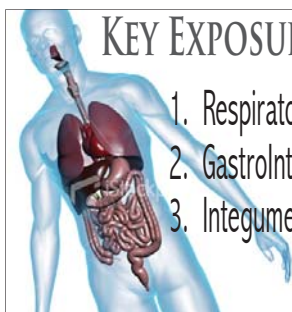


THE OCCUPATIONAL HEALTH AND SAFETY CONCERNS

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Nanotechnology is a rapidly emerging field. There are currently over 500 consumer products available in the marketplace and the field of nanotechnology itself will be worth over 1 trillion dollars by 2012. However, with an increasing number of products emerging there is also a consequent rise in ecological and human exposure. The risk and degree of exposure to nanoscale particles will vary depending on the form of the particle, for example, powder, liquid or encapsulated, when contact occurs. Although, general public exposure to nanoscale particles is increasing due to the sheer number of products available, the majority of human exposure still occurs in an occupational setting. Preliminary exposure studies demonstrate that nanoscale particles may enter the body via the gastrointestinal, respiratory and integumentary systems and then translocate to other vital organs and systems (for example via the olfactory bulb). Historical data on ultrafine particles have shown a higher incidence of lung cancer and respiratory disorders associated with exposure. Due to these data and evidence emerging directly on nanoscale particles, precautionary measures may be warranted to ensure worker safety. Regulatory agencies and manufacturers are beginning to consider standard practices that adequately protect workers from nanoscale particle exposure. The occupational hazards associated with exposure and the current safety recommendations will be discussed.



KEY EXPOSURE SITES

1. Respiratory Tract
2. Gastrointestinal Tract
3. Integumentary System

ENVIRONMENTAL HEALTH AND SAFETY PLANS

1. Guideline Documents
2. Risk Assessment Approaches
3. EHS plans based on Fine/Ultrafine Particles
4. Monitoring Actual Exposure to NP

A Report for ICON: Review of Safety Practices in the Nanotechnology Industry (2006)

WORKPLACE EXPOSURE CONTROLS

ASTM International, Standard Guide for Handling Unbound Engineered Nanoscale Particles in Occupational Settings. E 2535-07, 2007.

Department of Energy, Nanoscale Science Research Centers. Approach to Nanomaterial ESGH. Revision 2. June 2007.

1. Substitution/Elimination
2. Engineering Controls
 - a. Local ventilation
 - b. General exhaust ventilation
 - c. Encapsulation/isolation of workspace
 - d. Specialized filters
3. Administrative Controls
 - a. Worker training and education
 - b. Wet cleaning procedures
 - c. HEPA filtered vacuum systems
 - d. Surfactants during drilling
 - e. Specialized surfaces for workspaces (smooth)
4. Personal Protective Equipment
 - a. Respirators (N100 or HEPA)
 - b. Eyeglass protection
 - c. Gloves
 - d. Laboratory coats



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HydroQual Laboratories Ltd. (HydroQual), a wholly owned subsidiary of Golder Associates Ltd., does applied biology for environmental management. We use living organisms to assess environmental quality (effects testing for environmental assessment). The company is divided into eight operating groups: water, water quality, aquatic habitat restoration, air, soil, applied science, product testing and corporate services. We offer a broad range of routine biological tests (commodity testing services) and custom tests on a demand basis (technical consulting with testing). Our clients are consultants, general public, government, and industry. We are accredited by the Canadian Association of Environmental and Analytical Laboratories (CAEAL) to an ISO 17025 standard and the American Industrial Health Association (AIHA) in the Environmental Microbiology Laboratory Accreditation Program (EMLAP) and recognized by the United States Environmental Protection Agency (US EPA).

Nanotechnology falls into our product testing group for regulatory compliance. There is often little to no environmental fate and effects data on nanoparticles. This information is now being required under legislation in the US (HPV Testing), Canada (New Substances Act), and in Europe (REACH). Manufacturers must conduct testing as defined by the volumes consumed in their processes and submit the information to the government. Existing tests are intended for conventional materials and may not be appropriate for nanoparticles. We are currently evaluating conventional testing procedures for assessing the environmental fates and effects of nanoparticles. We also welcome the opportunity to validate existing and new methods.

Public safety and environmental protection are important and shared obligations of proponents and regulators in any industry. The risk assessment framework provides one tool that can be used effectively to organize information that can be useful to foster informed dialogue and to assist in making critical decisions. There is growing recognition of the need for risk assessments of nanoscale particles. Golder is applying its considerable expertise in risk assessment, product safety testing, and environmental assessments to assist clients to evaluate the risks associated with production and use of nanoscale particles. We are exploring the special requirements for assessing risks of nanoscale particles pertaining to fate, hazard, and exposure in terrestrial and aquatic environments for all phases of product use.

AFFILIATIONS

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- Fellow of the International College of Nutrition
- Member of the SETAC Nanotechnology Advisory Group Workstream 5: Risk Framework
- Member of ASTM Committee on Nanotechnology (E56)
- Member of ASTM Committee on Biological Effects and Environmental Fate (E47)
- Member of the SRA Ecological Risk Assessment Committee
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- Chair of Assessment of Nanotechnology Technical Session for the North American Lake Management Society 28th International Symposium of NALMS
- Executive Member of the Alberta Soil Science Workshop

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PUBLICATIONS

- Effects based risk assessment of emerging and existing nanomaterials (#1223). Nanoscience and Technology Institute 11th Annual NanoTech 2008 Meeting Technical Proceedings. Hynes Convention Center, Boston, Massachusetts, June 1 – 5, 2008. Pending
- Nanotechnology – The Occupational Health and Safety Concerns. NATO Advanced Research Workshop Technical Proceedings. Nanomaterials: Environmental Risks and Benefits and Emerging Consumer Products. Faro, Portugal, April 27 – 30, 2008. Pending
- Developing An Ecological Risk Assessment Framework to Assess Environmental Safety of Nanoscale Products. NATO Advanced Research Workshop Technical Proceedings. Nanomaterials: Environmental Risks and Benefits and Emerging Consumer Products. Faro, Portugal, April 27 – 30, 2008. Pending
- From micro to Nano. Public Works October: 54-44.

PRESENTATIONS

- Society of Environmental Toxicology and Chemistry. 5th SETAC World Congress. Sydney, Australia. August 3 – 7, 2007.
- Nano Science and Technology Institute 11th Annual NanoTech 2008 Meeting. Hynes Convention Center, Boston Massachusetts, June 1 - 5, 2008.
- NATO Advanced Research Workshop. Nanomaterials: Environmental Risks and Benefits and Emerging Consumer Products. Faro, Portugal. April 27 - 30, 2008.
- Society of Environmental Toxicology and Chemistry Europe. 18th Annual Meeting. Warsaw, Poland. May 25 – 29, 2008.
- Cascadia Nanotech Symposium 2008. Vancouver, B.C., March 3 - 5, 2008.
- Emerging Contaminants in Alberta's Environment: 2008 Workshop and Symposium. Edmonton, Alberta. February 28 – 29, 2008
- The Alberta Soil Science Workshop. Lethbridge, Alberta, February 19 – 21, 2008.
- XIII World Congress of Clinical Nutrition. Xalapa, Veracruz, Mexico. January 29 – February 2, 2008.
- Nanotechnology, the Environment and the University of British Columbia Okanagan. Nanotech BC. Kelowna, B.C. November 8, 2007.
- 28th Annual General Meeting of the Society of Environmental Toxicology and Chemistry North America. Milwaukee, WI. November 11 - 15: 2007.
- Technical Seminars from the Edmonton Waste Management Center of Excellence. Edmonton, A.B. October 18, 2007.
- Golder Workshops. Toronto, O.N. October 1 - 2, 2007 and Calgary, A.B. October 4-5, 2007
- 34th Aquatic Toxicity Workshop. Halifax, N.S. September 30 – October 3, 2007.
- 13th International Symposium on Toxicity Assessment. Toyama, Japan. August 19 - 24, 2007.
- 44th Annual Alberta Soil Science Workshop, Calgary, A.B. February 20 – 22, 2007.