintenance tasks.

Prepared the engineering design and contract drawings, specifications, and bid documents for a groundwater/soil vapor extraction treatment system at a former chemical solvent repackaging facility in Santa Fe Springs, California. Designed and supervised the construction and operation of a temporary groundwater treatment system using activated carbon at the site. Prepared Negative Declaration application and public notice of the project work in compliance with requirements of the California Environmental Quality Act.

Prepared the work plan for a former industrial site in San Jose, California, and implemented the remediation plan, which included excavating and backfilling a 3,500 cubic yard pit, testing the density of backfill material, and characterizing excavated soil for disposal. Oversaw remediation and disposal activities at the site. Prepared the remedial action report.

Operated and maintained a groundwater treatment system at an active industrial research facility in Palo Alto, California. Designed and supervised modifications to an existing groundwater treatment system that could not be shut down temporarily for construction activities.

Supervised construction of a groundwater and soil vapor extraction system at a former semiconductor manufacturing facility in Cupertino, California.

For a former automobile assembly plant facility, prepared the closure report and site management plan. Closure was granted by the California Regional Water Quality Control Board, San Francisco Bay region.