



LUCY H. FRAISER, PH.D., DABT PRINCIPAL SCIENTIST

Lucy Fraiser Toxicology Consulting LLC

AREAS OF EXPERTISE

- Toxicological Evaluations
- Risk Assessments
- Risk Communication
- Litigation Support
- Development of Innovative Risk-Based Approaches
- Exposure Modeling

EDUCATION

Ph.D., Toxicology,
University of Texas at Austin,
1992

B.A. Psychology, *University*
of Texas at Austin, 1985

CERTIFICATIONS/AFFILIATIONS

Diplomate of the American
Board of Toxicology

American College of Toxicology

National Society of Toxicology

South Central Society of
Toxicology

Society for Risk Analysis

Northwest Arkansas Food Bank,
Volunteer

Rowing Club of Northwest
Arkansas, Treasurer

CONTACT

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Dr. Lucy Fraiser is a board-certified toxicologist with over 33 years of experience in the areas of exposure and risk assessment, health effects and toxicology evaluations, development of quantitative toxicity criteria, development of risk-based air and water quality guidelines and soil cleanup criteria, and risk communication. Dr. Fraiser works with all environmental media, including soil, sediment, groundwater, surface water and air and is well versed in methods for evaluating exposure via all exposure routes (inhalation, dermal, ingestion). She has performed numerous air quality evaluations to determine whether pollutant emissions have caused or contributed to a condition of air pollution and the likelihood that air toxics will adversely impact health or welfare.

Dr. Fraiser has worked in both the public and private sectors. She has conducted and managed multi-pathway exposure assessments and human and ecological risk assessments for a wide variety of environmental pollutants and sources. Dr. Fraiser has, on many occasions, examined the scientific foundation on which exposure assumptions and toxicity criteria are based on behalf of private and public-sector clients and trade organizations. Her leading work on these issues has resulted in corrections to regulatory guidance and risk-based criteria on several occasions. She has conducted hundreds of exposure assessments for chemicals used in pharmaceutical laboratories and industrial processes, chemicals applied to control pests and unwanted vegetation, and chemicals released as unwanted by-products of chemical and product manufacturing, combustion of fossil and waste-derived fuels, generation of electricity, petroleum refining, smelting, rock crushing, and activities at military installations.

Litigation Experience

Dr. Fraiser has been qualified as an expert, deposed, and has provided expert testimony in contested case hearings, criminal case hearings, Federal Civil suits, and toxic tort litigation on many occasions. She has testified before the Texas and Illinois State Legislatures, in public meetings, and before numerous state regulatory agencies on behalf of commercial clients. Dr. Fraiser also conducted a televised press conference on behalf of a state and a national trade organization regarding mercury emissions from power plants.

Dr. Fraiser developed opinions and produced numerous reports regarding the potential for chemicals used in the semiconductor industry to cause developmental toxicity in a multi-Plaintiff lawsuit. She testified regarding the health protectiveness of air permits for a multi-billion-dollar plastics manufacturing facility and a construction



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aggregate company in Texas. In a lawsuit filed by the U.S. EPA seeking reimbursement costs incurred for response actions taken in connection with the release of cement kiln dust from a redeveloped site that was formerly a mine and cement plant, Dr. Fraiser developed opinions regarding when the site ceased posing an “imminent and substantial” threat to public health, welfare, and/or the environment under CERCLA.

Dr. Fraiser provided critical expert testimony in a high-profile toxic tort case involving a flaring event at a multi-national petrochemical company that resulted in a jury verdict for the defense. She also provided critical testimony in a citizen suit against a Texas energy company in which a judge from the Western District of Texas ruled from the bench that there were no violations of the Clean Air Act and later ordered the Plaintiff to pay \$6.4 million in defense attorneys’ fees. She has also provided critical expert testimony in a citizen suit against a Texas petrochemical company involving excess air emission and maintenance, startup, and shutdown events. The federal cases involved alleged violations of opacity standards, National Ambient Air Quality Standards (NAAQS), and in the case of the petrochemical plant, screening levels for compounds considered to be hazardous air pollutants.

Dr. Fraiser has provided testimony on potential risks associated with permitting of rock crushers (silica, limestone, particulates [PM_{10/2.5}]), concrete batch plants (silica, PM_{10/2.5}), hazardous waste combustion units (polycyclic aromatic hydrocarbons, polychlorinated biphenyls (PCBs), dioxins, and other semi-volatile organic compounds), and a copper smelter (PM_{10/2.5}, NO₂, sulfur dioxide [SO₂], sulfuric acid [H₂SO₄], arsenic, lead, and cadmium). Dr. Fraiser has developed opinions regarding health and welfare effects (including odor) in court cases involving accidental releases of hydrogen sulfide (H₂S) and other reduced sulfur compounds that cause odors, and potential H₂S/SO₂ health effects a from a Sulfur Recovery Unit. She also provided testimony on the potential for health effects associated with relatively short-term exposure to benzene concentrations in drinking water above the Maximum Contaminant Level (MCL), and potential risks associated with lead and total petroleum hydrocarbon (TPH) levels detected in street sweepings.

Regulatory Experience

Dr. Fraiser is currently advising a trade association that represents medical device manufacturers regarding potential health effects of sterilizer plant emissions on workers and neighboring communities in



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the midst of EPA rule development for controlling emissions of ethylene oxide.

She provided comments to EPA on behalf of several commercial clients and a trade organization questioning the extent to which health research studies supported the need for a tighter ozone NAAQS during the 2015 review. Dr. Fraiser also provided comments on the Second External Review Draft of the Integrated Science Assessment For Oxides Of Nitrogen (NO₂)–Health Criteria in 2014 and the Boiler MACT Health-Based Emissions Limitations on behalf of a trade organizations. In the past, she has developed technical comments on EPA Risk Assessment Protocols for Hazardous Waste Combustion Facilities on behalf of the Louisiana Chemical Association and the Cement Kiln Recycling Coalition and completed formal technical comments on behalf of a power generation client on a risk-based program intended to significantly reduce levels of toxic air contaminants in Kentucky.

As a Senior Toxicologist with the Texas Natural Resource Conservation Commission (TNRCC), the predecessor agency to the Texas Commission on Environmental Quality (TCEQ), Dr. Fraiser conducted and managed risk assessments for incinerators and industrial boilers seeking permits to burn hazardous waste. These risk assessments involved using air deposition modeling to estimate uptake into agricultural products (i.e., produce and livestock) and estimating risk to livestock as well as humans that consumed livestock and produce. Dr. Fraiser provided support to the U.S. EPA as they formulated national policies related to combustion risk assessment, provided critical input into the development of protective concentrations levels (PCLs) under the Texas Risk Reduction Program (TRRP), served as an external peer reviewer for risk assessment guidance documents developed by EPA Region 6 and adopted as national guidance and represented the Agency on EPA workgroups and in contested case hearings.

Air Quality Health Effects Evaluations

Several local governments with ethylene oxide sterilization facilities within their purview have considered imposing additional operating restrictions upon or complete prohibition of ethylene oxide emissions from these facilities. Dr. Fraiser was engaged by two of these communities to provide specialized toxicological expertise and advice to local Counsel on ethylene oxide health effects and to serve on their ethylene oxide task forces. Dr. Fraiser also testified before the Illinois



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House and Senate, and she has provided detailed presentations to community members, local regulators and EPA Region 7 on ethylene oxide health effects. Dr. Fraiser is helping one commercial sterilizer to communicate to the public and local officials about potential risks associated with ethylene oxide emissions.

Dr. Fraiser was the health risk assessment advisor for a study completed on behalf of the Electric Power Research Institute (EPRI) that evaluated the potential health risk from emissions of coal fired power plants throughout the U.S. using EPA's TRIM (Total Risk Integrated Methodology) model. She served as project manager responsible for multi-pathway risk assessment updates for a specialty chemical company to support permitting activity that reflected the installation of new SO₂ abatement equipment, served as the risk assessment team lead for a vapor intrusion evaluation using crawl-space soil vapor and ambient air samples collected beneath and near a house in the vicinity of a crude oil release and performed a health risk assessment using indoor and ambient air samples from a manufacturing facility.

Dr. Fraiser has conducted or served as task leader on more than two dozen human health risk assessments conducted in support of applications for hazardous waste combustion units at chemical plants, waste management facilities, army depots, and cement kilns.

Odor Evaluations

Dr. Fraiser has been engaged on numerous occasions to evaluate alleged nuisance odors and to determine whether odorous emissions could be accompanied by health effects. She evaluates the potential impact of alleged odors by: 1) obtaining local meteorological data for the time of the alleged event; 2) documenting the frequency, intensity, duration and offensiveness of odors based on reports from first-hand observers; and 3) noting any physical effects experienced by first-hand observers. A critical step in determining whether odors are likely to be accompanied by adverse health effects is establishing whether the threshold for odor detection is above or below the health effects threshold for the chemicals involved. Dr. Fraiser has substantial knowledge regarding the way in which odor thresholds and health-based levels are established, as well as the potential toxicological and psychological mechanisms by which odors may result in actual or perceived health effects. Even if the odors do not rise to the level of

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causing adverse health effects by known toxicological mechanisms, they can in some cases adversely affect welfare if they are frequent/recurring.

Risk-Based Corrective Action and Risk Assessment

Dr. Fraiser has conducted and/or served as task leader for over 75 human health risk assessments and/or risk-based corrective action (RBCA) evaluations in support of Resource Conservation Recovery Act (RCRA) closures or under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for both commercial companies and government clients.

Dr. Fraiser has substantial experience performing human health and ecological risk evaluations under the Texas Risk Reduction Rule and the Texas Risk Reduction Program (TRRP), as well as other state RBCA programs. She has completed and received Texas Commission on Environmental Quality (TCEQ) approval for several Affected Property Assessment Reports and has provided support on the successful completion of several Response Action Completion Reports.

Dr. Fraiser completed a multi-media human health risk assessment for a high school at which placement of fill material to build up the area for sports fields resulted in PCB contamination. She also assisted with a toxicity assessment and fish cooking loss study for dioxins and PCBs for a contaminated river segment in the northeast.

Toxicological Evaluations and Risk-Based Regulatory Criteria Development

Dr. Fraiser evaluated the potential health and nuisance (odor) impacts of Concentrated Animal Farming Operations (CAFOs) at the request of a law firm filing an appeal against the citing of a proposed CAFO near an existing CAFO in Texas.

She has developed numerous health-based criteria for compounds lacking published values using toxicity studies, structure activity relationships, and her knowledge of pharmacokinetics. She has developed risk-based regulatory criteria including emergency response planning guidelines (ERPGs), inhalation reference concentrations (RfCs), water quality criteria, and acceptable ambient air levels, including Effects Screening Levels (ESLs), for several compounds. Based on her understanding of the human health

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underpinnings of federal regulations and state corrective action and air quality guidelines, Dr. Fraiser has assisted many clients wishing to challenge health-based criteria during public comment periods and in identifying adjustments to existing criteria.

Publications, Presentations and Training Courses

Fraiser L. Trends in Setting National Ambient Air Quality Standards. Earth Day Legal Symposium. Dallas, TX. April 21, 2017

Fraiser L. In Chemical Litigation, Toxicology Fundamentals Matter. American Bar Association Newsletter. August 2016.

Fraiser L. EPA May Go Beyond Law and Science in Setting NAAQS. Natural Gas & Electricity, 30(3):1-8. October 2014.

Fraiser L., and Karen Olson. Ozone NAAQS – Where is it Headed? Texas Association of Business, Austin TX. July 24, 2014.

Fraiser L. Ozone NAAQS – Where is it Headed? Houston Regional Monitoring Association, Houston, TX. July 9, 2014.

Fraiser L., and Davis B. Ozone NAAQS – Where is it Headed? Clean Air Force of Central Texas, Austin TX. April 24, 2014.

Fraiser L., and Karen Olson. Ozone NAAQS – Where is it Headed? Winstead PC, Austin TX. May 27, 2014.

Fraiser L., and Sullivan, T. Ozone NAAQS – Where is it Headed? Texas Pipeline Association, Austin TX. April 9, 2014.

Fraiser, L. Recent Reductions in NAAQS – Good Science or Perpetuation of Dogma on Health Consequences of Low-Level Air Pollutants? Energy Utility Environment Conference, Phoenix AZ. February 3 -5, 2014.

Fraiser, L.H. and Bradley, L.J.N. Key Decisions in Establishing National Ambient Air Quality Standards. 52nd Annual Meeting of the Society of Toxicology. San Antonio, Texas. March 10 – 14, 2013.

Fraiser, L.H. Health Basis for EPA's 1-Hr SO₂ NAAQS. Alamo Chapter AWMA Meeting, January 10, 2013.

Ruffle, B., Fraiser, L., Kaczmar, S., Schew, W. Update on Cooking Loss Factors for PCDD/PCDFs, PCBs and Chlorinated Pesticides. Passaic River Symposium V. Passaic River Institute of Montclair State University. October 19, 2012.



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Fraiser, L.H. and Vosnakis, K.A.S. Evolution of PCB Regulations and Toxicity Assessment: Impact on Environmental Management. 27th Annual International Conference on Soils, Sediments, Water and Energy, Amherst, Massachusetts. October 17 – 19, 2011.

Fraiser, L. Toxicology & Risk Assessment in the News: Recent EPA Proposals with Broad Implications. Invited Presented at the Gulf Coast Air & Waste Management Association Meeting. Houston, Texas. June 08, 2010.

Quintin, A. and Fraiser, L. Comparison of International Risk-Based Screening Levels. Proceedings of the Annual International Conference on Soils, Sediments, Water and Energy. Vol. 15, Article 24. June 2010.

Fraiser, L.H. Toxicology & Risk Assessment in the News: Recent EPA Proposals with Broad Implications. Houston Air & Waste Management Association. June 2010.

Fraiser, L.H., Quintin, A. Durocher, K. Szembek, C. Heinold, D. EPRI Human Health and Environmental Risk Assessment Process. February 18, 2010.

Fraiser, L.H. Trends in International Risk-Based Screening Levels (RBSLs). Society of Toxicology and Chemistry, New Orleans, Louisiana. November 19 – 23, 2009.

Fraiser, L.H. Risk Assessment: How it Can Inform Site Closure Decisions. Invited Short Course presented to the Department of Environment Malaysia, Kuala Lumpur. March 4 – 5, 2009.

Fraiser, L.H. Incinerator Risk Assessment: Principles and Practices, Hong Kong. Regional Conference on Sustainable Waste Management in Carbon-Conscious Cities. December 2008.

Fraiser, L.H. Site-Specific Risk Assessments, RCRA Omnibus Provision and Combining Risk Burns and Comprehensive Performance Tests. MACT EEE EPA Training Workshop, Dallas, TX. November 3 – 8, 2008.

Fraiser, L.H. Involvement of Local Governments in Air Toxics Regulation. Texas Chemical Council/ Association of Chemical Industry of Texas's EH&S Seminar Moody Gardens Hotel, Galveston Texas. June 10, 2008.

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Fraiser, L.H., and Chaudhuri, I. Short-Term Toxicity Benchmark for Nickel Oxide. 42nd Annual Society of Toxicology Meeting. March 9 – 14, 2002. Salt Lake City, Utah.

Fraiser, L.H., and Ruffle, B. “Chemical Regulations with Business Implications.” Environmental Protection. June 2002.

Fraiser, L.H., and Chaudhuri, I. Short-Term Toxicity Benchmark for Nickel Oxide. International Conference on Incineration & Thermal Treatment Technologies Proceedings. May 13 -17, 2002. New Orleans, Louisiana.

Fraiser, L.H., and Chaudhuri, I. Short-Term Toxicity Benchmark for Nickel Oxide. Proceedings of the Air & Waste Management Association. April 16 - 19, 2002. St. Louis, Missouri.

Fraiser, L.H., Chaudhuri, I, and Smith, D. EPA’s Dioxin Reassessment – Potential Impacts to the Regulated Community. Proceedings of the Air & Waste Management Association. June 24 - 28, 2001. Orlando, Florida.

Fraiser, L.H., Roeck, D., and Smith, D. New Developments in Dioxin Regulation – Potential Impacts on the Regulated Community. International Conference on Incineration & Thermal Treatment Technologies Proceedings. May 14 -18, 2001. Philadelphia, Pennsylvania.

Fraiser, L.H., Roeck, D., and Smith, D. Current Environment of Hazardous Waste Combustion. International Conference on Incineration & Thermal Treatment Technologies Proceedings. May 14 -18, 2001. Philadelphia, Pennsylvania.

Fraiser, L.H., and Pope, P.G. Hazardous Waste Combustion Risk Assessment — Artifact or True Risk? International Conference on Incineration & Thermal Treatment Technologies Proceedings. May 8-12, 2000. Portland, Oregon.

Fraiser, L.H., and Lewis, D. Detection Limits: Practical Implications for Risk Assessments Conducted on Hazardous Waste Combustion Units. Presented before the Louisiana Chemical Association. September 9, 1999. Baton Rouge, Louisiana.

Fraiser, L.H., Tachovsky, J.A., King, M.L., McCoy, J.T., and Haws, L.C. Hazardous Waste Combustion Risk Assessment Experience in the State of Texas. International Conference on Incineration & Thermal Treatment Technologies Proceedings. pp. 189-196. May 11-15, 1998. Salt Lake City, Utah.

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Fraiser, L., McCoy, J.T., Perry, C., King, M., and Haws, L.C. Screening Risk Analysis for the Bayer Corporation Facility in Baytown, Texas. TNRCC publication number AS-120, AS-120A, and AS-120B. November 1996.

Fraiser, L., Lund, L., Tyndall, K., King, M., Schultz, D., and Haws, L. Case Studies in Risk Assessment for Hazardous Waste Burning Cement Kilns in Waste Combustion in Boilers and Industrial Furnaces Proceedings. pp.208-225. March 26-27, 1996. Kansas City, Missouri.

Fraiser, L., Lund, L., Hueske, K., and Haws, L.C. Indirect Risk Assessment: Case Studies of Hazardous Waste Combustors. Toxicologist 30:6, 1996.

Fraiser, L., Lund, L., Hueske, K., King, M., and Haws, L.C. Screening Risk Analysis for the North Texas Cement Company (NTCC) Facility in Midlothian, Texas. TNRCC publication number AS-71, AS-71A, and AS-71B. January 31, 1996.

Fraiser, L., Lund, L., Hueske, K., King, M., and Haws, L.C. Screening Risk Analysis for the Texas Industries (TXI) Facility in Midlothian, Texas. TNRCC publication number AS-72, AS-72A, and AS-72B. November 2, 1995.

Ramu, K., Fraiser, L., Mamiya, B., Ahmed, T., and Kehrer, J.P. Acrolein Mercapturates: Synthesis, Characterization, and Assessment of Their Role in the Bladder Toxicity of Cyclophosphamide. Chem. Res. Toxicol. 8:515-524, 1995.

Fraiser, L., and Kehrer, J.P. Effect of Indomethacin, Aspirin, Nordihydroguareitic Acid, and Piperonyl Butoxide on Cyclophosphamide-Induced Bladder Damage. Drug Chem. Toxicol. 16(2):117-133, 1993.

Fraiser, L., Barnett, J.W., and Hixson, E.J. 'Toxicity Equivalents for Chlorinated Hydrocarbon Pesticides Lacking EPA-Verified Toxicity Values.' Toxicologist 14: 1540, 1994.

Kanekal, S., Fraiser, L., and Kehrer, J.P. Pharmacokinetics, Metabolism, and Lung Toxicity of Cyclophosphamide in C57/Bl6 and ICR Mice. Toxicol. Appl. Pharmacol. 114:1-8, 1992.

Fraiser, L., and Kehrer, J.P. Murine Strain Differences in Bladder Toxicity of Cyclophosphamide. Toxicol. 75:257-272, 1992.



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Fraiser, L., Kanekal, S., and Kehrer, J.P. Cyclophosphamide Toxicity: Characterizing and Avoiding the Problem. *Drugs*. 42(5):781 -795, 1991.