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Engineering & Scientific Consulting

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Professional Profile

Mr. Su has over 20 years of experience studying a broad range of issues concerning the effects of chemical, physical, and biological agents on human health and the environment. Areas of his work include probabilistic analysis, dose-response analysis, chemical fingerprinting, sediment quality evaluation, sediment transport of pollutants, air dispersion modeling, food-chain/food-web modeling, angler fish consumption, pathogens in recreational waters, electric and magnetic field exposure, childhood lead exposure, epidemiology, and general toxicology. He provides state-of-the-art scientific support for site assessments, pollutant source identification and allocation, and evaluation of potential health and environmental impacts from new and existing products.

Mr. Su has considerable experience studying the effects of bioaccumulating chemicals, such as dioxins and PCBs, in the environment. He has applied his broad range of experience to coordinate multidisciplinary efforts in large projects. His work has resulted in more realistic characterization of potential risk from exposure to environmental pollutants to support technically sound and cost-effective risk management actions.

Academic Credentials & Professional Honors

M.P.H., Environmental Health Sciences, Yale University, *with distinction*, 1991

B.A., Chemistry, New York University, 1986

Prior Experience

Senior Associate, Hanna Associates — Integrated Risk Management, 1998-1999

Senior Associate, Sciences International, 1997-1998

Research Scientist, Bailey Research Associates, 1995-1997

Associate Health Scientist, McLaren/Hart - ChemRisk, 1992-1995

Database Consultant, 1990-1991

Database Manager, Technical Database Services, 1987-1990

Professional Affiliations

Association for Environmental Health and Sciences

Society for Risk Analysis

Society of Environmental Toxicology and Chemistry

Society of Toxicology

Languages

Mandarin Chinese

Publications

Shrestha PL, Su SH, James SC, Shaller PJ, Doroudian M, Firstenberg CE, Thompson CT. Conceptual site model for Newark Bay — Hydrodynamics and sediment transport. Journal of Marine Science and Engineering 2014; 2(1):123-139.

Alexander DD, Bailey WH, Perez V, Mitchell ME, Su S. Air ions and respiratory function outcomes: A comprehensive review. Journal of Negative Results in BioMedicine 2013; 12(1):14.

Saba T, Su S. Tracking polychlorinated biphenyls (PCBs) congener patterns in Newark Bay surface sediment using principal component analysis (PCA) and positive matrix factorization (PMF). Journal of Hazardous Materials 2013; 260(15):634-643.

Bailey WH, Johnson GB, Bishop J, Hetrick T, Su S. Measurements of charged aerosols near ±500 kV DC transmission lines and in other environments. IEEE Transactions on Power Delivery 2012; 27(1):371-379.

Gujral J, Proctor D, Su S, Fedoruk MJ. Water adherence factors for human skin. Risk Analysis 2011; 31(8):1271-1280.

Gujral J, Fowler J, Su S, Morgan D, Proctor D. Repeated open application tests for allergic contact dermatitis using two chemicals containing hexavalent chromium. The Toxicologist 2008; 102(S-1):137.

Proctor D, Su S, Gujral J, Fowler J, Morgan D. Risk assessment of allergic contact dermatitis due to dermal exposures to hexavalent chromium. The Toxicologist 2008; 102 (S-1):368.

Haws LC, Su SH, Harris M, DeVito MJ, Walker NJ, Farland WH, Finley B, Birnbaum LS. Development of a refined database of mammalian relative potency estimates for dioxin-like compounds. Journal of Toxicological Sciences 2006; 89(1):4-30.

Connor KT, Eversen M, Su SH, Finley BL. Quantitation of polychlorinated biphenyls in fish for human cancer risk assessment: A comparative case study. Environmental Toxicology & Chemistry 2005; 24(1):17-24.

Haws L, Harris M, Su S, Birnbaum L, DeVito M, Farland W, Walker N, Connor K, Santamaria A, Finley B. Development of a refined database of relative potency estimates to facilitate better characterization of variability and uncertainty in the current mammalian TEFs for PCDDs, PCDFs, and dioxin-like PCBs. Organohalogen Compounds 2004 66:3426-3432.

Haws L, Harris M, Su S, Birnbaum L, DeVito M, Farland W, Walker N, Connor K, Santamaria A, Finley B. A preliminary approach to characterizing variability and uncertainty in the mammalian PCDD/F and PCB

TEFs. Organohalogen Compounds 2004; 66:3439-3445.

Finley BL, Su SH. Contaminated sediments and bioaccumulation criteria: Procedures for evaluating dredging and open ocean disposal permits in the New York/New Jersey harbor. Proceedings, International Conference on Remediation of Contaminated Sediments, Venice, Italy, October 10-12, 2002.

Su SH, Pearlman LC, Rothrock JA, Iannuzzi TJ, Finley BL. Potential long-term ecological impacts caused by disturbance of contaminated sediments: A case study. Environmental Management 2002; 29(2):234-249.

Su S, Rothrock J, Pearlman L, Finley B. Health-based criteria for sediment disposal options: A case study of the Port of New York/New Jersey. Human and Ecological Risk Assessment 2001; 7(6):1737-1756.

Hanna LM, Lou S-R, Su S, Jarabek AM. Mass transport analysis: Inhalation RfC methods framework for interspecies dosimetric adjustment. Inhalation Toxicology 2001; 13(5):437-463.

Bailey WH, Su SH, Bracken TD. Probabilistic approach to ranking sources of uncertainty in ELF magnetic field exposure limits. Health Physics 1999; 77(3):282-290.

Su SH, Little RM, Gudka NJ. Characterization of uncertainty. In: Risk Assessment and Indoor Air Quality. Anderson EL, Albert RE (eds), CRC Press, Boca Raton, FL, 1998.

Bailey WH, Su SH, Bracken TD, Kavet R. Summary and evaluation of guidelines for occupational exposure to power frequency electric and magnetic field. Health Physics 1997; 73(3):433-453.

Iannuzzi TJ, Harrington NW, Shear NM, Curry CL, Carlson-Lynch H., Henning MH, Su SH. Distributions of key exposure factors controlling the uptake of xenobiotic chemicals in an estuarine food web. Environmental Toxicology & Chemistry 1996; 15(11):1979-1992.

Price PS, Su SH, Harrington JR, Keenan RE. Uncertainty and variation in indirect exposure assessment: An analysis of exposure to tetrachlorodibenzo-p-dioxin from a beef consumption pathway. Risk Analysis 1996; 16(2):263-277.

Ebert ES, Su SH, Barry TJ, Gray MN. Estimation of rate of fish consumption from Connecticut Housatonic River creel survey. North American Journal of Fish Management 1996; 16:81-89.

Gillis CA, Bonnevie NL, Su SH, Ducey JG, Huntley SL, Wenning RJ. DDT, DDD, and DDE contamination of sediments in the Newark Bay Estuary. Archives of Environmental Contamination and Toxicology 1995; 28:85-92.

Huntley SL, Wenning RJ, Su SH, Bonnevie NL, Paustenbach DJ. Geochronology and sedimentology of the Lower Passaic River, New Jersey. Estuaries 1995; 18(2):351-361.

Ehrlich R, Wenning RJ, Johnson GW, Su SH, Paustenbach DJ. A mixing model for polychlorinated dibenzo-p-dioxin and dibenzofurans in surface sediments from Newark Bay, New Jersey. Archives of Environmental Contamination and Toxicology 1994; 27:486-500.

Price PS, Su SH, Gray MN. The effect of sampling bias on estimates of angler consumption rates. Journal of Exposure Science and Environmental Epidemiology 1994; 4(3):355-371.

Su SH. Computer modeling of indoor air quality: A validation study. Thesis. Department of Epidemiology and Public Health, Yale University School of Medicine, New Haven, CT, 1991.

Presentations

Saba T, Su S. Tracking sources of polychlorinated biphenyls (PCBs) to Newark Bay sediments using positive matrix factorization (PMF). Platform presentation at SETAC North America 32nd Annual Meeting, Boston, MA, 2011.

Gujral J, Su S, Craven V. Prevalence rates of pleural abnormalities among populations with environmental asbestos and non-asbestos exposures. Poster presentation at Society of Toxicology Annual Meeting, Salt Lake City, UT, 2010.

Reiss R, Su S, Anderson E, Schoeny R, Southerland E, Carrington CD, Cox T, Ozkaynak H, Faustman EM, Hays SM, Cullen AC. Platform session: The evolution of health risk assessment. Society for Risk Analysis Annual Meeting, Baltimore, MD, 2009.

Gujral J, Proctor D, Su S, Fedoruk MJ. Water adherence factors for human skin. Poster presentation at Society of Toxicology Annual Meeting, Baltimore, MD, 2009.

Gujral J, Fowler J, Su S, Morgan D, Proctor D. Repeated open application tests for allergic contact dermatitis using two chemicals containing hexavalent chromium. Poster presentation at Society of Toxicology Annual Meeting, Seattle, WA, 2008.

Su SH. Modeling exposures for "high-end" individuals. Platform presentation at Society for Risk Analysis Annual Meeting, San Antonio, TX, 2007.

Su SH. Human health risk from pathogens in the Lower Passaic River. New York-New Jersey Harbor Estuary Program Pathogens Workgroup Meeting, New York, NY, January 2005.

Su SH, Finley BL. Historical and projected surficial sediment concentrations of PCDD/Fs and PCBs in the Lower Passaic River, New Jersey, USA. Dioxin 2003, Boston, MA, August 2003.

Su SH, Finley BL. Contaminated sediments and bioaccumulation criteria: Procedures for evaluating dredging and open ocean disposal permits in the NY/NJ Harbor. SETAC 22nd Annual Meeting, Baltimore, MD, November 11-15, 2001.

Su SH, Finley BL. Review of proposed "risk-based" criteria for the New York/New Jersey Harbor. SETAC 22nd Annual Meeting, Baltimore, MD, November 11-15, 2001.

Finley BL, Su SH. Contaminated sediments and bioaccumulation criteria: Procedures for evaluating dredging and open ocean disposal permits in the New York/New Jersey Harbor. International Conference on Remediation of Contaminated Sediments, Venice, Italy, October 10-12, 2001.

Su SH, Finley BL. Contaminated sediments and bioaccumulation criteria: Procedures for evaluating dredging and open ocean disposal permits in the New York/New Jersey Harbor. EPA Forum on Managing Contaminated Sediments at Hazardous Waste Sites, Alexandria, VA, May 30-June 1, 2001.

Su SH, Hanna LM, Little RM. Application of chemical fingerprinting for pollutant source characterization. Platform presentation at Society for Risk Analysis Annual Meeting, Washington, DC, 1997.

Su SH, Price PS, Harrington JR, Abel TB, Curry CL. Characterizing uncertainty and variation in indirect risk assessment of dioxin emission from hazardous waste incinerators. Platform presentation at Society for Risk Analysis Annual Meeting, Baltimore, MD, 1994.

Price PS, Keenan RE, Su SH. Accounting for interindividual variation in the current system of safety factors. Platform presentation at Society for Risk Analysis Annual Meeting, Baltimore, MD, 1994.

Su SH, Carlson-Lynch H, Wenning RJ. Source apportionment of 2,3,7,8-substituted dioxin and furan in

municipal sewage sludge using multivariate fingerprinting analysis. Abstract presented at Society of Environmental Contamination and Toxicology Annual Meeting, Denver, CO, 1994.

Wenning RJ, Johnson GW, Paustenbach DJ, Su SH. Characterization of polychlorinated dibenzo-p-dioxin and dibenzofuran fingerprint patterns in sediments using multivariate statistical analysis. Platform presentation at IAWQ Conference on Contaminated Aquatic Sediments, Milwaukee, WI, 1993.

Su SH, Johnson GW. Chemical fingerprinting of environmental media. Platform presentation at Maine Biological and Medical Sciences Symposium, Castine, ME, May 1993.

Project Experience

Probabilistic Risk Assessment

Derived a probabilistic soil cleanup level for dioxin for the residential area near an industrial facility. The analysis was performed to support the renewal of the facility's operating permit. The probabilistic exposure model included site-specific bioavailability data and the most current information on child soil ingestion behavior.

Developed and applied a probabilistic model to separately characterize uncertainty and variability of human exposure to dioxin emissions through a food-chain pathway. The results were used to develop comments to the USEPA regarding the indirect exposure assessment methodology. The work was presented in technical conferences and published in a peer-reviewed journal.

Developed and applied a probabilistic food web model to estimate pollutant body burden of several aquatic organisms in an estuary. The food web model provided a necessary tool to assess potential human risk and natural resource damage associated with the contaminated estuary. The work was published in a peer-reviewed journal.

Performed probabilistic exposure assessment to characterize potential "imminent" health risk to residential population near the Housatonic River in Massachusetts due to PCB-contaminated sediment and floodplain soil. The risk assessment provided the client and regulatory agency the necessary information to determine the need for a short-term measure remediation.

Conducted a probabilistic human health risk assessment to determine if the accidental spilling of tetraethyl lead-containing product at an oversea loading dock could pose potential harm through fish consumption. The study involved deriving plausible exposure scenarios for a variety of anglers, characterizing the local edible fish stock and fish consumption rates, and quantifying the distributions of potential exposures of the anglers and their family members. The result of the study found the levels of potential exposure to the lead-containing product would not pose an unacceptable health risk. The acceptance of this risk assessment allowed approval of the site closure strategy.

Dose Response Modeling

Performed dose response analysis of auditory startle response in rats for a chemical product undergoing EPA review. The efforts involved reviewing historical data and conducting statistical analysis to identify the appropriate benchmark response (BMR) for this endpoint. Dose response analysis using EPA's benchmark dose softwares (BMDS) was conducted to identify the appropriate point-of-departure for risk assessment.

Evaluated chronic bioassay results from the National Toxicology Program for a chromium-containing compound. Dose response analysis was performed to evaluated cancer slope factors that could be derived with this dataset using EPA's benchmark dose softwares (BMDS) and GLOBAL86.

Performed dose response analysis of rodent and human cholinesterase inhibition data for a pesticide

product undergoing EPA risk assessment for Reregistration Eligibility Decision. The analysis identified alternative points-of-departure and uncertainty factors for consideration in derivation of acute population adjusted dose (aPAD). Efforts included modeling using EPA's OPCumRisk and benchmark dose softwares (BMDS) and in-depth review of EPA organophosphate and n-methyl carbamate cumulative risk assessment methodologies.

Derived minimum elicitation thresholds (METs) for allergic contact dermatitis effect of two chromium-containing compounds. The analyses utilized EPA's benchmark dose software (BMDS) to evaluate various dose response models and their goodness-of-fit. The results provided basis for the derivation of acute RfD for dermal contact with these chemicals.

Performed an analysis of pertinent dosimetry data, and derived a site-specific cancer slope factor for Polonium-210, a radionuclide that is found in the emissions from an elemental phosphorus production facility. Considered factors such as inhaled dose, particle size, and solubility of inhaled materials, from which an estimate of the potential inhalation cancer risk upon exposure to the radionuclide was developed. The results of the analysis provided the basis for a more realistic site-specific assessment of potential human health impacts of emissions from the facility.

Analyzed dosimetry data, and supported the development of EPA's method to derive the RfC for gaseous chemicals. The analysis provided technical support to the applicability of the method to assess non-cancer risk from inhalation exposure to a wide range of gaseous chemicals. The work was presented in technical workshops and published in a peer-reviewed journal.

Analyzed and performed low-dose extrapolation modeling of chronic toxicity data using GLOBAL86 (linearize multistage modeling) and BMDS (benchmark dose modeling) software to derive cancer slope factors for several chemicals undergoing IRIS toxicological review and update.

Analyzed and reviewed acute exposure toxicological data, and performed sensitivity analysis of categorical regression modeling analysis used in the preliminary development of Acute Reference Exposure values.

Chemical Fingerprinting

Identified and apportioned potential sources of PCBs in sediments from Newark Bay, New Jersey, using multivariate fingerprinting techniques (Principal Components Analysis [PCA] and Positive Matrix Factorization [PMF]). The work was conducted to support Remedial Investigation (RI) data interpretation and Feasibility Study (FS) source area delineation. The work was presented at a technical conference and published in a peer-reviewed journal.

Evaluated PCDD/PCDF profiles in soil and ash samples collected near a waste-to-energy facility. The work supported identification of potential sources that may explain the presence and levels of PCDD/PCDF found in those samples.

Evaluated PCDD/PCDF profiles in soils near a solvent-related facility. The work supported identification of potential source areas of concern and remediation.

Identified and apportioned potential sources of PCDD/PCDFs in sediments from Newark Bay, New Jersey, using multivariate fingerprinting techniques (PCA and Polytopic Vector Analysis [PVA]). The results of the analysis provided scientific basis for source identification and allocation in a region that has a long history of industrialization and limited emission and discharge information. The work was published in a peer-reviewed journal.

Identified and apportioned potential sources of PCBs using multivariate fingerprinting analysis of contaminated river sediment and floodplain soil. The analyses took into account analytical uncertainties for this class of chemicals and various abiotic and biotic degradation pathways. The results of the

analysis provided valuable scientific assessment for discussions amongst the PRPs.

Provided managerial and technical support in the investigation of a river system in the Midwest impacted by historical PCB discharges from former small motor manufacturing facilities and other sources in the region. Prepared sampling and analysis and quality assurance plans for several rounds of field investigation efforts, and supervised subcontractor laboratories and consultants. Evaluated and presented data using GIS for client and regulatory officials.

Conducted an analysis to identify potential sources of pollutants found on residential properties downstream from a pulp and paper manufacturing facility. The analysis provided scientific information used in toxic tort activities regarding the potential liability of the facility.

Sediment Contamination

Provided modeling support in the development of a conceptual site model (CSM) for the Newark Bay Study Area (NBSA), located in New Jersey, as part of the Remedial Investigation/Feasibility Study (RI/FS) for this site. The CSM describes current understanding of the physical, chemical and biological processes influencing the fate and transport of contaminants from sources to exposure media (air, water, sediment, and biota). The CSM is used for designing sampling plans, developing and evaluating remedial actions, etc. The work focused on the physical setting and characteristics of the study area, and the interaction between hydrodynamics and sediment transport.

Characterized the declining levels of dioxin and PCB congeners in the surface sediments from a major industrial waterway under the Superfund program. The work was conducted to support site-specific human health and ecological risk assessments. In this analysis the sediment radiodating results from core samples were evaluated to derive a historical profile of the surface sediment levels of these contaminants. The result of the analysis found that the levels of some contaminants are declining at rates that will reach background levels in the near future, and that other contaminants are declining at a slower rate. The findings suggest the termination of incoming loads for some contaminants and the possible existence of on-going sources for other contaminants. The characterization of the historic decline of the contaminants also provided a basis to model future surface sediment levels and potential food-web exposures for the humans and ecological receptors.

Evaluated potential bioaccumulation impacts of sediment disturbance on aquatic organisms. The study analyzed water column data collected during the removal of sediment entrenched abandoned barges and historical sediment data. Food web modeling was conducted to characterize the levels of bioaccumulation of several semi-volatile organic chemicals in fish and shellfish as a result of the sediment disturbance. The findings highlight the potential impacts of human disturbance of deeply buried contaminated sediments. The work was presented at technical conferences and published in a peer-reviewed journal.

Evaluated the technical basis of sediment quality criteria for bioaccumulation used by the Army Corps of Engineer for dredge material management for the New York-New Jersey Harbor. The pre-existing criteria were derived from a mixture of technical approaches, some of which are risk-based, while other criteria lacked scientific validity for protecting human health and ecological receptors. The project derived risk-based criteria for all chemicals to address those chemicals that lacked risk-based criteria and to take into account for up-to-date toxicity data. The work was presented at technical conferences and published in a peer-reviewed journal.

Electric and Magnetic Fields

Evaluated the effects of power line electric and magnetic fields on the distributions of charged aerosol of particle sizes and distances from the powerline. The evaluation was conducted to support investigating potential health effects of power line-related charged aerosols. The work was based on analysis of field measurements obtained over two seasons near a rural power line and two urban regions. Results of this

work was published in a peer-reviewed journal.

Conducted a magnetic field exposure analysis to estimate the exposure of residents to magnetic fields from a proposed substation. The analysis involved conducting a probabilistic exposure analysis to characterize the levels of potential exposure for the apartment residents and pedestrians. The exposure model included data from a major exposure survey that described the daily activity patterns of apartment dwellers, distribution of anticipated electrical loads at the substation, and anticipated levels of magnetic fields in all areas of apartment units. The results of the analysis showed that the level of potential exposure from an upgraded substation would not be significantly increased over the pre-existing typical exposures.

Evaluated the technical basis of exposure limits of ACGIH and several international organizations for power frequency electric and magnetic fields for occupational exposures. Conducted probabilistic analysis to identify key uncertainties in the exposure limits, and recommended approaches to derive more scientifically valid limits. The work was published in a peer-reviewed journal.

Evaluated the potential exposure to magnetic fields of residents near proposed power generation plant. Analyses were conducted to compare estimated exposures to magnetic fields from various household and workplace sources against fields from proposed power plant.

Evaluated the potential exposure to magnetic fields of residents and workers near a proposed electric train line extension. Analyses were conducted to compare estimated exposures to magnetic fields from various household and workplace sources against fields from proposed line extension.

Consumer Products

Conducted a modeling analysis of potential exposures to volatile organic chemicals from a mattress product to address California's Prop 65 requirements. The analysis evaluated various exposure scenarios based on test chamber data and California Department of Public Health methodology. The result of the analysis showed that the level of potential exposure from the product is minimal and not expected to pose an unacceptable level of potential health risk.

Conducted a literature review to investigate sources of lead found in imported herbal products. The review targeted on studies that are found in the general scientific literature as well as studies representative of major herbal production regions. The results of the review suggested that lead levels found in the herbal products are typically associated with background lead in soil.

Quantitative assessment of exposure and health risks for chemicals associated with fragrances used in various consumer products. Developed exposure models to evaluate the range of potential exposures. Provided opinions on experimental designs to better characterizing actual product use and exposures.

Provided evaluation of alleged poisoning from ingesting an herbal product. Technical input provided in this case included deriving a timeline of the plaintiff's behavior and medical status, review of scientific and herbal literature on the use and effects of the alleged product, and identifying other likely causes of the symptoms. The investigation found reasons to suggest the plaintiff's previous medical condition or the use of other herbal products and related devices could also be causes of the health effects.

Conducted an exposure analysis to evaluate potential health risk from the use of a spray paint product to address California's Prop 65 labeling requirements. The analysis included deriving plausible exposure scenarios and critique of alternative exposure estimates. The result of the analysis included a more realistic estimate of exposure that indicated no potential harm from the use of the product.

Conducted an exposure analysis to evaluate potential health risk from the use of a hair shampoo product to address California's Prop 65 listing requirements. The analysis included deriving plausible exposure scenarios, characterizing the potential chemical absorption during shampooing, and deriving a realistic

estimate of exposure. The result of the analysis showed that the level of potential exposure from the product use would not pose an unacceptable level of risk.

Biological Agents

Developed and conducted field sampling to characterize pathogen input to an urbanized river system through the combined sewer overflow (CSO) during storm events. Conducted an assessment of potential health risks from exposures to surface waters contaminated with pathogens. The study supported the need for additional characterization of pathogen levels in the river system and potential health risks from biological agents.

Conducted an exposure analysis for potential chemical and biological terrorism attack. The work involved characterizing the dispersions of chemical and biological agents indoors, developing plausible exposure scenarios, and estimating the potential number of individuals that could succumb to the effects of the agents over time. The analysis supported the design of a warning system to minimize the casualties from such terrorism attack.

Lead Exposure

Evaluated site-specific factors and derived an appropriate soil cleanup level using EPA's Adult Lead Model. Site-specific factors incorporated into the model included ambient levels of lead in the regional environment and demographic-specific blood lead level.

Provided technical support to evaluate alleged childhood lead poisoning from ingesting lead-containing paint chips in a residential setting. Derived a timeline of the behavioral and medical status, review of the scientific validity in the "lead inspection" conducted at the property, and identifying other likely causes of the symptoms. The investigation found key flaws in the allegation and reasons to suggest previous residences and lifestyle could also be causes of the health effects.

Evaluated allegation of childhood lead poisoning from exposures associated with lead-containing mini-blinds. Developed evidence collection sampling plan. Coordinated evidence collection, laboratory analysis, and medical record review efforts. Conducted analysis of blood lead level chronology. The investigation found that the blood lead levels are more consistent with exposures from multiple sources.

Air Risk Assessment

Performed a retrospective exposure assessment of individuals who alleged illnesses due to historical chromium exposures from rocket engine manufacturing and testing emissions. The analysis applied air dispersion analysis to estimated airborne concentrations for over 400 receptor locations for each year of alleged exposures. Inhalation exposures for each individual were estimated based on information regarding residential, occupational, and educational history and other exposure parameters. The analysis provided estimated total potential exposures attributable to the sources for verifying the scientific validity of the allegation. The result of the analysis showed that the allegation lacked validity since the estimated historical exposures were many orders of magnitude below the levels associated with the illnesses.

Modeled the potential human air exposure to benzene-soluble organics (BSO) emissions from coke ovens using a unique combination of Buoyant Line Plume (BLP) and Industrial Source Complex Short-Term (ISCST) modeling approach. The approach involved detailed characterization of coke oven physical parameters to be applied toward BLP estimation of realistic plume rise. The results of BLP were joined with ISCST dispersion algorithms by amending FORTRAN source codes of the two models to allow plume rise estimates from BLP model to be utilized by ISCST source characterization. The estimated air concentration from ISCST was then applied in a probabilistic exposure analysis using state-of-the-science distributions of exposure parameters.

Formulated and performed air dispersion modeling for secondary aluminum smelters in response to

EPA's proposed best-achievable control technology (BACT) standard. The analysis modeled a variety of plant configurations for multiple facilities using Industrial Source Complex Short-term (ISCST) model. The modeling results provided the facility operators scientific data for strategic decision formulation and discussions with EPA regarding the proposed standards.

Brownfield Risk Assessment

Provided managerial and technical support for a former industrial site under the Maryland's Brownfield Voluntary Cleanup Program. The work involved conducting a site human health risk assessment to determine the degree of remedial response necessary for future commercial or industrial use of the site. The risk assessment applied the state default exposure assumptions and, where defaults were not applicable, the data from the most recent and applicable scientific data. The result of the work found the site contaminants posed no unacceptable level risk. The risk assessment was accepted by the state agency requiring only minor modifications. The site received a "No Further Action" certificate from the state.

Angler Fish Consumption

Addressed the bias of angler creel surveys used by EPA in developing recommended fish consumption rates for risk assessment. Conducted a re-analysis of original survey data and applied bias reduction methodology to derive more realistic anglerfish consumption rates. The work was published in a peer-reviewed journal.

Analyzed survey data of recreational anglers to develop site-specific distributions of angler fish consumption rates for the Housatonic River in Connecticut. Evaluated seasonal variation of angler activities to provide a more realistic estimate of consumption rates. The work was published in a peer-reviewed journal.

Toxicology Literature Review and Database Development

Reviewed asbestos exposure-related information submitted by litigation claimants and developed a database of exposure data. The effort involved developing protocols and coordinating the efforts of a team of scientists to review a large amount of file materials.

Developed a refined database for characterizing mammalian relative toxicological potencies of PCDD/F and PCB congeners. The effort involved the refinement of the relative potency database used by the WHO in 1997 for the development of mammalian toxic equivalency factors (TEFs). The refined database is suitable for quantifying the uncertainty and variability of the relative potency values and updating the TEFs. The work was published in a peer-review journal.

Reviewed scientific literatures and developed a database of toxicological data for nearly 1,000 chemicals under a small business innovative research (SBIR) grant from the National Institute of Environmental Health Sciences (NIEHS). The literature review included epidemiological studies, rodent assays, and genetic toxicology. A goal of the literature review was collecting dose-response information and providing a quantitative weight-of-evidence regarding the potential for a chemical to be a human carcinogen.

Prepared a review and critique of PCB cancer epidemiology literature as a part of compendium of all available knowledge on PCB toxicology. The compendium was distributed to plant managers to assist them in answering inquiries regarding this chemical.