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Professional Profile

Dr. Brent Kerger is a Principal Scientist in Exponent's Health Sciences Center for Toxicology and Mechanistic Biology. A board-certified toxicologist, Dr. Kerger specializes in the study of environmental chemical fate and transport, exposure assessment, pharmacokinetics, and adverse human health effects. He has over 38 years of experience conducting and managing laboratory, field, and clinical studies of exposure, toxicology, epidemiology, and disease causation analysis. He provides scientific and strategic consultation regarding regulatory and litigation matters including 30 years of environmental chemistry and toxicology expert witness experience. He has in-depth expertise regarding asbestos, talc, dioxins and furans, PCBs, PAHs, chlorinated solvents, benzene and petroleum products, irritant gases, pesticides, flavoring chemicals, and heavy metals.

He has over 35 years of experience as a professional toxicologist focusing on:

- Multi-disciplinary research in fate/transport, exposure assessment and toxicokinetics;
- Design and implementation of studies to characterize exposure/dose and toxicity;
- Human health and ecological risk assessments including complex indirect pathways;
- Evidence-based approaches for analysis of epidemiologic studies; and
- Disease causation analysis using the Hill Criteria and alternative cause assessment.

A board-certified toxicologist since 1994, Dr. Kerger has extensive experience in evaluating scientific issues involving claims of chemical causation or increased risk of diseases in humans in regulatory and litigation settings. He has thoroughly researched key toxicological issues surrounding human exposures to a broad range of chemicals and mineral dusts. Dr. Kerger guides the optimized research capabilities and access to resources (expertise and information) that promote an integrated, multi-disciplinary perspective to addressing scientific issues. He has designed and implemented a variety of field studies, laboratory studies, and clinical studies aimed at characterizing chemical exposure and toxicity. He has published numerous articles in peer-reviewed journals on chemical toxicity, physiologically-based pharmacokinetic modeling, Monte Carlo uncertainty analysis, evidence-based analysis, and innovative exposure and risk assessment techniques.

Academic Credentials & Professional Honors

Ph.D., Toxicology, University of Arkansas for Medical Sciences, 1988

B.S., Chemistry, Florida State University, 1983

Licenses and Certifications

Diplomate of the American Board of Toxicology (DABT)

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Prior Experience

Senior Principal Health Scientist, Cardno ChemRisk, LLC 2012-2014

Independent Toxicology Consultant, Health Science Resource Integration, Inc., 1997-2012

Managing Principal Health Scientist, McLaren-Hart, Inc. ChemRisk Division, 1992-1997

Senior Toxicologist, Toxicological Evaluations, Research and Risk Assessment, 1988-1992

Professional Affiliations

Society of Toxicology—SOT

Society for Risk Analysis—SRA

International Society for Exposure Science

Publications

Peer-Reviewed Publications

Kerger BD, Odo NU, and Loccisano AE. 2023. Age-period-cohort analysis of mesothelioma: Flat incidence trends for males entering the US workforce after 1972. Ann Clin Pathol 10(1), in press.

Dalton PH, Maute C, Hicks JB, Watson HN, and Loccisano AE, Kerger, BD. 2023. Environmental chamber studies of eye and respiratory irritation from use of a peracetic acid-based hospital surface disinfectant. Antimicrob Steward Healthcare Epidemiol 3(1):e71. doi: 10.1017/ash.2023.138. PMID: 37113200; PMCID: PMC10127244.

Kerger BD, Loccisano AE, Gerads R, and Glassman MJ. 2020. Small chamber study of lead exposures from manual soldering of microelectronics. Human and Ecological Risk Assessment, 27:2, 451-464. https://doi.org/10.1080/10807039.2020.1730690.

Kerger, BD, Odo, NU, Loccisano, AE. 2023. Age-period-cohort analysis of mesothelioma: Flat incidence trends for males entering the US workforce after 1972. Ann Clin Pathol 10(1), 1165.

Kerger BD. 2018. Longevity and Pleural Mesothelioma: Age-Period-Cohort Analysis of Incidence Data from the Surveillance, Epidemiology, and End Results (SEER) Program, 1973-2013. BioMedCentral Research Notes 11:337; doi:10.1186/s13104-018-3436-0.

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Kerger B., Gerads R, Gurleyuk H, and Tsuji JA. 2018. Metals Measurements in Body Tissues and Fluids: Toxicological and Clinical Importance of Standardizing Quality Analytical Methods for Differentiating Cobalt Partitioning on a Molecular Level, Beyond the Implant: Retrieval Analysis Methods for Implant Surveillance, ASTM STP1606, W. M. Mihalko, J. E. Lemons A Greenwald S, and Kurtz SM, Eds., ASTM International, West Conshohocken, PA, 2018, pp. 229–244, http://dx.doi.org/10.1520/STP160620170034

Kerger BD, Bernal A, Paustenbach DJ, and Huntley-Fenner G. 2016. Halo and spillover effect illustrations

for selected highly beneficial medical devices and drugs. BioMedCentral Public Health 16:979.

Kerger BD and Fedoruk MJ. 2015. Pathology, toxicology and latency of irritant gases known to cause bronchiolitis obliterans disease: does diacetyl fit the pattern? Toxicology Reports 2:1463-1472.

Kerger BD, Gerads R, Gurleyuk H, Urban A, and Paustenbach DJ. 2015. Total cobalt determination in human blood and synovial fluid using inductively-coupled plasma-mass spectrometry: Method validation and evaluation of performance variables affecting metal hip implant patient samples. Toxicological and Environmental Chemistry 97(9):1145-1163.

Scott P, Abelmann A, Hoyt S, and Kerger B. 2015. Headspace and small chamber studies of airborne diacetyl release from selected food flavoring mixtures: Activity coefficients and air modeling implications. Toxicological and Environmental Chemistry 97(10):1319-1336.

Tvermoes BE, Paustenbach DJ, Kerger BD, Finley BL, and Unice KM. 2015. Review of cobalt toxicokinetics: Implications for health risk assessment and metal-on-metal hip implant patients. Critical Reviews in Toxicology 45:367-387.

Kerger BD, Thuett KA, and Finley BL. 2014. Evaluation of four alpha-diketones for Toll-like receptor 4 (TLR-4) activation in a human transfected cell line. Food and Chemical Toxicology 74:117–119.

Unice KM, Kerger BD, Paustenbach DJ, Finley BL, and Tvermoes BE. 2014. Refined biokinetic model for human exposure to cobalt dietary supplements and other sources of systemic cobalt exposure. Chemico-Biological Interactions 216:53–74.

Tvermoes BE, Banducci AM, Devlin KD, Kerger BD, Abramson MM, Bebenek IG, and Monnot AD. 2014. Screening level health risk assessment of selected metals in apple juice sold in the United States. Food and Chemical Toxicology 71, 42-50.

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Kerger BD, Scott PK, Pavuk M, Gough M, and Paustenbach DJ. 2012. Re-analysis of Ranch Hand Study supports reverse causation hypothesis between dioxin and diabetes. Critical Reviews in Toxicology 42(8):669–687

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Kerger BD, Schmidt CE, and Paustenbach DJ. 2000. Assessment of airborne exposure to trihalomethanes from tap water in residential showers and baths. Risk Analysis 20(5):637–651.

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Corbett GE, Dodge DG, O'Flaherty E, Liang J, Throop L, Finley BL, and Kerger BD. 1998. In vitro reduction kinetics of hexavalent chromium in human blood. Environmental Research 7:7–11.

Corbett GE, Finley BL, Paustenbach DJ, and Kerger BD. 1997. Systemic uptake of chromium in human volunteers following dermal contact with hexavalent chromium (22 mg/L): Implications for risk assessment. Journal of Exposure Analysis and Environmental Epidemiology 7(2):179–189.

Finley BL, Kerger BD, Corbett GE, Katona M, Gargas M, Reitz R, and Paustenbach DJ. 1997. Human ingestion of chromium (VI) in drinking water: pharmacokinetics following repeated exposure. Toxicology and Applied Pharmacology 142:151–159.

Kerger BD, Finley BL, Corbett GE, Dodge DG, and Paustenbach DJ. 1997. Ingestion of chromium (VI) in drinking water by human volunteers: absorption, distribution, and excretion of single and repeated doses. Journal of Toxicology and Environmental Health 50:67–95.

De Flora S, Camoirano A, Bagnasco M, Bennicelli C, Corbett GE, and Kerger BD. 1996. Estimates of the chromium(VI) reducing capacity in human body compartments as a mechanism for attenuating its potential toxicity and carcinogenicity. Carcinogenesis 18(3):531–537.

Finley BL, Kerger BD, Dodge DG, Meyers SM, Richter RO, and Paustenbach DJ. 1996. Assessment of airborne hexavalent chromium in the home following use of contaminated tap water. Journal of Exposure Analysis and Environmental Epidemiology 6(2):229–245.

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Kerger BD, Richter RO, Chute SM, Dodge DG, Overman SK, Liang J, Finley BL, and Paustenbach DJ. 1996. Refined exposure assessment for ingestion of tap water contaminated with hexavalent chromium: Considerations of exogenous and endogenous reducing agents. Journal of Exposure Analysis and Environmental Epidemiology 6(2):163–179.

Kuykendall JR, Kerger BD, Jarvi EJ, Corbett GE, and Paustenbach DJ. 1996. Measurement of DNA-protein cross-links in human leukocytes following acute ingestion of chromium in drinking water. Carcinogenesis 17(9):1971–1977.

Mirsalis JC, Hamilton CM, O'Loughlin KG, Paustenbach DJ, and Kerger BD. 1996. Chromium(VI) at plausible drinking water concentrations is not genotoxic in the in vivo bone marrow micronucleus or liver UDS assays. Environmental and Molecular Mutagenesis 28:60–63.

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Paustenbach D, Karch N, Golden R, Kerger BD, and Leung H-W. 1995. The relative susceptibility of animals and humans to the carcinogenic hazard posed by exposure to 2,3,7,8-TCDD: An analysis of standard and alternative dosimetric measures. Organohalogen Compounds 26:31-34.

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Kerger BD, Roberts SM, Harbison RD, and James RC. 1989. Antagonism of bromobenzene-induced hepatotoxicity by phentolamine: role of hypothermia. Toxicology and Applied Pharmacology 97:360–369.

Kerger BD. 1988. Investigation of the adrenergic potentiation of halogenated hydrocarbon induced hepatotoxicity. (Full Dissertation), University of Arkansas for Medical Sciences Library, Little Rock, AR, 1988.

Kerger BD, Mancuso CA, Nichols PD, White DC, Langworthy T, Sittig M, Schlesner H, and Hirsch P. 1988. The budding bacteria pirellula and planctomyces, with atypical 16S rRNA and absence of peptidoglycan, show eubacterial phospholipids and uniquely high proportions of long chain beta-hydroxy fatty acids in the lipopolysaccharide lipid A. Archives of Microbiology 149:255–260.

Kerger BD, Gandy J, Hinson JA, Roberts SM, Harbison RD, and James RC. 1988. Antagonism of bromobenzene-induced hepatotoxicity by phentolamine: evidence for a metabolism-independent intervention. Toxicology and Applied Pharmacology 95:24–31.

Kerger BD, Gandy J, Bucci TJ, Roberts SM, Harbison RD, and James RC. 1988. Antagonism of Bromobenzene-Induced Hepatotoxicity by the Alpha Adrenergic Blocking Agents, Phentolamine and Idazoxan. Toxicology and Applied Pharmacology 95:12–23.

Kerger BD, James RC, and Roberts SM. 1988. An assay for phentolamine using high performance liquid chromatography with electrochemical detection. Analytical Biochemistry 170:145–151.

Kerger BD, Roberts SM, and James RC. 1988. Comparison of mouse and human liver microsomal metabolism of bromobenzene and chlorobenzene to 2- and 4-halophenols. Drug Metabolism and Disposition 16(5):672.

Kerger BD, Nichols PD, Sand W, Bock E, and White DC. 1987. Association of acid producing thiobacilli with the degradation of concrete: Analysis by 'signature' fatty acids from the polar lipids and lipopolysaccharide. Journal of Industrial Microbiology 2:63–69.

Kerger BD, Nichols PD, Antworth CP, Sand W, Bock E, Cox JC, Langworthy TA, and White DC. 1986. Signature fatty acids from the polar lipids of the acid producing thiobacilli spp.: Methoxy, cyclopropyl, alphahydroxy-cyclopropyl and branched and normal monoenoic fatty Acids. FEMS Microbial Ecology 38:67–77.

Smith GA, Nickels JS, Kerger BD, Davis JD, Collins SP, Wilson JT, McNabb JF, and White DC. 1986. Quantitative characterization of microbial biomass and community structure in sub-surface material: A unique prokaryotic consortium responsive to organic contamination. Canadian Journal of Microbiology 32:104–111.

Book Chapters

Kerger, BD, Loccisano, AE, and Dalton, P. 2024. Case Study: Occupational use, exposures, and environmental chamber studies of human eye and respiratory irritation responses for a peracetic acid-based hospital surface disinfectant. In: Human and Ecological Risk Assessment: Theory and Practice, Third Edition (ed. Paustenbach, DJ). Hoboken, NJ: Wiley. https://onlinelibrary.wiley.com/doi/10.1002/9781119742975.ch18

Loccisano AE, Bernal A, and Kerger BD. 2023. Polyhalogenated Biphenyls, In: Patty's Toxicology, Seventh Edition (eds. Paustenbach, DJ, Farland, WH, Greim, H, Klaunig, JE, and Levy L). Hoboken, NJ: Wiley. https://onlinelibrary.wiley.com/doi/10.1002/0471125474.tox066.pub3

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Kerger BD, Finley BL and Paustenbach DJ. 2002. Hexavalent chromium in groundwater: The importance of chemistry in quantifying exposure, dose, and risks. In: Health Risk Assessment, 2nd Edition. Paustenbach DJ (ed.), John Wiley and Sons; Chapter 7, pp. 445–474, 2002.

Scientific Society Research Presentations

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2021: An updated age-period-cohort analysis of potential occupational and longevity effects using SEER-8 data. Toxicological Sciences: 204: 607. Abstract #4582.

Kerger, BD, Loccisano, AE, Mezei, G, and Odo, N. 2024. Quantitative cancer contribution analysis for malignant mesothelioma: Assessing attributable causal fractions from low level cumulative exposure to asbestos and selected germline mutations. Toxicological Sciences 198:222 Abstract #3388.

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Loccisano AE and Kerger B. 2021. A Physiologically Based Pharmacokinetic Model for Endocrine Active Drugs Administered by the Intranasal Route. Toxicological Sciences 180: 161. Abstract #2373.

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pleural mesothelioma? Toxicological Sciences 150(1): 464. Abstract #2979.

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Kerger BD, Bernal AJ, and Scott P. 2015. Tissue dose modeling and bronchiolar fibrosis risk for inhalation of highly water soluble irritant gases: Comparison of acetaldehyde, acrolein, and diacetyl. Toxicological Sciences 142:158. Abstract #737.

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Presentations

The Toxicology of Chlorinated Hydrocarbons. Florida State University Course: Introduction to Toxicology, Fall 1990.

Consulting Toxicology: Current Issues. Seminar to faculty/graduate students at University of California, Irvine Inhalation Toxicology Laboratories, March 1992.

Current Problems and Future Trends for Improving Health Risk Assessment. Seminar to faculty and graduate students at the University of California, Irvine Civil Engineering Department, May 1992.

Multiple Chemical Sensitivity: Update on Hypotheses and Current Evidence. Lecture for American Industrial Hygienists Association, Northern California Section, April 1996.

Arsenic and Chromium: Toxicology and Risk Assessment Issues. Lecture for Continuing Engineering Education program at California State University, Long Beach, CA, April 1996.

Risk-Based Corrective Action (RBCA) and Methyl-tert Butyl Ether (MTBE) Toxicity Concerns at Petroleum Contaminated Sites. Seminar on The New Era in Remediation of Petroleum Contamination presented by McLaren/Hart, Inc, July 1996.

Workplace-Related Skin Diseases and Exposure Assessment. Invited participant for the Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health (NIOSH) seminar. Rockville, MD, September 25–26, 1996.

Toxicology Expert in Panel Discussions for Desert Storm: Environmental Contamination, Litigation Strategies & Bankruptcy Considerations -- A Series of Round Table Discussions Featuring Judges, Corporate, Plaintiff, Insurance and Bankruptcy Attorneys and Experts. Annual Spring Meeting of the American Bar Association Tort and Insurance Practice Section, Toxic and Hazardous Substances and Environmental Law Committee, Chandler, AZ, March 7, 1997.

Televised Expert Panel Presentation: Centers for Disease Control and Prevention/Florida Department of Health, Bureau of Environmental Epidemiology, Childhood Lead Poisoning: Research, Practice and Prevention". Dr. Kerger Presented on the topics of maternal transmission of Lead to infants via in utero exposure and via breast milk transfer. Broadcast from WFSU at Florida State University, September 17, 1999.

Invited Speaker, The International Society for Regulatory Toxicology and Pharmacology Seminar: EPA's Characterization of Dioxin Risks: Do Background Dioxin Exposures Pose a Human Health Threat? October 6, 2000, Washington, D.C.

External Peer Reviewer to USEPA in the Peer Review Workshop on Chapter 9: Toxicity Equivalency Factors (TEF) for Dioxin and Related Compounds, and the Revised Integrated Summary and Risk

Characterization Document, July 24, 2000.

Human Toxicokinetics of Dioxins and PCBs: New Perspectives on Risks and Public Health Implications Now and For Future Generations. Graduate Student Seminar at the University of California-Irvine, March 14, 2008.

Project Experience

Overview of Expert Testimony Experience Experience with Asbestos-Talc-Silica-Dusts:

Served as an expert witness in asbestos litigation since 1997 concerning a variety of consumer products and workplace or environmental exposure/risk claims including:

- Automotive, fork lift, and lawn/farm equipment friction products including brakes, clutches, and gaskets.
- Asbestos-containing materials in soils from demolition activities.
- Talc, fibrous talc, and chrysotile exposures from gypsum products.
- Talc and silica dusts from body shop worker exposures.
- Exposures from working with domestic and commercial water heater systems.

Testified and/or provided expert documents on the following issues:

- Exposure assessment, risk assessment, and dose threshold for chrysotile and talc product risks.
- Amphibole and chrysotile fibrogenicity and cancer potency relating to fiber chemistry, fiber dimensions/structure, and persistence in the body or in the environment.
- Interpretation of TEM/SEM/PCM data from air samples, lung fiber burden studies, and specific product testing results.
- Adequacy of hazard communication and label warnings, i.e., state of the art testimony.
- Disease causation analysis and alternative source/alternative cause analysis when relevant, pertaining to claims of mesothelioma, asbestosis, and lung cancer causation.

Published research presentations on the following topics:

- Field study and hazard assessment of dust exposures to body shop workers using fiberglass filler products and various abrasive materials.
- Field study and risk assessment of TEM asbestos exposures to maintenance workers and athletes regarding a soccer field with ACM debris from demolition of barracks.
- Field study and risk assessment of TEM asbestos exposures to agricultural workers contacting a utility easement with ACM debris from pipeline demolition.
- Research on genetic markers for tumors that may mimic asbestos-related mesothelioma and on longevity-related impacts on mesothelioma incidence through analysis of age-period-cohort trends in US cancer registry data.

Experience with ***Persistent Organic Pollutants: PCBs, Chlorinated Dioxins and Dibenzofurans, Organochlorine Pesticides, Toxaphene, PFOA/PFOS, and PAHs***:

Served as an expert witness in toxic tort litigation or evaluated regulatory compliance concerning these compounds since 1992, with key chemicals and health claims including:

- Dioxins/furans exposures from pulp/paper mill stack emissions and effluent sediments associated with claimed cancer causation and increased cancer risk.
- Dioxins/furans, pentachlorophenol, and creosote/PAH exposures from wood treatment plant airborne emissions and surface water/sediment transport, groundwater transport, and multi-pathway intake associated with claimed cancer causation and various other diseases.
- PAH exposures from coal distillation at manufactured gas facilities, from petroleum refinery coke production, and from diesel-powered generators and vehicles in relation to claims of cancer causation and various other disease.
- Dioxin/Furan/PCB exposures from stack emissions of titanium ore processing units, industrial boilers/furnaces, commercial hazardous waste incinerators, and chemical weapons incinerators in relation to operational permitting hearings.
- Dioxin/Furan/PCB exposures from degraded Aroclors or combustion of PCBs in transformer fires or other electrical equipment associated with claimed cancer causation and various other diseases.
- Dioxin/Furan/PCB exposures from rocket engine testing associated with claimed cancer causation and various other diseases.
- PCB and associated dibenzofurans in soils from past operations of a publicly operated water treatment facility; sampling plan, data analysis, and risk assessment in support of a brownfields redevelopment project overseen by local regulatory agencies.
- Evaluated chlordane and heptachlor exposures to residents in homes with termite prevention treatments and claimed neurological, autoimmune, and other diseases.

Testified and/or provided expert documents on the following issues:

- Exposure/risk assessment purpose, methods, results and comparative risks.
- Use of the RCRA Combustor risk assessment methodology for human health and ecological risk assessment, integrating emission rates from point sources and area sources, particulate and volatile emissions, fate and transport analysis including watershed modeling and transport to surface waters, sediments, and assessing direct and indirect pathway intakes for extreme scenarios like subsistence fishermen, subsistence farmers, and consumption of homegrown livestock/produce or local fish consumption.
- Disease causation analysis using epidemiological data and Hill Criteria.
- Alternative cause analysis to support medical expert testimony.
- State of the art analysis regarding historical knowledge and hazard communication for warning about potential groundwater contamination from industrial use of pentachlorophenol in wood treatment operations.
- Indoor air exposure modeling for chlorpyrifos, pyrethroids, and other pesticides.

Published research presentations on the following topics:

- Interpretation of available animal toxicology studies pertaining to mechanism or mode of action and of epidemiology studies on exposure, dose, and disease risks.
- Absorbed dose and cumulative body burden (toxicokinetics) of dioxins and dibenzofurans in humans, including mother’s milk exposures to infants, soil exposures and dietary exposures to

children and adults, changing elimination rates with age and at high body burden, and tenuous dose-response relationships for dioxin and diabetes.

- Published collaborative studies with Italian researchers of the Seveso trichlorophenol reactor explosion of 1976, with Japanese and Canadian researchers of the PCB/PCDF rice oil poisoning incidents in Japan (1969) and Taiwan (1978), and with US Air Force and CDC researchers of Vietnam veterans exposed to Agent Orange.
- Published a toxicokinetic model integrating human data on age-dependent half-life of dioxins/furans with dietary and soil-related intake to estimate childhood body burdens and a similar presentation on PCBs.
- Published 2 papers on toxaphene's receptor-based mode of action and a proposed reference dose for carcinogenicity based on demonstrated nonlinear dose-response.
- Published dose-response and disease causation review on PFOA/PFOS.

Experience with ***Heavy Metals: e.g., Chromium, Lead, Arsenic, Mercury, Beryllium***:

Served as an expert witness in toxic tort litigation or evaluated regulatory compliance concerning these metals since 1994, with key compounds and health claims including:

- Soluble chromate compounds in tap water and claimed cancers and various other diseases.
- Chromates in industrial primer coatings and sealants and claimed cancers.
- Lead and other metals bound into glass aggregates and groundwater dispersion concerns.
- Lead in artist's paints and claimed failure to warn under Proposition 65.
- Lead in microelectronics soldering as a claimed cause of a serious neurodevelopmental birth defect.
- Chromium, copper, mercury and arsenic in soils near a wood treatment plant and claimed cancers and property value diminution
- Mercury stack emissions from incinerator facilities and environmental impacts.

Testified and/or provided expert documents on the following issues:

- Exposure/risk assessment purpose, methods, results and comparative risks or exposures.
- Warning requirements and absorbed dose assessment under Proposition 65.
- Exposure assessment for tap water chromates in relation to research and field/clinical studies conducted on ingestion of beverages; thresholds for oral uptake into the blood; inhalation exposures related to cooling tower emissions, Rainbird sprinklers, showering, and evaporative cooler; dermal uptake through bathing; human and animal studies of DNA damage; and observational benchmarks of exposure.
- Leachability and groundwater or surface water transport of metals.
- Airborne transport of metals from stack emission including wet and dry deposition, watershed effects, and accumulation in soils, surface waters and sediments.
- Soldering-related lead exposures and internal dose to mother and fetus.

Published research presentations on the following topics:

- Interpretation of available animal toxicology studies pertaining to mechanism or mode of action and of epidemiology studies on exposure, dose, and disease risks.
- Extensive series of field studies, clinical studies, animal toxicology studies, PBPK modeling, and reviews on oral, dermal and inhalation exposures to tap water chromates.

- Topical research presentations on beryllium, lead, arsenic, and chromium.
- Lead-based soldering occupational exposure assessment and internal dose.

Experience with ***Volatile Organic Compounds and Inhaled Irritants: TCE, PCE, Trihalomethanes, Vinyl Chloride, Benzene, MTBE, Diacetyl, Hydrogen Sulfide, Mercaptans, Ammonia, Chlorine/HCl, Formaldehyde***:

Served as an expert witness in toxic tort litigation or evaluated regulatory compliance concerning these VOCs since 1994, with key compounds and health claims including:

- Petroleum solvents with trace benzene levels and claimed leukemia, myelodysplastic syndrome, or lymphoma.
- Inhaled irritant exposures and claims of lung damage, fibrotic disease, or cancer.
- Indoor air exposure to chlorinated VOCs or BTEX/MTBE from tap water use and claimed cancers and various other diseases.
- Biologically-generated H2S/mercaptan exposure and claimed neurological injury/disease.
- Critique of agency guidelines for irritant gases under Proposition 65.
- Inhalation of artificial butter flavorings (diacetyl) and claimed bronchiolitis obliterans.

Testified and/or provided expert documents on the following issues:

- Exposure/risk assessment purpose, methods, results and comparative risks or exposures.
- Worker exposures and risks from benzene in solvents via inhalation and dermal contact.
- Indoor air modeling related to VOCs in tap water and vapor intrusion pathway.
- Groundwater plume modeling and validation using well monitoring data.
- Field studies measuring VOCs in homes with high THMs in tap water.
- Disease causation analysis focusing on the Hill criteria and epidemiological studies.
- Alternative cause assessment relating to family history and known disease risk factors.

Published research presentations on the following topics:

- Evidence-based analysis of diacetyl and bronchiolitis obliterans and related exposure assessment and mechanism of action.
- Evidence-based analysis of a human irritation threshold for formaldehyde.
- Evidence-based analysis of gasoline vapor exposure and leukemia/lymphoma risk
- Field studies of bathing exposures and evaporative cooler system contributions relating to chlorinated VOCs in tap water.
- Worker exposures to benzene from use of mineral spirits degreaser equipment.
- Benzene vapor exposures and effects of aromatic content on Raoult’s law predictions.
- Benzene pharmacokinetics and bone marrow dose of key hematotoxic metabolites related to occupational exposures, smoking, and background air.
- In-cabin exposures to VOCs in passenger cars in static and driving conditions.
- Ammonia exposures from normal use and spills of household cleaners.
- Topical research presentations on diacetyl, hydrogen sulfide, MTBE/BTEX, formaldehyde, and others.
- Influence of protein binding on tracheal and bronchiolar target organ dose of diacetyl and fibrotic lung disease.

Experience with ***Drugs, Medical Devices, and Pathogenic/Toxic Mold***:

Served as an expert witness in toxic tort litigation or evaluated regulatory compliance concerning these materials since 1995, with key compounds and health claims including:

- Hazard communication and Proposition 65 compliance regarding use of cytotoxic and antineoplastic drug mixtures in a facility making intraocular implants and in another facility with pilot operation for making capsules of a similar drug mixture.
- Recreational drug intake and claimed wrongful death from overdose related to hazing.
- Morphine derivative drug intake and wrongful death during surgical recovery.
- Exposures to pathogenic and toxigenic molds and claims of allergy, pulmonary and/or neurological disease, and increased cancer risk.
- Wear debris and corrosion of metal alloy implants (Co/Cr/Mo and Ti/Al/V), systemic toxicokinetics and local tissue toxicodynamics and cytotoxicity, and disease causation analysis on toxicological consequences.
- Chloramphenicol pharmacokinetics relating to a claimed risk of aplastic anemia from a pre-biotic product that had been recalled.
- Contribution of alcohol intoxication to impulsivity, sedation, and reaction times relating to a fatal traffic accident.

Testified, provided expert documents, and/or published on the following issues:

- Disease causation analysis and alternative cause assessment for metal ions released from metal alloy implants, for narcotic drugs, alcohol and illicit drugs.
- Measurement techniques and accuracy issues regarding cobalt in blood and tissues.
- Toxicology reviews and toxicodynamics for drugs or metals and underlying disease states, injuries or events.
- Pain medication toxicity and tolerance, and impacts of uncontrolled diabetes and severe electrolyte imbalance on death after surgery.
- Background exposures to pathogenic and toxigenic molds in indoor and outdoor air and surfaces; data interpretation from air and surface sampling; pattern analysis; and critique of opposing expert methods for sampling and data analysis.

Influence of protein binding on bone marrow target organ dose of chloramphenicol and aplastic anemia.

Project Examples

Chemical Product Risk Assessment

Auto body shop product exposure characterization for litigation. Assisted in design and data analysis of field studies examining particulate exposures from use of auto body filler and abrasive products by experienced workers in auto repair shops, including evaluation of total and respirable particulates and subcomponents including talc, silica, and metal oxides. SEM studies of suspended dusts were also included. The data analysis showed a relatively low fraction of respirable dust generated by grinding of body fillers, and suspended dusts were mainly comprised of larger resin debris rather than respirable talc, silica, or metal oxides. These field studies were presented at the Society of Toxicology annual meeting.

Sealant product exposure characterization for litigation. Managed the process of collecting key information and conducting innovative emissions testing regarding a sealant product that was claimed to cause excessive exposure to hexavalent chromium and other materials. Reviewed all of the product

information on use and chemical contents, and performed interviews, facility document reviews, and literature searches to obtain specific information on product usage at the aerospace facility at issue. Developed a flux chamber methodology in conjunction with external experts to characterize the magnitude and timing of emissions of chromium and potentially hazardous solvents from the sealant matrix during mixing, application, and curing. Used the flux chamber measurements to develop specific exposure concentration estimates for worker exposures under different, known conditions of use. Personally presented testimony and exhibits which assisted in educating the jury about chromium toxicology and the findings of the analyses.

Coating product exposure characterization for litigation. Developed a series of bench-testing protocols to examine the chemical contents and exposure characteristics of chromate-containing products used to coat metals in the aerospace industry. The testing protocols characterized the low potential of the product to breakdown or be released in vapor or aerosol form during normal product usage. Also determined the plausible dermal loading rate for persons using the product and/or handling treated metals. Developed a multipathway, quantitative exposure analysis and risk assessment for 22 test plaintiffs using the testing information and workplace exposure data.

Pesticide product dioxin exposure assessment for litigation. Researched the available scientific literature to develop plausible, refined estimates of dioxin uptake resulting from specific work activities. Lead the design and conducted experiments to quantitate aerosol blowback exposure for a roadside weed abatement operator. Developed dermal uptake models which were integrated with physiologically-based pharmacokinetic models for total dioxin uptake that allowed estimation of the change in the worker's tissue concentrations of dioxin over time. Compared quantitative estimates of daily and total dioxin dose to dietary uptake, and made similar comparisons for contributions to the overall body burden from occupational versus dietary sources of dioxin.

Pentachlorophenol/dioxin research and risk assessment for litigation. Managed a detailed research project which delineated the state of scientific knowledge from 1950 to present regarding the known environmental fate and transport characteristics of pentachlorophenol products. Prepared a detailed chronology and briefing notebook to assist the attorneys and clients in defending product liability and failure-to-warn claims regarding knowledge of pentachlorophenol impacts to soils and groundwater. Also provided a summary and analysis of site-characterization data and a screening level risk assessment for two California facilities seeking cost recovery on these issues. Personally gave a deposition on these issues in one case where the determination of the timing of the spill helped to resolve the cost recovery and other liability issues.

Metals bioavailability research for litigation. Managed the research of several issues pertaining to the production of a vitrified aggregate material from soils originally contaminated with creosote. Analyzed numerous technical expert reports and data pertaining to the processing of soils to create aggregates that could be recycled as construction materials and/or for land filling purposes. Provided research materials on metals accumulation and the fate/transport and risk assessment considerations of potential importance for determining safe uses of the aggregate.

Pesticide toxicology research for litigation. Provided assistance in researching and developing strategies regarding opposing expert claims that certain pesticides cause 1) a rare form of cutaneous lymphoma; 2) chronic obstructive pulmonary disease (COPD) in a chronic heavy cigarette smoker, and 3) aplastic anemia. Researched the available literature and drafted detailed reports analyzing the known mechanisms (if any) for chemical causation of these diseases and the validity of expert reports proposing hypothetical mechanisms and causal associations for the pesticides at issue.

Drug toxicology research for litigation. Reviewed opposing expert claims that a 42-year old man had experienced a fatal heart attack due to chronic occupational exposure to methylene chloride; he died approximately one year after leaving that company. Supervised an analysis of the man's medical records and chemical exposure history, and researched the literature concerning known and suspected causes of heart disease. Verbal reports were given to the defense attorneys regarding the key scientific issues. The medical records revealed that the plaintiff had been a heavy smoker and drinker, and had experienced a

series of long-term pulmonary infections prior to death. Review of the medical records indicated that the man had taken a heart medication and an antibiotic agent which together cause allergic myocarditis and asthmatic-type bronchoconstriction. The plaintiff's rapidly degrading condition was likely attributable to continued intake of the antibiotic which promoted these effects independent of his limited methylene chloride exposure in the past.

Hydrocarbon solvent risk assessment for litigation. Reviewed opposing expert claims that a contractor who applied solvent to remove asbestos floor tile caused building contamination (kerosene and odorous chemicals) that resulted in long-term impacts on the performance and health of employees in the office building. Supervised the analysis of all the exposure information, an industrial hygiene audit of the building, and a review of historical events. This information was assimilated into a temporal pattern analysis of the exposures and health effects, and concurrent analysis of modeled indoor air chemical concentrations for the chemicals at issue. Prepared a report summarizing these findings and related information that was reviewed by the testifying physician/toxicologist in preparation for testimony. The analysis supported the viewpoint that the building management took responsible and appropriate actions and that the abatement contractor may have created a temporary nuisance, but no long-term problems.

Product safety assessment. Planned and implemented an expedited sampling and analysis plan to determine potential human or environmental risks associated with continued use of a proprietary polymeric binder material used for certain race track surfaces. Drafted a report summarizing the analytical findings, the toxicological information and regulatory compliance issues, and including our recommendations concerning prudent resolution of potential risks to human health and the environmental resulting from continued use of the product.

Environmental Risk Assessment

Asbestos exposure/risk characterization for regulatory agencies. Assisted in design and data analysis of two separate field studies examining the airborne asbestos exposure potential for human activities (agricultural, recreational, maintenance) disturbing residual debris from asbestos-containing materials in soils. The exposure/risk calculations were reported to local regulatory agencies in support of plans for site closure based on limited exposure potential/health risk. These field studies were presented at the Society of Toxicology annual meeting. In this and other projects, weight of evidence reviews of the epidemiological and toxicological studies on asbestos fail to demonstrate health risks in the absence of distinctly elevated exposures to longer asbestos fibers and/or amphiboles that exhibit much higher toxic potency than the more commonly used short-fiber chrysotile.

Chromium exposure/risk assessment for litigation. Managed the process of researching the available literature and developing key topic briefing notebooks regarding hexavalent chromium toxicology. Developed a detailed multipathway exposure and risk assessment to estimate the retrospective exposure history of 10 test plaintiffs with alleged exposure to hexavalent chromium in groundwater. ChemRisk designed and conducted a series of bench scale testing, field studies, animal genotoxicity studies, and human pharmacokinetic and genotoxicity studies to examine the fate and toxic potential of hexavalent chromium at low part per million levels in drinking water. Also investigated desert climate effects on exposure parameters, coordinated research with national and international experts on chromium toxicology, conducted collaborative research and interviews with epidemiologists examining chromium exposed populations in China and Mexico, and developed physiologically-based pharmacokinetic models examining the fate of hexavalent chromium in the human body. The research resulted in more than 20 scientific meeting presentations and 14 manuscripts regarding the scientific issues of hexavalent chromium.

Chloroform/H2S/dioxin risk assessment and research for litigation. Supervised the research assistance on multiple scientific issues in a major litigation in Washington State relating to airborne chemical emissions from a wastewater treatment facility. Analyzed more than thirty expert reports and datasets provided by the plaintiffs' experts with summaries and rebuttals/critiques provided for review by defense experts. Created a Dose Comparison Study to characterize the environmental fate of 38 chemicals allegedly at issue and to evaluate the potential public health concerns relating to those feasibly emitted from the

facility. The study demonstrated that the maximum exposures at issue were insufficient to cause alleged health effects. Several notebooks of briefing materials (scientific literature and interpretive/tutorial analyses) concerning the chemicals and diseases allegedly at issue were provided to assist the attorneys and to optimize the preparation of defense experts. The chemicals included chlorinated dioxins and furans, chloroform, methylene chloride and other chlorinated compounds, hydrogen sulfide and mercaptans, mustard gas, oxides of sulfur and nitrogen, nitrosamines, and sulfuric acid mist or fog. Key health claims at issue included cancer, lung injury and susceptibility to infections.

Risk assessment research for CERCLA cost recovery litigation. Managed a comprehensive summary and critique of remedial investigation, risk assessment, and feasibility study documents prepared for an extensively investigated CERCLA site in California. Examined the strengths and weaknesses of the reported findings and conclusions to assist in demonstrating a de minimis contributor role for a pesticide product supplier involved in a civil suit for cost recovery. Briefing documents, figures and exhibits were created to summarize the scientific conclusions and our critique of the environmental fate and transport and chemical toxicology issues most pertinent to our client's potential responsibilities.

Research and risk assessment for a refinery litigation. Managed a detailed analysis of several topics concerning chemical emissions and risks from a refinery in California. Topics included analysis of Air Toxics Inventory Reports and Risks Assessments created according to AB2588 guidance, and detailed research of aerosol, particulate and gaseous emissions of a variety of chemicals including predominantly hydrocarbons, metals and sulfur compounds. Past chemical emissions were linked to refinery records to formulate a retrospective assessment of exposures for nearby residents, including in excess of 400 plaintiffs. Briefing documents were created for key issues including aerosol transport and exposure characteristics, and updated toxicological data on chemicals of interest.

Chemical weapons incinerator risk assessment for litigation. Managed the process of information collection and quantitative analysis of a claim filed by environmental groups in Utah and Oregon regarding a RCRA-permitted incinerator for destruction of chemical weapons at a military depot. Personally provided expert testimony regarding injunctions filed in state and federal courts to stop trial burn operations at the facility, and an appeal to the state permitting board to have the operating permit revoked.

Risk assessment of wood treatment chemicals for litigation. Managed the research of contaminant migration and potential human health risks to community members in relation to a former wood treatment facility contaminated with creosote, polycyclic aromatic hydrocarbons, pentachlorophenol, and dioxin compounds. Researched the critical factors in determining whether alleged chemical releases could have adversely affected residents, provided critical analysis of preliminary conclusions reached by regulatory agencies and opposing experts, and developed an exposure assessment to examine site-related and other chemical exposures and risks relevant to the community at issue.

CERCLA Risk Assessment. Author and strategist in developing a state-of-the-art risk assessment evaluation for a major Superfund site in southern California. The analysis provided a Monte Carlo-Based Analysis of key parameters concerning multipathway community exposures to chlorinated solvents (e.g., chloroform and TCE) and nonvolatile chemicals (e.g., nitrate, sulfates, metals) present in a groundwater plume emanating from a former waste disposal site. The analysis also provided the range of plausible health risks which were calculated based on three scenarios with varied assumptions with respect to continued remediation/containment or failure of current remedial systems. The report was the first Monte Carlo-based risk assessment accepted by Region IX USEPA; it was used in the final Record of Decision regarding the CERCLA Site.

Human health and ecological risk assessment at a port facility. Project manager in the planning and development of the risk assessment portion of a remedial action plan for incorporation into an environmental impact report for a metal recycling facility located in a Port District area in Southern California. Assessed potential exposures to on-site workers, nearby residents, and marine life related to heavy metals, polycyclic aromatic hydrocarbons, and polychlorinated biphenyls. Developed an innovative risk-based sampling approach to derive data in support of using site-specific leaching characteristics with

regard to the transport of soil contaminants into groundwater and to an adjacent marine habitat. The risk assessment supported final clean-up criteria approved by the Los Angeles Regional Water Quality Control Board.

Human health risk assessment of former municipal landfill. Project manager for planning, developing and negotiating a human health risk assessment regarding contamination of a former landfill property with proposed future development into a retail mall. Assessed potential exposures to volatile organic chemicals, paint and petroleum wastes for on-site workers and nearby residents. Also evaluated the potential risks associated with a hypothetical uncontrolled residential development of the landfill and for the proposed future commercial use with Title 23 cap, gas collection systems, and building/parking lot structures in place. The detailed work plan of the risk assessment was approved by the California Department of Toxic Substances Control.

Regulatory Compliance

Regulatory compliance documentation/environmental assessment for new drugs. Supervised the research of scientific literature and a local regulatory requirement survey relevant to the environmental assessment protocols for an FDA new drug application. The toxicology and environmental fate and chemistry information for a selected cytotoxic antineoplastic drug was summarized for use in hazard communication, medical monitoring program refinement, and a detailed regulatory compliance audit encompassing environmental and worker safety regulations. Created a document to summarize the findings and provide recommendations and precautions regarding enhancement of safety programs applicable to Research and Development uses and a limited production campaign involving this antineoplastic drug.

Regulatory policy scientific critique documents. Reviewed a hazard communication document released by a State Health Department regarding hydrogen sulfide toxicity, finding several incorrect and unsupported statements and interpretations. Supervised research and documentation to support critical comments for the State Health Department to consider in revising the hazard communication, including a review of the scientific literature on toxicological effects and mechanism of action, a review of current regulatory policies on hydrogen sulfide throughout the world, and specific recommendations for revision. An addendum to this report was subsequently researched and drafted in response to a revised hazard communication released 6 months later. The client utilized both documents to provide a more rational decision-making process during regulatory negotiations with the State.

Worker safety program development and hazard communication. Researched the scientific and medical literature regarding a cytotoxic virustatic drug proposed for use at a medical device manufacturing facility. Supervised production of a resource document which reviewed the relevant scientific literature and facility-specific process and hygienic procedures and provided recommendations and precautions regarding Research and Development uses and pilot production operations with this compound. This document was used for hazard communication during a McLaren/Hart training program for workers potentially exposed to this drug.

Worker safety program development and hazard communication. Researched the scientific and medical literature regarding selected immunosuppressant and cytotoxic/antineoplastic drugs proposed for production and/or Research and Development use at an encapsulation facility. Supervised research of relevant scientific literature and the facility-specific process and hygienic procedures and provided preliminary recommendations and precautions regarding Research and Development uses and pilot production operations with these drugs. These recommendations were used for hazard communication during a McLaren/Hart training program for workers potentially exposed to this drug, and also for

development of an appropriate medical monitoring program and hygiene/monitoring procedures for these drugs.

Editorships & Editorial Review Boards

BMC Public Health (associate editor)

Frontiers in Environmental Health (editorial board)

Peer Reviews

Environment International

British Journal of Cancer

Environmental Health Perspectives

Journal of Toxicology and Environmental Health

Toxicological Sciences

Critical Reviews in Toxicology

Environmental Research

Regulatory Toxicology and Pharmacology

Risk Analysis

Journal of Exposure Science and Environmental Epidemiology

Journal of Children's Health

Atmospheric Environment

Human and Ecological Risk Assessment

Chemosphere

International Journal of Environmental and Analytical Chemistry

International Journal of Soils, Sediments, and Water

Cancer Causes & Control