

SARAH R. ARMSTRONG, M.S., D.A.B.T.

EDUCATION:

1990. M.S. Health Policy and Management. Harvard School of Public Health, Boston, Massachusetts. Received the Wilinsky Prize for outstanding academic achievement.

1983. M.S. Biological Sciences. Stanford University, Stanford, California. Conducted original research on inhibitors of eukaryotic gene amplification.

1981. A.B. *magna cum laude* Biochemistry. Harvard University, Cambridge, Massachusetts. Conducted original research on the organization and regulation of Drosophila heat shock genes.

BOARD CERTIFICATION:

Certification in general toxicology — Diplomate of the American Board of Toxicology (D.A.B.T.), 2003.

PROFESSIONAL EXPERIENCE:

1998-Present. Senior Scientist, Cambridge Environmental Inc., Cambridge, Massachusetts.

1990–1998. Associate Scientist, Cambridge Environmental Inc., Cambridge, Massachusetts.

1989–1990. Associate (part–time), Industrial Economics, Inc., Cambridge, Massachusetts. Designed and conducted study of public–health risk factors at chemical plants.

1983–1988. Faculty member, Santa Catalina School, Monterey, California. Taught physics, biology, marine biology, chemistry, and math at an independent secondary school. Designed courses, supervised labs and science projects. Received a grant from the National Science Foundation to take part in ecological research in Costa Rica.

1981–1982. IBM Corp., Yorktown Heights, New York. Laboratory Technician in the Materials Science Division of IBM Research. Developed and conducted experiments testing dielectric materials.

PROFESSIONAL ASSOCIATIONS:

ACGIH

International Society of Regulatory Toxicology and Pharmacology
Society for Risk Analysis NE Chapter

SELECTED PROJECT EXPERIENCE:

Litigation support. Provided general, day-to-day scientific expertise to attorneys regarding health impacts of environmental, residential, and occupational exposures to numerous industrial and commercial chemicals. Analyzed and prepared technical privileged and evidentiary materials. Designed, conducted, or reviewed chemical and environmental analyses and exposure assessments. Researched medical and scientific literature pertaining to health effects and chemicals of interest. Assisted in deposition of experts and preparation of expert testimony. Examples of issues:

- allegations that occupational exposures to benzene or coal tar caused cases of leukemia and lymphoma;
- claims that occupational exposures caused multiple chemical sensitivity;
- allegations that occupational exposure to chlorinated solvents caused central nervous system damage;
- claims that environmental exposures to industrial chemicals caused various birth defects, including Downs syndrome;
- allegations that environmental exposures to synthetic pyrethrins (used as pesticides) caused acute illnesses.

Support for regulatory affairs. Provided technical assistance to private clients affected by various regulatory programs. Examples:

- developed emergency planning guidelines for exposure to certain chemicals released to air;
- managed statistical analysis of dioxin and PCB concentrations in biosolids to aid in development of regulations for disposal of biosolids;
- prepared robust summary of ethanol for the High Production Volume Chemical Challenge;
- served as technical representative for ethanol makers obliged to fulfill EPA testing requirements for fuel additives;
- conducted toxicology reviews of components of art materials as required by the CPSC;
- analyzed the basis of a Clean Water Act regulation limiting molybdenum content of biosolids for land application;
- analyzed characteristics of landfilled or otherwise released materials in light of Federal and State Superfund regulations to determine their status as hazardous waste;
- evaluated state statutes and regulations pertaining to hazardous materials in order to clarify issues of land transfer.

Critical analysis of toxicological, medical, and environmental subjects for various purposes.

Examples:

- compilation of data describing concentrations of dioxin-like compounds in foodstuffs worldwide, for the Institute of Medicine;
- inhalation toxicology of ethanol;
- efficacy of medical screening tests for breast, liver, colon, and other cancers;
- relevance of rodent carcinogenicity of phthalates to human health;
- carcinogenicity of trichloroethylene;
- toxicity and dietary doses of indoles;
- epidemiology regarding risk factors for birth defects, cancers of many kinds, and organic brain syndrome;
- potential toxicity of photographic chemicals used in a manufacturing facility;
- potential respiratory toxicity of components of a cleaning product.

Risk assessment. Examples:

- assessment of health risks posed by traces of MTBE in a public water supply;
- assessment of health risks posed by incineration of sewage sludge;
- assessment of health and environmental impacts of chemicals released from solid waste incinerators and landfills.

OTHER PROFESSIONAL EXPERIENCE:

Guest Lecturer. Boston College. 1993-1998.

E.L. Wiegand Visiting Scientist. Santa Catalina School, Monterey, CA. March 1992.

SELECTED PRESENTATIONS:

Armstrong, S.R., Ames, M.R., and Green, L.C. "Is ambient hydrogen sulfide a risk to human health?" Presented by M. Ames at the Water Environment Foundation and Air & Waste Management Association Odors and Air Emissions Specialty Conference, Bellevue, Washington, 2004.

"Scientific Analysis of an MCS Claim: A Consultant's Experience," Massachusetts Continuing Legal Education, Inc., Boston, MA, April, 1998.

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"Environmental Health Risk Assessment: A Public Policy Tool," Lambda Alpha International program on Brownfields, Boston, MA, May, 1997.

"Uncertainty in Risk Assessment," New York Roundtable on the Future of Biosolids, Albany, NY, April, 1995.

"Risk Assessment and Environmental Rulemaking," Environmental Business Conference, New York, NY, June, 1994.

"Chemophobia," Semiconductor Safety Association, Phoenix, AZ, April, 1993.

ORIGINAL REPORTS:

Armstrong, S.R. and Green, L.C. (2008). MTBE Fact Sheet. Cambridge Environmental, Inc.

Adilman, D., Ames, M.R., Armstrong, S.R., Copley, L.G., Green, L.C., Hartzel, R., Holmén, B., Klens-Caprio, J., Lester, R.R., Roy, S.P., Swift, R., Tyler, M., Zeeb, P. and Zemba, S.G. (2008). An assessment of the environmental and public health impacts of Omya's operations in Florence, Vermont: Integrated report. Cambridge Environmental Inc. and Geosyntec Consultants, Inc.

Zemba, S.G., Adilman, D., Ames, M.R., Armstrong, S.R., Copley, L.G., Green, L.C., Klens-Caprio, J., Lester, R.R., Roy, S.P., Shifrin, A., and Zeeb, P. (2007). Final phase I report, Omya Verpol Facility - Florence, Vermont. Cambridge Environmental Inc. and Geosyntec Consultants, Inc.

Satterstrom, F.K, Zemba, S.G., and Armstrong, S.R. (2005). Ecological risk assessment for the Indeck Elwood Energy Center. Cambridge Environmental Inc. and Epsilon Associates, Inc.

Armstrong, S.R. and Green, L.C. (2004). Chlorinated hydrocarbon solvents. *Clin. Occup. Environ. Med.* 4(3):481-496.

Green, L.C. and Armstrong, S.R. (2003). Particulate matter in ambient air and mortality: toxicologic perspectives. *Regulatory Toxicology and Pharmacology* 38:326-335.

Armstrong, S. (2002). Synopsis of dietary exposure to dioxin-like compounds. Cambridge Environmental Inc.

Liaw, J., Armstrong, S., and Green, L. (2002). Initial survey of the toxicity of super absorbent polymers and laundry detergent enzymes. Cambridge Environmental Inc.

- Armstrong, S.R. and Liaw, J. (2002). The fundamentals of fungi. *ASHRAE Journal* November:18–24.
- Green, L.C., Armstrong, S.R., and Liaw, J. (2002). Comments on U.S. EPA's Third External Review Draft *Air Quality Criteria Document for Particulate Matter*. Cambridge Environmental Inc.
- Alvarado, M.J., Armstrong, S., and Crouch, E. (2001). The AMSA 2000/2001 survey of dioxin-like compounds in biosolids: statistical analyses. Cambridge Environmental Inc.
- Armstrong, S.R. (2001). Ethanol test package (CAS RN 64-17-5): test plan, test plan justification, robust summary. Cambridge Environmental Inc.
- Green, L. and Armstrong, S. (2001). A review of the "*Yana Curi Report: Impact of Oil Activity on the Health of Rural Populations in the Ecuadorian Amazon*" by M. San Sebastian and coworkers published in 2000 by Medicus Mundi. Cambridge Environmental Inc.
- Crouch, E.A.C. and Armstrong, S.R. (2000). Review of exposure assessments for Cry9C protein in StarLink Corn. Cambridge Environmental Inc.
- Armstrong, S. (2000). Ethanol: Brief Report on its Use in Gasoline: Expected Impacts and Comments of Expert Reviewers. Cambridge Environmental Inc.
- Crouch, E., Armstrong, S., and Zemba, S. (2000). Comments on EPA's Proposed Standards for the Use of Disposal of Sewage Sludge, December 23, 1999. Cambridge Environmental Inc.
- Armstrong, S. (2000). "Public Health" in The New York City Comprehensive Solid Waste Management Plan: Draft Modification, Draft Environmental Impact Statement. HDR Architecture & Engineering, P.C.
- Crouch, E., Armstrong, S., Lester, R. and Burmaster, D. (1999). Comments on *Importation of Fresh Citrus Fruit (Sweet Orange, Citrus sinensis, Lemon, C. limon, and Grapefruit, C. paradisi) from Argentina into the Continental United States: Supplemental Plant Pest Risk Assessment*. Cambridge Environmental Inc.
- Armstrong, S. and Valberg, P. (1998, 1999). "EMF and MCS: Truth or Scare?" in *Environmental Law and Policy volume 3, no. 1 and volume 3, no. 2*. Morrison, Mahoney & Miller, L.L.P.
- Armstrong, S.R., Rauw, B.J., and Green, L.C. (1999). Health hazard evaluation of nickel emissions from Dept. 4 and Dept. 13. Cambridge Environmental Inc.

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- Bartlett, K.L., Armstrong, S.R., and Zemba, S.G. (1997). Air modeling and toxicity evaluation of emissions from Eastern Acoustic Works Painting Facility in Manchaug, MA. Cambridge Environmental Inc.
- Green, L.C., Armstrong, S.R., and Mennear, J.H. (1997). Comments on the *NTP Toxicology and Carcinogenesis Studies of Pyridine in Rats and Mice*. Cambridge Environmental Inc.
- Crouch, E.A.C., Lester, R.R., Lash, T.L., Armstrong, S.R., and Green, L.C. (1997). Health risk assessments *per* the risk assessment reforms under consideration in the U.S. Congress. *Human and Ecological Risk Assessment* 8:713–785.
- Green, L.C., Crouch, E.A., Lester, R.R., Lash, T.L., Armstrong, S.R. (1997) Letter from America: Can health risk assessment be improved, and should it? *European Safety and Reliability Association Newsletter*, p. 6-8.
- Armstrong, S.R., Dominak, T., Lenhart, T., Koh, B. (1997). Health assesment of biosolids residuals at Northeast Ohio Regional Sewer District Facilities. Cambridge Environmental Inc.
- Armstrong, S.R. (1997). Biosolids: how large a source of dioxins? *Biosolids Technical Bulletin* 3(1):9-11.
- Green, L.C. and Armstrong, S.R. (1996). Comments on ATSDR's *Petitioned Public Health Assessment Addendum Tucson International Airport Area*. Cambridge Environmental Inc.
- Barter, R.A., Twerdok, L.E., Sharp, C.C., Lax, D., Armstrong, S., Daughtrey, W., Rodney, S., and Drew, R.T. (1996). The Utility of Gasoline Engine Exhaust Emission Toxicology Testing. American Petroleum Institute.
- Armstrong, S.R., Zemba, S.G., and Crouch, E.A.C. (1996). Acute health effects assessment for the Plainville Landfill. Cambridge Environmental Inc.
- Armstrong, S.R. (1995). Toxicology of inhaled ethanol. Cambridge Environmental Inc.
- Crouch, E.A.C., Lester, R.R., Lash, T.L., Armstrong, S.R., and Green, L.C. (1995). Report to the Commission on Risk Assessment and Risk Management. Health risk assessments prepared per the risk assessment reforms under consideration in the U.S. Congress. Cambridge Environmental Inc.
- Green, L.C. and Armstrong, S.R. (1995). EPA's dioxin reassessment: still not enough science. *Solid Waste Technologies* March/April:27-34.

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- Green, L.C., Crouch, E.A.C., Armstrong, S.R., and Lester, R.R. (1995). Comments on *Health Assessment Document for 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) and Related Compounds: review draft*. Cambridge Environmental Inc.
- Green, L.C., Crouch, E.A.C., Armstrong, S.R., Lash, T.L., and Lester, R.R. (1995). Comments on *Estimating Exposure to Dioxin-like Compounds: review draft*. Cambridge Environmental Inc.
- Armstrong, S.R., Zemba, S.G., and Green, L.C. (1995). Health evaluation of the Pine Grove Landfill, Pine Grove, PA. Cambridge Environmental Inc.
- Crouch, E., Green, L., Zemba, S., Armstrong, S., and Gaffey, K. (1995). Some further comments on *Development of Human Health Based Exit Criteria for the Hazardous Waste Identification Project Phase III Analysis*. Cambridge Environmental Inc.
- Armstrong, S.R. and Zemba, S.G. (1994). Risk characterization for the Raytheon Facility, 190 Willow St., UST area, Waltham, MA. Cambridge Environmental Inc.
- Zemba, S.G., Perkins, K.K., Armstrong, S.R., Crouch, E.A.C., Lester, R.R., and Green, L.C. (1994). A health risk assessment for the Capital District integrated solid waste management facility. Cambridge Environmental Inc.
- Crouch, E., Green, L., Zemba, S., Armstrong, S., Perkins, K., and Burmaster, D. (1994). Some initial comments on *Development of Human Health Based Exit Criteria for the Hazardous Waste Identification Project Phase III Analysis*. Cambridge Environmental Inc.
- Zemba, S.G., Perkins, K.K., and Armstrong, S.R. (1994) Risk characterization for the Raytheon Facility, Quincy, MA. Cambridge Environmental Inc.
- Armstrong, S.R., Crouch, E.A.C., and Green, L.C. (1994). Comments on claims of health effects and risk assessments in *Rights Violations in Ecuador: Human Consequences of Oil Development in the Oriente*. Cambridge Environmental Inc.
- Armstrong, S.R. (1993). Comments on EPA's derivation of the reference application rate (RP_c) and pollutant concentration (PC) for molybdenum in sludge applied to land (40 CFR Part 257 *et al.*). Cambridge Environmental Inc.
- Green, L.C., Armstrong, S.R., Crouch, E.A.C., Lash, T.L., Luis, S.J., Perkins, K.K., and Zemba, S.G. (1993). Protocol for a multi-pathway risk assessment for the WTI Facility in East Liverpool, OH. Cambridge Environmental Inc.

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Zemba, S.G., Pilkington, M.B.G., Crouch, E.A.C., Armstrong, S.R., Jaffe, D.H., Lash, T.L., and Green, L.C. (1992). A health risk assessment of the waste-to-energy plant proposed for Green Island, NY. Cambridge Environmental Inc.

Armstrong, S.R., Green, L.C., and Lash, T.L. (1992). Comments on the ATSDR's November 8, 1991 *Draft Health Assessment for the Groton/Gratuity Road Site*. Cambridge Environmental Inc.

Armstrong, S.R., Green, L.C., and Zemba, S.G. (1991). Waste-to-energy: Health and environmental issues. Cambridge Environmental Inc.

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BOOKS AND BOOK CHAPTERS:

Taniguchi, C.M., Armstrong, S.R., Green, L.C., Golan, D.E., Tashjian, A.H., Jr. (2007). Drug toxicity. In: D.E. Golan, A.H. Tashjian, Jr, E.J. Armstrong, and A.W. Armstrong, eds., *Principles of Pharmacology: The Pathophysiologic Basis of Drug Therapy*, 2nd Edition. Philadelphia, PA: Lippincott Williams & Wilkins, Chapter 5.

Armstrong, S.R., Galanter, J.M., Green, L.C., and Tashjian, A.H., Jr. (2007). Poisoning by drugs and environmental toxins. In: D.E. Golan, A.H. Tashjian, Jr., E.J. Armstrong, and A.W. Armstrong, eds., *Principles of Pharmacology: The Pathophysiologic Basis of Drug Therapy*, 2nd Edition. Philadelphia, PA: Lippincott Williams & Wilkins, Chapter 51.

Galanter, J.M., Armstrong, S.R., Green, L.C., and Tashjian, Jr., A.H. (2004). Principles of toxicology. In: D.E Golan, A.J. Tashjian, Jr., E.J. Armstrong, J.M. Galanter, A.W Armstrong, R.A. Arnaout, H.S. Rose, eds., *Principles of Pharmacology: The Pathophysiologic Basis of Drug Therapy*. Baltimore, MD: Lippincott Williams & Wilkins, Chapter 47.

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Armstrong, S.R. (1998). Scientific analysis of an MCS case: a consultant's experience. In: S.C. Smith, S.R. Armstrong, R.C. Autieri, *et al.*, eds., *Multiple Chemical Sensitivity Cases and Daubert*. Boston, MA: MCLE, p. 21-30.