



World Health Organization
Collaborating Centres

RECOMMENDED FORMAT FOR ANNUAL REPORTS

Annual Report (Year/2006)

Annual Reports must be annually submitted by WHO collaborating centres for each year of their current designation period. Reports should be sent to the WHO technical programme immediately concerned which, in its turn, will provide comments on the centre's performance as well as information on WHO's input and the use the Organization has made of this collaboration.

Title of the Collaborating Centre: PAHO/WHO Collaborating Centre in Population Health Risk Assessment

Institution name: R. Samuel McLaughlin Centre for Population Health Risk Assessment, Institute of Population Health, University of Ottawa

Exact name of the department/unit/section/laboratory, etc. which acts as the WHO Collaborating Centre: R. Samuel McLaughlin Centre for Population Health Risk Assessment

Designation period: June 2005-June 2009

City and country of location: Ottawa, Canada

Terms of Reference and Workplan:

- I. Air Pollution and Population Health
- II. Radiation Health Risks
- III. Chemical Risk Assessments
- IV. Risk Perception
- V. Building Research Capacity and Training
- VI. Risk Management
- VII. Prion Diseases

I. Air Pollution and Population Health

A. NERAM: The Network for Environmental Risk Assessment and Management (NERAM), developed in 1988, integrates the scientific knowledge and expertise that exists across many diverse disciplines in Canada to provide a comprehensive approach to environmental risk assessment and risk management that supports more effective and efficient environmental protection practices and decision-making. NERAM contributes to both industry and government by addressing issues such as the need for more effective and efficient environmental protection practices and decision-making, the need for consistency/agreement on risk assessment methodologies and the need for more consistent and credible message in communicating about environmental risk. The Network's principal objectives are to develop risk-based methodologies, standards and tools based on scientific models of environmental risk assessment, focusing on methodologies that are practical and evidence-based, and to establish an integrated scientific framework for theoretical and practical principles of integrated environmental risk assessment and management, based on actual risk management decisions. NERAM is based at the University of Waterloo, Institute for Risk Assessment, with several "Nodes" including the University of Ottawa-McLaughlin Centre, Institute of Population Health. Daniel Krewski serves as Director of the Ottawa Node of NERAM while Dr. William Leiss, a McLaughlin scientist, serves as Director of the Risk Communication Node.

1.1 Work performed in relation to the terms of reference:

1) In follow up to NERAM IV held in February 2005 in Mexico, NERAM V – an international Colloquium on "Strategic Policy Directions for Air Quality Risk Management" was held in Vancouver, Canada on October 16-18, 2006 at Simon Fraser University. NERAM V is the final meeting in this 5-year international colloquium series. It was organized by the Network of Environmental Risk Assessment and Management (NERAM). The NERAM V Colloquium Statement is available at:

<http://www.irr-neram.ca/>.

2) Publication of the entire proceedings of the NERAM IV Colloquium was initiated and submitted for publication and review:

- i) Craig L, Krewski D, Shortreed JH, et al. Preface to Strategies for Clean Air and Health. *Journal of Toxicology and Environmental Health*
- ii) Craig L, Krewski D, Samet J, et al. Strategies for Clean Air and Health. *Journal of Toxicology and Environmental Health*

1.2 Recommendations, where applicable, for further implementation of the activity:

1) Publication of the entire proceedings of the NERAM V Colloquium has been submitted and is currently in preparation.

2. Collaboration between the centre and WHO/PAHO:

- 1) Dr. Michal Krzyzanowski, WHO Regional Office for Europe, was a delegate at the NERAM V colloquium and also served on the International Planning Committee.
- 2) Dr. Jacobo Finkelman, PAHO, was also a member of the NERAM V International Planning Committee.

B: APHENA

Principal Investigator(s): Daniel Krewski, Arden Pope, Richard. Burnett

Funding: HEI, \$543,000 2001-2003; 2002-2005

Description of Project: There is increasing scientific and medical evidence that exposure to fine and ultra fine particulate matter could have relatively more significant health implications than exposure to larger particles or to other airborne pollutants. At present there is, however, not enough information available on the exposure-response relationship for fine and ultra fine particulate matter to consider appropriate guidelines, which would protect the whole population or at least the most susceptible groups. Particle characterization for epidemiological studies can be costly, because extended time-series are

needed for these studies including parameters that are not routinely monitored. Inclusion of these parameters in a study program could add to the costs and complexity of the program. Due to budget limitations often only routine data is used, which does not necessarily expand the existing knowledge. To facilitate this WHO, with the participation of McLaughlin Centre affiliate scientist Dr. Arden Pope, undertook the task of developing Guidelines for Concentration and Exposure-Response Measurement of Fine and Ultra Fine Particulate Matter for Use in Epidemiological Studies to be used by national and international organizations undertaking studies in this area. Air Pollution and Health: A European and North American Approach (APHENA), a project carried out by an international team of investigators at several institutions in Europe and North America will produce analyses that characterize effects of air pollution on mortality and morbidity in Europe and North America, using a common analytic framework, in order to describe and explain spatial variation in the health effects of air pollution. The methodological research is intended to evaluate the comparability of methods used by the investigative groups, to develop and apply analytic methods for characterizing heterogeneity of air pollution effects across locations, and to explore the degree of mortality displacement. These methods will then be applied to existing databases on mortality and hospitalization from the European Air Pollution and Health: A European Approach (APHEA) 1 and 2 Studies, the US National Morbidity Mortality and Air Pollution Study (NMMAPS), and from the Canadian studies. This project addresses the analysis and quantification of environmental factors (air pollution) and interacting factors (climate) on health outcomes (mortality and morbidity) and will produce innovative analytical methods for the development of national and regional air quality standards in both developed and developing countries.

1.1 Work performed in relation to terms of reference:

- 1) Funding proposal “Source Apportionment of US. Particulate Matter and Human Mortality” submitted to the Health Effects Institute in 2006 and subsequently approved.
- 2) Analysis of data ongoing (10 Canadian cities, 25 European cities, 90 U.S. cities).
- 3) Publication:
 - i) Fung, K.Y., Khan, S., Krewski, D., Chen, Y. (2006). Association between air pollution and multiple respiratory hospitalizations among the elderly in Vancouver, Canada. *Inhalation Toxicology*, 18, 1005-1011.
 - ii) Liu, S., Krewski, D., Shi, Y., Chen, Y., & Burnett, R. (2006). Association between maternal exposure to ambient air pollutants during pregnancy and fetal growth restriction. *Journal of Exposure Science and Environmental Epidemiology*, 1-7.
 - iii) Turner, M.C., Chen, Y., Krewski, D., Calle, E.E., & Ghadirian, P. (2006). An overview of the association between allergy and cancer. *International Journal of Cancer*. 3124-3132.

1.2 Recommendations, where applicable, for further implementation of the activity:

- 1) Final report currently under preparation to be available in 2007.
- 2) In 2006, a Preliminary Application to HEI entitled “Effect of Long-Term Particulate Air Pollution Exposure on Increasing the Risk for Diabetes Mellitus and Hypertension: American Cancer Society (ACS) Study Cohort” was submitted. This preliminary application was approved and a full proposal has been invited and is currently being developed.

2. Collaboration between the centre and WHO/PAHO:

- 1) Dr. Arden Pope is a member of the Outdoor Air Pollution Working Group of the WHO Global Burden of Disease Comparative Risk Assessment Project.

II. Radiation Health Risks

A.WHO Epidemiological Study of Cellular Telephones and Head and Neck Cancer

Principal Investigator(s): Daniel Krewski, Mary McBride, Jack Siemiatycki

Funding: CIHR, CWTA

Description of Project: Potential health effects of electromagnetic fields (EMF) have been a topic of scientific interest since the late 1900s, and have received particular attention in the last 40 years. Common sources of these fields include power lines, household electrical wiring, appliances and motor driven instruments, computer screens, telecommunications and broadcast facilities, cellular telephones and their base stations. Cellular telephone use has increased steadily in the past few years in many countries. Evidence suggests that low-level exposure to radiofrequency electromagnetic fields due to cellular telephone use may result in adverse health effects. Further study is required to determine whether cellular telephone use is associated with increased incidence of brain tumours, salivary gland tumours and other head and neck tumours. In 1998, an international group of scientists convened by the International Agency for Research on Cancer (IARC) recommended a coordinated international study of cancer risks related to the use of cell phones. Thirteen countries have been invited to participate, including Canada. The primary objective is to evaluate the relationship between cell phone usage and the incidence of adult leukemia and head and neck cancer. Three centres in Canada – Montreal, Ottawa and Vancouver/Victoria – have been selected due to a high prevalence of cell phone use over several years enabling a sufficient number of population-based cases to be identified and the availability of a non-biased control group. The three Canadian centres that are collaborating in this study have already acquired a substantial sum of funding and the McLaughlin Centre will coordinate the Ottawa activities. The McLaughlin Centre will act to coordinate and create a central database for cell phone billing records for the verification of cell phone usage in study patients with cancer. The McLaughlin Centre will coordinate, collect and analyze the data from the Ottawa cohort of patients involved in the study.

1.1 Work performed in relation to terms of reference:

- 1) Completion of billing records database by Daniel Bedard in January 2006.
- 2) Finalize the response rate and participation rate for subjects in the validation study (Jan 2006)
- 3) Joint meeting on November 17, 2006 between CWTA, Health Canada, Industry Canada and McLaughlin Centre staff attended by Dr. Daniel Krewski, Daniel Bedard and Michelle Turner regarding INTERPHONE update, status of Canadian study.
- 4) Review of INTERPHONE methodology paper in September 2006
- 5) Descriptive analyses of SMP data sent to Martine Vrijheid at IARC in February 2006.
- 6) Received Base-Station measurements from Rogers Wireless in March 2006.
- 7) Analysis of base-station data for GSM network in Canada
- 8) Sent median income data by postal codes in Canada to Lesley Richardson at IARC
- 9) Finalize medical radiation data for Ottawa with Monika Moissonnier at IARC
- 10) Review characteristics of mobile phone networks used in Canada with Elisabeth Cardis (November 2006)
- 11) Preparation of Retrospective validation study paper with IARC collaborators
- 12) Preparation of INTERPHONE main results paper in collaboration with IARC
- 13) Presentation on cell phones and health risk by Dr. Michael Tyshenko at the 20/20 radiation conference in Ottawa in November 2006.
- 14) Correspondence with Dr. Emilie Van DeVenter (WHO –EMF project) regarding wireless devices and health
- 15) Dr. Daniel Krewski was working at IARC in March, April and September 2006 as visiting scientist working with the Radiation Group and Dr. Elisabeth Cardis for the INTERPHONE Study.

16) Publication:

i) Vrijheid, M., Deltour, I., Krewski, D., Sanchez, M., & Cardis, E. (2006). The effects of recall and non-response bias in epidemiologic studies of the potential cancer risk of mobile phones. *Journal of Exposure Science and Environmental Epidemiology*. 1-14.

17) M.G. Tyshenko. (2006) Invited speaker. Health Risk Management in Radio communications: Risk Assessment, Cellular Telephone Use and Cancer Risk. Industry Canada and the Radio Advisory Board of Canada-Spectrum 20/20 2006 Conference Marriott Hotel. Ottawa, Ontario. November 30.

1.2 Recommendations, where applicable, for further implementation of the activity

1) Finalize Retrospective Validation Study paper in collaboration with Dr. Martine Vrijheid and Dr. Elisabeth Cardis (IARC).

2) Finalize analysis of base-station study data for Rogers Wireless' GSM network.

3) Start Canadian analysis for all 3 centres in Canada on cell phone use and tumours.

4) Preparation of the Canadian paper for INTERPHONE.

5) Further discussion of main results of INTERPHONE paper with IARC and Dr. Daniel Krewski.

6) Collaborate with IARC on papers to be published using Canadian data (Retrospective Validation Study, Base-station study, SMP study).

7) Send IARC the data and results of analyses for the base-station study in Canada.

2. Collaboration between the centre and WHO/PAHO:

1) Contacts between (IARC) Dr. Elisabeth Cardis and Dr. Isabelle Deltour with Dr. Daniel Krewski and Daniel Bedard regarding INTERPHONE study.

2) Contacts between Monika Moissonnier (IARC) and Daniel Bedard for Canadian study final database of interviews and medical radiation.

3) Ongoing discussions between IARC and Dr. Daniel Krewski regarding main results INTERPHONE paper on brain tumors and mobile phones case-control study.

4) Published paper in collaboration with IARC: Vrijheid M, Deltour E, Krewski D, Sanchez M, and Cardis E. The effects of recall errors and of selection bias in epidemiologic studies of mobile phone use and cancer risk. 2006. *J Expo Sci Environ Epidemiol*. 1-14.

5) Contribute to the preparation of the methodology paper of the INTERPHONE study with IARC collaborators Dr. Elisabeth Cardis, Dr. Isabelle Deltour and Lesley Richardson.

6) Dr. Daniel Krewski was a visiting scientist with the radiation group (Dr. Elisabeth Cardis) at IARC from July 2005-July 2006 and he worked at IARC in March, April and September 2006.

7) Contribute to the preparation of the INTERPHONE main results paper with IARC collaborators (Dr. Elisabeth Cardis and Dr. Isabelle Deltour).

8) Preparation of paper on output power from mobile phones with IARC (Dr. Elisabeth Cardis and Dr. Martine Vrijheid and Daniel Bedard and Dr. Daniel Krewski).

9) Discussion with Dr. Emilie Van DeVenter of WHO-EMF project on EMF.

B. Royal Society of Canada Report on Health Risks of Radiofrequency Fields

Principal Investigator(s): Daniel Krewski, Craig Byus, Barry W. Glickman, W. Gregory Lotz, Rosemonde Mandeville, Mary McBride, Frank S. Prato, and Donald F. Weaver

Funding: Health Canada

Description of Project: The Royal Society of Canada is the senior national body of distinguished Canadian scientists and scholars with a primary objective to promote research in the natural and social sciences as well as the humanities. One of the Royal Society's roles is to provide independent expert advice on significant issues of concern to Canadians. The Royal Society fulfills this role by convening Expert Panels to prepare independent authoritative reports according to well-established process developed by the Royal Society. Dr. Krewski was selected by the Royal Society to chair the Expert Panel on the Potential Health Risks of Radiofrequency Fields from Wireless Telecommunication Devices in 1998. Funding for this Expert Panel was provided by Health Canada, who requested a review of the scientific

literature on the potential health risks of radiofrequency fields and an assessment of the implications of this review for Safety Code 6, which provides guidelines on safe levels of exposure to radiofrequency fields in Canada. The Expert Panel's report was published by the Royal Society of Canada in 1999, and subsequently appeared in a special issue of the peer reviewed *J Toxicol Environ Health* (Vol B4, 2001, pp. 1-143). Members of the Expert Panel have continued to work together following the completion of their original report, and have prepared biannual updates to the original report. The first update, covering the period 1999-2001 has been published in the *J Toxicol Environ Health* (Vol B4, 2001, pp. 145-159).

1.1 Work performed in relation to terms of reference:

1) Publication:

- i) Krewski, D., Byus, C., Glickman, B.W., Habash, R.W.Y., Habbick, B., Lotz, W.G., Mandeville, R., McBride, M., Prato, F.S., Salem, T., Stuchley, M., & Weaver, D.F. (2006). Recent advances in radio-frequency fields and health: 2001-2003. *Journal of Toxicology and Environmental Health*. Vol. 4-4.

1.2 Recommendations, where applicable, for further implementation of the activity:

- 1) Development of a manuscript which specifically reviews the epidemiological studies which examine the associations between cell phone use and cancer.

2. Collaboration between the centre and WHO/PAHO:

- 1) Dr. Michael Repacholi, WHO, Coordinator, Radiation and Environmental Health, meeting January 20-21, 2005 in Geneva with Dr. Daniel Krewski and ongoing discussions of radiofrequency fields.
- 2) Dr. Elisabeth Cardis, IARC, will be asked to participate in the development of a review on cell phone use and cancer risks.

C. Electromagnetic Fields (EMF) and Health

Principal Investigator(s): Daniel Krewski, Riadh Habash, Lynn Brodsky, William Leiss, Michael Repacholi

Funding: CWTA, CIHR \$850,000

Description of Project: The McLaughlin Centre, led by Daniel Krewski, participated in the WHO-sponsored development of a report on risk assessment, risk perception, and risk communication issues pertaining to the health effects of electromagnetic fields, based on the international reviews in Vienna in 1997 and Ottawa in 1998.

1.1 Work performed in relation to terms of reference:

1) Preparation of four manuscripts:

- i) Habash RWY, Krewski D, Bansal R, and Alhafid HT. Thermal Therapy-Part I: An Introduction to the Topic for New Comers, *Crit Rev Biomed Eng* (to appear in 2006).
- ii) Habash RWY, Krewski D, Bansal R, and Alhafid HT. Thermal Therapy-Part II: Hyperthermia Techniques, *Crit Rev Biomed Eng* (to appear in 2006).
- iii) Habash RWY, Krewski D, Bansal R, and Alhafid HT. Thermal Therapy-Part III: Ablation Techniques, *Crit Rev Biomed Eng* (to appear in 2006).
- iv) Habash RWY, Krewski D, Bansal R, and Alhafid HT. Thermal Therapy-Part IV: Electromagnetic and Thermal Dosimetry, *Crit Rev Biomed Eng* (to appear in 2006).

- 2) Development of a grant to study the association between brain cancer and occupational chemicals and EMF in the INTERPHONE study.

- 3) Manuscript submitted: Johns K, Birkett N, Krewski D, Johnson KC, Villeneuve PJ, Agnew DA, Canadian Cancer Registries Epidemiology Research Group. 2005. Occupational exposure to power frequency magnetic fields and non-Hodgkin's lymphoma: case-control results from the Canadian National Enhanced Cancer Surveillance System, 1994-97. *Scand J Health Environ Work*, submitted.

1.2 Recommendations for further implementation of the activity:

- 1) Submit grant to NIH in 2006 to study the association between brain cancer and occupational chemicals and EMF in the INTERPHONE study. [as above]
- 2) Prepare and submit a paper on the association between EMF and Non-Hodgkin's Lymphoma.

2. Collaboration between the centre and WHO:

- 1) Collaboration with IARC to develop a grant to study the association between brain cancer and occupational chemicals and EMF in the INTERPHONE study.
- 2) Dr. Michael Repacholi, WHO, Coordinator, Radiation and Environmental Health, ongoing discussions about electromagnetic fields and health.

D. Residential Radon and Risk of Lung Cancer- A Global Study

Principal Investigator(s): Daniel Krewski, Kevin Brand, Jan Zielinski

Funding: MRC (CIHR), \$81,000; 1999-2001

Description of Project: The World Health Organization has been concerned with air pollution and, in particular, its dangers to human health for over 30 years. In addition to being present at high concentrations in many types of underground mines, radon is found in homes and is also present outdoors. Extensive measurements of indoor radon concentrations in homes show that although concentrations vary widely, radon is universally present raising concerns that radon in homes increases lung-cancer risk for the general population, especially those who spend a majority of their time indoors at home. For the purpose of developing public policy to manage the risk associated with indoor radon, there is a need to characterize the possible risks across the range of exposures received by the population. The report "Biological Effects of Ionizing Radiation (BEIR) VI Report: "The Health Effects of Exposure to Indoor Radon" confirms that radon is the second leading cause of lung cancer in the U.S. and that it is a serious public health problem. The study fully supports EPA estimates that radon causes about 15,000 lung cancer deaths per year, however, the report acknowledges that there are gaps in our scientific knowledge about the effects at low levels of radon exposure. Daniel Krewski contributed to the combined analysis of North American radon case-control studies and was an integral member of the team investigating radon and lung cancer risk in both the US and Canada. This project began in 1995 and is ongoing. Currently, European nations are undertaking their own radon and lung cancer studies to assess the risk of residential radon in their communities. The McLaughlin Centre, led by Daniel Krewski, will participate in the global pooling of the North American data and European data for a global assessment of the risks of residential radon exposure in the development of lung cancer.

1.1 Work performed in relation to terms of reference:

1) Publication:

- i) Zielinski, J.M., Carr, Z., Krewski, D., & Repacholi, M. (2006). World Health Organization's residential radon project. *Journal of Toxicology and Environmental Health*, 69, 759-769.
 - ii) Tracy, B., Krewski, D., Chen, J., Zielinski, J.M., Brand, K.P., & Meyerhof, D. (2006). Assessment and management of residential radon health risks: A report from the Health Canada radon workshop. *Journal of Toxicology and Environmental Health*, 69, 735-758.
 - iii) Field, R.W., Krewski, D., Lubin, J.H., Zielinski, J.M., Alavanja, M., Catalan, V.S., Letourneau, E.G., Lynch, C.F., Lyon, J.L., Sandler, D.P., Schoenberg, J.B., Steck, D.J., Stolwijk, J.A., Weinberg, C., & Wilcox, H.B. (2006). An overview of the North American residential radon and lung cancer case-control studies. *Journal of Toxicology and Environmental Health*, 69, 599-631.
- 2) Dr. Daniel Krewski serves as co-chair of the risk assessment and global burden of disease committees of the WHO Radon Project 2005-2008.
 - 3) Dr. Daniel Krewski represented North America in the EU global pooling of residential case-control studies.

1.2 Recommendations, where applicable, for further implementation of the activity:

1) Adapt WHO Global Burden of Disease methodology to develop risk estimates specific to Canada.

2. Collaboration between the centre and WHO/PAHO:

1) Dr. Daniel Krewski served as co-chair of the risk assessment and global burden of disease committees of the WHO Radon Project 2005-2008.

3. Collaboration with other WHO collaborating centres:

1) Dr. Daniel Krewski attended meeting in Geneva (January 17-18, 2005) to present the results of the North American pooling of residential radon and lung cancer case-control studies. Discussions were held regarding the Global Pooling of Residential Radon data with Göran Pershagen, Professor, WHO Collaborating Centre for Environmental Health Effects/Institute of Environmental Medicine, Karolinska Institute and Chair World Pooling Group for Residential Radon Exposure and Lung Cancer.

E. International Collaborative Study of Cancer Risk among Radiation Workers in the Nuclear Industry

Principal Investigator(s): Daniel Krewski, William Sont, Jan Zielinski, JP Ashmore, H Jiang, PR Band

Funding: CIHR, \$240,000

Description of Project: The International Collaborative Study of Cancer Risk among Radiation Workers in the Nuclear Industry is a retrospective cohort study of over 600 000 nuclear industry workers in seventeen countries initiated in 1990. The objective of the study is to obtain direct estimates of the effect of low-dose protracted exposure to ionizing radiation in order to assess the adequacy of radiation protection standards for environmental and occupational exposures. The specific purpose of the study is to obtain data for comparison with the risk estimates derived from studies of persons having received high dose/high dose-rate exposures. This will provide a direct test of the adequacy of the extrapolation models used currently for radiation risk assessment and for the setting of radiation protection standards, and may assist in the construction of improved risk assessment models. A subcohort nuclear industry workers from the National Dose Registry has been analyzed for mortality as Canada's contribution to the IARC study. Using the National Dose Registry of Canada, scientists at the McLaughlin Centre, WS Sont, JM Zielinski, JP Ashmore, H Jiang, PR Band and D Krewski, are examining cancer incidence and occupational radiation exposure. The National Dose Registry of Canada data enables McLaughlin scientists to obtain direct estimates of the effect of low-dose protracted exposure to ionizing radiation in Canadian Nuclear Workers.

1.1 Work performed in relation to terms of reference:

- 1) Submission of manuscript using NDR (Canada) to examine radiation exposure in medical workers.
- 2) Dr. Daniel Krewski chaired the IARC working group 2005-2006 on "Estimates of the cancer burden in Europe from radioactive fallout from the Chernobyl accident" Lyon, France, September 21-22, 2005.
- 3) Publication:
 - i) National Research Council. Health Risks from Exposure to Ionizing Radiation. BEIR VII-Phase 2. 1-710. 2006. Washington, D.C., National Academy Press. (D Krewski member of BEIR VII-Phase 2).
 - ii) Cardis, E., Krewski, D., Boniol, M., Drozdovitch, V., Darby, S.C., Gilbert, E.S., Akiba, S., Benichou, J., Ferlay, J., Gandini, S., Hill, C., Howe, G., Kesminiene, A., Moser, M., Sanchez, M., Storm, H., Voisin, L., & Boyle, P. (2006). Estimates of the cancer burden in Europe from radioactive fallout from the Chernobyl accident. *International Journal of Cancer*, 119, 1224-1235.
 - iii) Hazelton, W.D., Zielinski, J.M., Ashmore, J.P., Krewski, D., & Moolgavkar, S.H. (2006). Analysis of male lung cancer incidence attributable to low dose, low LET gamma and tritium exposures in the Canadian National Dose Registry cohort. *Journal of Toxicology and Environmental Health*; A69: 1013-1038.

1.2 Recommendations, if applicable, for further implementation of the activity:

1) Publication of manuscript using NDR (Canada) to examine radiation exposure in medical workers.

2. Collaboration between the centre and WHO/PAHO:

1) Dr. Pat Ashmore contributed data and expert analysis to IARC International Nuclear Worker Study lead by Dr. Elisabeth Cardis.

2) Collaboration with Dr. Cardis (IARC) on publication ii (see above)

III. Chemical Risk Assessments

A. Environmental Chemicals and Human Health Risks

Principal Investigator(s): Karen Phillips, Daniel Krewski, Tye Arbuckle

Funding: McLaughlin Centre for Population Health

Description of Project: Endocrine chemicals and human health risks.

Environmental chemicals contribute to the global burden disease largely by mechanisms of toxicity or carcinogenesis. A third mechanism, ‘endocrine disruption’ has also been proposed and has gained acceptance by the world community. In 2002 the WHO published its State of the Science treatise on the issue of endocrine disrupters. So called endocrine toxicants, which include pesticides, pharmaceuticals and industrial chemicals, are ubiquitous environmental compounds characterized by their ability to mimic or antagonize endogenous hormones. Endocrine toxicants have the potential to disrupt hormone-dependent processes in both wildlife and humans producing infertility (impaired spermatogenesis, endometriosis), abnormal prenatal and childhood development (spontaneous abortion, male reproductive tract abnormalities, precocious puberty) and reproductive cancers (prostate, breast, ovarian, endometrial and testicular). Although the current state of the science recognizes a range of pathologies due to endocrine toxicant exposure in wildlife; comprehensive and reproducible studies are needed to establish risk to human health. The McLaughlin Centre has assumed a leadership role regarding risks posed to human health following exposure to environmental chemicals and maintains a large program of research evaluating all three mechanism- toxicity, carcinogenesis and endocrine disruption.

1.1 Work performed in relation to terms of reference:

1) Dr. Daniel Krewski is the Chair, U.S. National Academy of Sciences Committee on Toxicity Testing and Risk Assessment of Environmental Agents (2004-).

2) Dr. Daniel Krewski is a Member of the IARC Advisory Group to Recommend Updates to the Preamble to the IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, International Agency for Research on Cancer

3) Preparation of Journal of Toxicology and Environmental Health (JTEH): Special Issue on Endocrine Toxicants. Guest Editors: James Gomes, Karen Phillips, Warren Foster, Daniel Krewski. Guest editors assumed responsibility for paper selection, peer review process and liaison with JTEH editor Dr. Sam Kacew.

4) Preparation of several manuscripts on human health risks associated with endocrine disrupter exposure for publication as a special issue Journal of Toxicology and Environmental Health

i) Manuscript under review: Towards less confusing terminology in endocrine disrupter research- WG Foster and J Agzarian. JTEH; Special Issue on Endocrine Toxicants.

ii) Manuscript under review: Environmental contaminants and human infertility: Hypothesis or cause for concern? WG Foster, M Neal, EV YoungLai, MS Han, MM Dominguez; JTEH; Special Issue on Endocrine Toxicants.

iii) Manuscript under review: Endocrine toxicants including TCDD and dioxin-like chemicals and endometriosis: Is there a link? - WG Foster; JTEH; Special Issue on Endocrine Toxicants.

iv) Manuscript submitted for publication: Human exposure to endocrine disrupters and semen quality- KP Phillips*, N. Tanphaichitr; JTEH; Special Issue on Endocrine Toxicants.

- v) Manuscript submitted: The influence of the environment and other exogenous agents on spontaneous abortion risk- M Weselak, T Arbuckle, MC Walker, D Krewski; JTEH; Special Issue on Endocrine Toxicants.
 - vi) Manuscript under review: Role of hormonal and other factors in human prostate cancer- DT Wigle*, MC Turner, J Gomes, ME Parent; JTEH; Special Issue on Endocrine Toxicants.
 - vii) Manuscript submitted: Overview: Testicular cancer and hormonally active agents- M Garner, MC Turner, P Ghadirian, D Krewski, M Wade; JTEH; Special Issue on Endocrine Toxicants.
 - viii) Manuscript submitted: Review of the etiology of breast cancer with special attention to organochlorines as potential endocrine disruptors- F Salehi, MC Turner, KP Phillips, DT Wigle, D Krewski, K Aronson; JTEH; Special Issue on Endocrine Toxicants.
 - ix) Manuscript submitted: Risk Factors for Ovarian Cancer: An overview with emphasis on hormonal factors- F Salehi, L Dunfield, KP Phillips, D Krewski, B Vanderhyden; JTEH; Special Issue on Endocrine Toxicants.
 - x) Manuscript under review: Risk communication of endocrine disrupting chemicals: The Internet as an emerging tool for improving knowledge translation and transfer -MG Tyshenko, KP Phillips, M Mehta, W Leiss and R Poirier; JTEH; Special Issue on Endocrine Toxicants.
 - xi) Manuscript under review: Risk assessment and risk management of endocrine disrupters- KP Phillips, W Foster, W Leiss, V Sahni, N Karyakina, M Turner, S Kacew, D Krewski; JTEH; Special Issue on Endocrine Toxicants.
- 5) Maintained EM-COM: internet-risk communication vehicle about endocrine disrupters and human health risk
- 6) Manuscript submitted for publication KP Phillips, W Leiss, W Foster, D Krewski. Knowledge transfer: Development of a web-based information resource for communication of potential health risks associated with exposure to endocrine disrupters. *Environmental Science and Technology*.
- 7) Publications:
- i) Chen, X.K., Yang, Q., Smith, G., Krewski, D., Walker, M., & Wen, S.W. (2006). Environmental lead level and pregnancy-induced hypertension. *Environmental Research*, 100, 424-430.
 - ii) Salehi, F., Normandin, L., Krewski, D., Kennedy, G., Philippe, S., & Zayed, J. (2006) Neuropathology, tremor, and electromyogram in rats exposed to manganese phosphate/sulfate mixture. *Journal of Applied Toxicology*, 26, 419-426.
 - iii) Weselak, M., Arbuckle, T.E., Wigle, D.T., Krewski, D. In utero pesticide exposure and childhood morbidity. Submitted and Accepted. *Environmental Research*
- 8) Development of special issue on children's environmental health to be published in *Journal of Toxicology and Environmental Health*
- i) Tyshenko, M.G., Benidickson, J., Turner, M.C., Craig, L., Armstrong, V., Harrison, J., Krewski, D. Health policy approaches to children's environmental health
 - ii) Wigle, D.T., Arbuckle, T.E., Walker, M., Wade, M.G., Liu, S., Krewski, D. Environmental Hazards: Evidence for Effects on Child Health.
 - iii) Wigle, D.T., Krewski, D. Special Issue: Children's Health and the Environment: Review of Certain Chemicals and Canadian Governmental Policies.

1.2 Recommendations, where applicable, for further implementation of the activity:

- 1) Contribute to the planning for IARC Monograph #100.
- 2) Examine the potential human health risks from chromium and cobalt exposure due to metal on metal hip implants
- 3) Examine the association between occupational chemical exposures and lung cancer risk; MSc thesis: Occupational Risk Factors for Lung Cancer: A Population-Based Case-Control Study In British Columbia; Nagarajkumar Yenugadhati
- 4) Preparation of manuscripts: on occupations and lung cancer: A population based case-control study in British Columbia Yenugadhati N, McArthur A, Band PR, Birkett NJ, Fang R, Momoli F, Krewski D.

- 5) Complete Special Issue on Endocrine Toxicants
- 6) Complete Special Issue on Children's Environmental Health

2. Collaboration between the centre and WHO/PAHO:

- 1) Dr. Daniel Krewski chaired IARC monograph meeting on polycyclic aromatic hydrocarbons and the working group on cancer burden in Europe from the radioactive fallout from Chernobyl.
- 2) Dr. Daniel Krewski participated in a scientific working group to prepare IARC monograph on avoidable causes of cancer, in an IARC scientific meeting to update the preamble on carcinogenic risks to humans, and was part of advisory groups to develop priorities for future IARC monographs on carcinogenic risks to humans and to recommend and review updates to the Preamble to the IARC Monographs on the Evaluation of Carcinogenic Risks to Humans.
- 3) Dr. Daniel Krewski was a visiting scientist at IARC from 2005-2006.

B. Biomonitoring

Principal Investigator(s): Daniel Krewski, Daniel Bedard

Funding: McLaughlin Centre for Population Health

Description of Project: Recent advances in analytical chemistry allow us to better detect both natural and synthetic substances in human tissues through an advanced technology called biomonitoring. This promising public health tool can help us better understand human exposure to a wide range of substances. Biomonitoring is defined as one method for assessing human exposure to chemicals by measuring the chemicals or their metabolites in human tissues or specimens, such as blood or urine (CDC 2005). Biomonitoring has identified and confirmed human exposure to environmental substances, such as the presence of lead in children's blood and can be applied in various ways, including evaluation of the presence of chemicals in body tissues, and to track spatial variation and temporal trends in chemical exposure. In particular, biomonitoring may also be helpful in identifying at-risk populations.

1.1 Work performed in relation to terms of reference:

- 1) Understanding Human Biomonitoring: October 5, 2006 Ottawa, Ontario. On October 5th, 2006, the McLaughlin Centre for Population Health Risk Assessment hosted a one-day roundtable workshop entitled, 'Understanding Human Biomonitoring'. Seventy-two people attended including representatives from academic institutions, government agencies, industry and the NGO community. The purpose of the workshop was to increase the understanding of human biomonitoring and the importance of robust study designs, scientifically sound interpretations of results and effective communication of new results.
- 2) Completion of workshop report: Workshop Proceedings on Understanding Human Biomonitoring, McLaughlin Centre for Population Health Risk Assessment (http://www.mclaughlincentre.ca/events/bio_monitoring/BiomonitoringWorkshop_Summary_Final_UofO_Oct2006.pdf)
- 3) Supervision of Morgan MacNeill (MSc thesis- Epidemiology, University of Ottawa) Identifying the characteristics of individuals with high body burdens of endocrine disrupting chemicals: An analysis of the national health and nutrition examination survey (NHANES) 1999-2002.

1.2 Recommendations, where applicable, for further implementation of the activity:

- 1) factor analysis of NHANES data set by Morgan MacNeill

IV. Risk Perception

A. Public perception and acceptable levels of health risk among Canadians

Principal Investigator(s): Louise Lemyre, Daniel Krewski, Louise Bouchard, Kevin Brand, Christine Dallaire, William Leiss, Pierre Mercier

Funding: Health-Canada

Description of Project: Social, psychological and political factors have considerable influence on the impact of risk judgments. Determination of those psychosocial parameters which most strongly affect risk perception and acceptable may be extrapolated to various societies and cultures throughout the world. For global organizations, the use of psychosocial parameters to model risk perception and acceptability will enhance the ability to implement risk management strategies through changes in public policy. This research program will elucidate the factors shaping public perceptions of risk and risk acceptability. Specifically, a psychosocial model for understanding the factors influencing attitudes and opinions about risk will be developed. Established guidelines of risk acceptability will be reviewed in detail, and psychosocial values underlying acceptability of risk examined. Common-sense benchmark risk scales to assist in understanding and communicating scientific information on health risks, particularly small risks difficult to identify and comprehend, will be developed. Public and expert perceptions of risks to health will be evaluated through representative national surveys. A predictive model of risk perception and risk acceptability will also be developed. The use of the research results in informing national policies for health risk management will be explored. Our objectives are: (I) to document the conceptualization of risk and of risk acceptability from both the public and regulatory perspectives; (II) to describe profiles of risk perception and risk acceptability according to types of risk (known, voluntary, involuntary, theoretical), expert status (toxicologist, physician, public), and sociodemographics (gender, age, ethnolinguistic identity, and region); to track the evolution of such profiles over the last decade; to elucidate the role of risk characteristics (e.g., familiarity, controllability, severity) with respect to perception and acceptability; and (III) to model the role of risk perception and acceptability in decisions about risks, such as judgments and evaluations of risk that have implications for risk management and policy-making.

1.1 Work performed in relation to the terms of reference:

1) Analysis of survey results from National Survey of risk perception conducted in Canada in 2004.

2) Publications:

- i) Krewski, D., Lemyre, L., Turner, M.C., Lee, J.E.C., Dallaire, C., Bouchard, L., Brand, K.P., & Mercier, P. (2006). Public perception of population health risks in Canada: Health Hazards and sources of information. *Human and Ecological Risk Assessment*, 12: 626-644
- ii) Lemyre, L., Lee, J.E.C., Mercier, P., Bouchard, L., & Krewski, D. (2006). The structure of Canadians' health risk perceptions: environmental, therapeutic, and social health risks. *Health, Risk, and Society*, 8, 185-195.

2) Preparation and Submission of manuscripts:

- i) Krewski D, Lemyre L, Turner MC, Lee JEC, Dallaire C, Bouchard L, Brand K, Mercier P. 2005. Public Perception of Population Health Risks in Canada: Risk Perception Beliefs. *Health, Risk & Society*, submitted.
- ii) Krewski D, Lemyre L, Turner MC, Lee JEC, Dallaire C, Bouchard L, Brand K, Mercier P. 2005. Public Perception of Population Health Risks in Canada: Health Hazards and Health Outcomes. *International Journal of Risk Assessment and Management*, submitted.
- iii) Lee, J.E.C., Lemyre, L., Legault, L., Turner, M.C., Krewski, D. Factor analytic investigation of population health risk perceptions among Canadians: towards a new approach. *Journal of Global Environmental Issues*. submitted
- iv) Lee JEC, Lemyre L, Turner MC, Orpana HM, Krewski D. 2007. Health Risk Perceptions as Mediators of Socioeconomic Differentials in Health Behaviour. *Journal of Health Psychology*, preparation

1.2 Recommendations, where applicable, for further implementation of the activity:

Completion of manuscripts, publications as per 2.

2. Collaboration between the centre and WHO/PAHO:

- 1) Collaboration with Dr. Emilie Van Deventere and Dr. Michael Repacholi, WHO, on the role of risk perception in the WHO precautionary framework.
- 2) Electronic collaboration with Dr. Lars Weiseath (Oslo), WHO, on mental health and disasters.
- 3) Research meeting and collaboration with Dr. Beverly Rapheal (Australia), WHO, on mental health and disasters.
- 4) Electronic collaboration with Dr. Simon Wesseley (UK), WHO, on mental health and disasters.
- 5) Facilitation meeting with Dr. Natacha Joubert (Ottawa) on population mental health at WHO.

B. Psychosocial and bioenvironmental risk assessment and management tools to enhance response to CBRN attacks and threats in Canada

Principal Investigator(s): Louise Lemyre, Daniel Krewski, Wayne Corneil, M. Brodhead, John Shortreed, E. Weckman, Sam Kacew, D. Lean, E. Todd, Robert Clarke

Funding: CBRN Research and Technology Initiative (CRTI)

Description of Project: Following the recent spate of terrorist activities, both in the US and abroad, countries are forced to develop both short and long-term response strategies in the event of a bioterrorist attack or threat. These response strategies must also include early detection and prevention. Behavioural and psychological impacts of bioterrorism associated with the risk of massive outbreaks of human illnesses and death may well be the most widespread, long-lasting and costly consequence. Infrastructures required to address CBRN threats or attacks include federal and local governments, police, fire and other emergency services, hospitals and specialized laboratories. We have developed a proposal to develop strategies to deal with psychosocial impacts following CBRN threats and attacks. This proposal seeks to understand and mitigate the psychosocial impacts arising from social disruption, stress, panic, acute individual trauma, and anticipated behavioural changes. A transdisciplinary team of psychologists, scientists and risk analysts are well positioned to address these issues. The proposed program aims to develop an integrated psychosocial and bioenvironmental risk management framework for biological agents and practical field based training tools to enhance the capability of first responders to mitigate the human health and psychosocial impacts of bioterrorist threats and attacks. The *Psychosocial Risk Assessment and Management Module* includes surveys, field work and natural laboratory experiments to assess CBRN risk perceptions among Canadians.

1.1 Work performed in relation to the terms of reference:

- 1) Analysis of data collected as part of the National Survey of CBRN risk perception conducted in 2004.
- 2) Publications:
 - i) Lemyre, L., Turner, M.C., Lee, J.E.C., & Krewski, D. (2006). Public perception of terrorism threats and related information sources in Canada: Implications for the management of terrorism risks. *Journal of Risk Research*, 9, 755-774.
 - ii) Lemyre L, Turner MC, Lee JEC, Krewski D. 2005. Differential Perception of Chemical, Biological, Radiological and Nuclear Terrorism in Canada. *International Journal of Risk Assessment and Management*, submitted.
 - iii) Lemyre L, Lee JEC, Turner MC, Krewski D. Terrorism preparedness in Canada: A public survey on perceived institutional and personal response to terrorism. *International Journal of Emergency Management*, 4:296-315. (accepted)
- 3) Research meeting in Sevilla and work on threat assessment as part of international collaboration (2004-2007) with European Union Coordination Action Project "Assessment of the vulnerabilities of modern societies to terrorism acts employing radiological, biological, or chemical agents with the view to assist in developing preventive and suppressive crisis management strategies (ASSRBCVUL)".

1.2 Recommendations, where applicable, for further implementation of the activity:

- 1) completion of manuscripts
- 2) submission of grant for additional funding

2. Collaboration between the centre and WHO/PAHO:

- 1) Electronic collaboration with Dr. Lars Weiseath (Oslo) WHO on mental health and disasters.
- 2) Research meeting and collaboration with Dr. Beverly Raphael (Australia) WHO on mental health and disasters.
- 3) Electronic collaboration with Dr. Simon Wessely (UK) WHO on mental health and disasters.
- 4) Facilitation meeting with Dr. Natacha Joubert (Ottawa) on population mental health at WHO.

B. Perception of bioterrorist/pandemic influenza risk by Canadian nurses

Principal Investigator(s): Carol Amaratunga, Karen Phillips, Louise Lemyre, Daniel Krewski, Wayne Corneil, Tracey O'Sullivan, Eileen O'Connor

Funding: CRTI: Government of Canada: CBRN Research Technology Initiative

Description of Project: Caring about healthcare workers as first responders: Enhancing capacity for gender-based support mechanisms in emergency preparedness planning. Following the events of 9-11, Canada invested in the development of research to provide capacity and necessary infrastructure in response to terrorism. This project uses Canada's experience with SARS as a model for a bioterrorist attack (infectious respiratory agent) to ascertain our hospital's readiness, plans and preparedness emphasizing mechanisms in place to support health care workers. The CRTI project plans a multipronged approach including assessment of pandemic and emergency plans at multiple jurisdictions, focus groups with Canadian nurses (Ottawa (2), Toronto, Halifax and Vancouver; n=100), a risk perception survey of emergency room and ICU nurses across Canada (n=1543), development of a sex and gender based analysis (SGBA)- risk framework and a policy forum.

1.1 Work performed in relation to terms of reference:

1) Publications:

- i) CA Amaratunga, D Dow, TL O'Sullivan, L McCrann, J Hardt; T Prentice, W Corneil; KP Phillips, L Lemyre, E O'Connor, D Krewski, H Smith Fowler. 2006. *Gap Analysis of Support Mechanisms of Selected Ontario Hospital Emergency Plans*. Report submitted to the CRTI Secretariat, Project 03-0009RD, Government of Canada.
- ii) CA Amaratunga, TL O'Sullivan, D Dow, W Corneil; KP Phillips, L Lemyre, E O'Connor, D Krewski, L McCrann, H Smith Fowler. 2006. *Caring About Health Care Workers as First Responders: Enhancing Capacity for Gender-based Support Mechanisms in Emergency Preparedness Planning: Survey Report Preliminary Descriptive Data*, Report submitted to the CRTI Secretariat, Project 03-0009RD, Government of Canada.
- iii) CA Amaratunga, TL O'Sullivan, W Corneil, J Hardt, D Gibson, L McCrann, H Smith Fowler, KP Phillips, L Lemyre, E O'Connor, D Krewski. 2006. *Health Care Workers Reflect on Their Roles in Infectious Disease Outbreaks*. CBRN Research and Technology Initiative (CRTI), Government of Canada.

2) Conference presentations:

- i) Amaratunga, CA., O'Sullivan, TL & the Institute of Population Health CRTI Investigative Team. 2006. *Health care professionals as first responders: Preliminary findings for preparedness planning, health, and well being during disasters*. Poster published in: Proceedings for the 16th World Conference on Disaster Management, June 18-21, 2006, Toronto, ON.
- ii) Amaratunga, CA & the Institute of Population Health CRTI Investigative Team. *Caring about health care workers as first responders: enhancing capacity for gender-based support mechanisms in emergency preparedness planning*. Proceedings for the 2006 CRTI Summer Symposium June 13-15, 2006, Gatineau Quebec.

iii) Amaratunga CA, O'Sullivan **TL**, Dow **D**, Phillips **KP**, Corneil W, Lemyre L, O'Connor E, Krewski D. 2006. *Ecological Analysis of Nurses Support Needs in Large-Scale Outbreaks. Towards a New Public Health: An Ecological View*. Public Health Association of British Columbia. November 27-29, 2006, Vancouver, British Columbia.

iv) KP Phillips, T O'Sullivan, C Amaratunga. 2006. *Reproductive Risks Associated with Severe Acute Respiratory Infections: Implications for Pandemic Influenza Planning*. Canadian Fertility and Andrology Society Meeting Program. TP22; p69

1.2 Recommendations, where applicable, for further implementation of the activity:

- 1) development of manuscripts on gaps in emergency planning, survey results, focus group results
- 2) preparation for policy forum Winter 2007

V. Building Research Capacity and Training

A. Injury Surveillance

Worldwide, it is estimated that injuries accounted for five million deaths and 12% of the burden of disease in the year 2000, and is expected to rise. Road traffic injuries, self-inflicted injuries, interpersonal violence, and drowning were among the leading causes of death and disability. Injuries have been seen to disproportionately affect people living in low and middle income countries including the Caribbean. Currently, however, insufficient is known about the epidemiology of injuries in these areas for the purpose of assessing needs, developing policy and evaluating interventions. An injury surveillance system was established in Trinidad and Tobago in 2002 by CAREC and the SWRHA through support from IDRC at the San Fernando General Hospital. Currently the resources are not available for the timely analysis and dissemination of the information gathered by the surveillance system. By partnering with the SWRHA and CAREC, the McLaughlin Center will assist in developing capacity and serve as the analytical support to describe the epidemiology of these injuries in order to provide policy makers with important priorities for injury prevention. The injury surveillance system will provide a model that can be used in other areas of Trinidad and Tobago and the broader Caribbean region.

1.1 Work performed in relation to the terms of reference:

- 1) Established an injury surveillance steering committee, formed of members from Canada, PAHO, and the Caribbean to develop a strategic initiative to extend injury surveillance in the Caribbean
- 1) Developed a funding proposal "Caribbean – Canadian Partnership, Injury Surveillance in Trinidad" submitted to the Pan American Health Organization Technical Cooperation Among Countries August 2, 2006 in order to continue collaboration with CAREC and the SWRHA
- 2) Developed a funding proposal : "Caribbean – Canadian Partnership on Injury Surveillance in the Caribbean: Technical Cooperation Among Countries" submitted to the Canadian Institutes for Health Research September 2006 in order to initiate expansion of the injury surveillance system throughout Trinidad & Tobago and the broader Caribbean.
- 3) Developed a funding proposal "Injury Surveillance in Trinidad & Tobago: Applied Research to Support Injury Prevention Policy" submitted to the Global Health Research Initiative Teasdale-Corti Team Grants January 16, 2006 order to build on current partnerships to initiate the expansion of the injury surveillance system throughout Trinidad & Tobago and the broader Caribbean.
- 4) Two papers presented at the Caribbean Health Research Council (CHRC) 51st Annual Scientific Meeting April 27-29, 2006 in Frigate Bay, St. Kitts:
 - i) Ramroop S, Turner MC, Garner M, Bynoe R, Clarke R, Krewski D, Francis M. Injury surveillance in Trinidad: An accident and emergency based injury surveillance system at the San Fernando General Hospital. Poster presented (Turner, Bynoe) at the Caribbean Health Research Council 51st Annual Scientific Meeting, Frigate Bay, St. Kitts, April 27-29, 2006.
 - ii) Turner MC, Bynoe R, Garner M, Francis M, Clarke R, Krewski D, Ramroop S. The epidemiology of injuries in Trinidad: Results from an accident and emergency department injury

surveillance system at the San Fernando General Hospital. Oral presentation (Turner, Ramroop) at the Caribbean Health Research Council 51st Annual Scientific Meeting, Frigate Bay, St. Kitts, April 27-29, 2006.

5) The following manuscripts were submitted for publication in 2006:

i) Ramroop S, Turner MC, Bynoe R, Garner MJ, Clarke R, Krewski D, Francis M. 2006. Injury Surveillance in Trinidad: An Accident and Emergency Based Injury Surveillance System at the San Fernando General Hospital. *Journal of Emergency Medicine*, submitted

ii) Turner MC, Bynoe R, Garner MJ, Francis M, Clarke R, Krewski D, Ramroop S. 2006 The Epidemiology of Injuries in Trinidad: Results from an Accident and Emergency Department Injury Surveillance System at the San Fernando General Hospital, *Annals of Emergency Medicine*, submitted.

1.2 Recommendations, where applicable, for further implementation of the activity:

- 1) Develop funding proposal to continue collaboration with CAREC and the SWRHA.
- 2) Develop funding proposal to initiate expansion of the injury surveillance system throughout Trinidad & Tobago and the broader Caribbean.
- 3) continue to analyse data from injury surveillance database and prepare manuscripts
- 4) identify a graduate student to evaluate traffic injury epidemiology and health policy implications in Trinidad to work collaboratively with SWRHA, CAREC, and the McLaughlin Centre
- 5) Develop, in collaboration with Dr. Paul Moroz, an injury surveillance system in the Thimpu Valley, Bhutan

2. Collaboration between the centre and WHO/PAHO:

1) Injury surveillance steering committee formed of: Dr. Nigel Harris and Dr. Elizabeth Ward University of the West Indies, Jamaica; Dr. Beverly Barnett and Dr. Alberto Concha-Eastman, PAHO, Washington; Dr. Stephen Ramroop, SWRHA, Trinidad; Dr. Lilian Reneau-Vernon, PAHO, Trinidad/CAREC; Dr. Pascal Frison, PAHO/CPC; Dr. Daniel Krewski and Ms. Michelle Turner, University of Ottawa, Ms. Kate Dickson, Health Canada; Dr. Robert Clarke, Public Health Agency of Canada.

1) Funding proposals developed in collaboration with CAREC (Dr. James Hospedales, Ms. Marlene Francis, Dr. Lilian Reneau-Vernon) and PAHO (Dr. Beverly Barnett and Dr. Alberto Concha-Eastman)

2) Scientific papers prepared for presentation at the CHRC 51st Annual Scientific Meetings in collaboration with CAREC (Ms. Marlene Francis)

3) Scientific papers prepared for journal submission in collaboration with CAREC (Ms. Marlene Francis)

5) Ongoing discussions with CAREC personnel: Ms. Marlene Francis

On going discussion with PAHO, Washington personnel: Dr. Albert Concha-Eastman

6) Email correspondence with Dr. Margie Peden, WHO, and Dr. Chamaiparn Santikarn *Regional Adviser - Disability, Injury Prevention and Rehabilitation*, World Health Organization, South-East Asia Regional Office, New Delhi

B. Graduate Certificate Program in Population Health Risk Assessment and Management

Population health risk assessment is the comprehensive assessment of health risks in the general population based on environmental, genetic, economic, social and behavioural determinants of health. This leads to evidence-based population health risk policy analysis, and ultimately, cost effective population health risk management decisions. The Graduate Certificate in Population Health Risk Assessment and Management offered through the McLaughlin Centre is specially designed for those individuals employed and/or interested in population health analysis and risk assessment. The certificate aims to provide the professional skills and knowledge needed to pursue careers in both the public and the private sectors.

1.1 Work performed in relation to terms of reference:

- 1) The Graduate Certificate accepted a new cohort of students in 2006.
- 2) discussions regarding e-learning

1.2 Recommendations, where applicable, for further implementation of the activity:

- 1) Continue to successfully graduate students.
- 2) Continue to seek opportunities to give short courses and e-learning modules to relevant groups related to specific aspects of population health risk assessment and management.
- 3) Investigate the possibility of offering the Graduate Certificate via distance learning and make it an internationally accessible and recognized program.

2. Collaboration between the centre and WHO/PAHO:

- 1) Training session for Roanna Bynoe developed in collaboration with CAREC (Ms. Marlene Francis).

C. Short Course on Risk Management and Food Safety

The McLaughlin Centre plays a leadership role in providing training in population health risk assessment. Food safety has become an increasingly complex risk management issue with the emergence of prion diseases, e-coli contaminations and other events.

1.1 Work performed in relation to terms of reference:

The Centre organized a two-week course on Risk Management and Food Safety for Chinese government officials who visited the capital from Beijing and surrounding area (October 30th, 2006 to November 10th, 2006). The course was held on the main campus at the University of Ottawa and was sponsored by the Canadian International Development Agency (CIDA) Delegates received expert training from Canadian government representatives and University of Ottawa professors including the Centre's own Director, Dr. Daniel Krewski. Presentations covered diverse aspects of risk management with a particular emphasis on food safety. Along with in class lectures, participants were given the opportunity to visit key Canadian government departments such as the Public Health Agency of Canada and Agriculture and Agri-Food Canada along with other key organizations such as the Canadian Food Inspection Agency.

1.2 Recommendations, where applicable, for further implementation of the activity:

- 1) Expanding the course for a new cohort of a Chinese delegation of government officials in 2007.

VI. Risk Management

WHO Workshop on the Precautionary Framework for Developing Public Health Policy Options in Areas of Scientific Uncertainty

The lack of global scientific consensus on the long term health risks associated with electromagnetic radiation exposures from cellphones has resulted in inconsistent radiation exposure standards around the world. As a result, WHO initiated the development of the framework in parallel with their International EMF project to provide assistance to regulators in member states in formulating policies on the EMF issue and other emerging issues in which technological development has outpaced the scientific assessment of the risks. More than 120 scientists, academics, regulators, and representatives of industry and non-governmental organizations from 17 countries worldwide convened at the University of Ottawa on July 11-13, 2005 to participate in a *Workshop on Guiding Public Health Policy in Areas of Scientific Uncertainty*. The Workshop was spearheaded by the World Health Organization (WHO) and organized in collaboration with the McLaughlin Centre for Population Health Risk Assessment to seek stakeholder feedback on a draft WHO framework designed to assist member states in managing issues where scientific evidence of the risks is uncertain.

1.1 Work performed in relation to the terms of reference:

- 1) Workshop held in Ottawa from July 11-13, 2005 to discuss a WHO precautionary framework for developing public health policy options in areas of scientific uncertainty.
- 2) Dr. Daniel Krewski, Radon case study. Invited paper presented at the *World Health Organization Workshop on Guiding Public Health Policy in Areas of Scientific Uncertainty*, Ottawa, Ontario, July 12, 2005.
- 3) Dr. Daniel Krewski, Summary of strengths and weaknesses of the WHO Framework for Guiding Public Health Policy Decisions in Areas of Scientific Uncertainty. Invited paper presented at the *World Health Organization Workshop on Guiding Public Health Policy in Areas of Scientific Uncertainty*, University of Ottawa, Ottawa, Ontario, July 13, 2005.
- 4) Workshop report prepared and disseminated
- 5) Publications under development:
 - i) Krewski, D., Hogan, V., Birkwood, P., Turner, M.C., McDowell, I., Edwards, N., Losos, J. An integrated framework for risk management and population health. *Human and Ecological Risk Assessment*.
 - ii) Krewski, D., Shilnikova, N., Lewis, R., Farhat, N., Turner, M.C., Tyshenko, M.G. The application of precaution in science-based decision making about risk: A discussion paper for Health Canada.

1.2 Recommendations, where applicable, for further implementation of the activity:

- 1) preparations for second workshop in 2007
- 2) completion of manuscripts for publication

2. Collaboration between the centre and WHO/PAHO:

- 1) Discussions with Dr. Michael Repacholi, Coordinator, Radiation and Environmental Health, WHO and Emilie Van Deventere, WHO.

VII. Prion Diseases

PrioNet

In recent years, Canada along with many other countries has faced a growing number of crises related to the safety of agricultural products. These concerns have ranged from the use of antimicrobials and growth hormones in food-producing animals, to the use of genetic modification (transgenic animals, rBST, StarLink corn) and to concerns over the emergence of zoonotic diseases from animal populations (SARS, Avian Influenza, and BSE or mad cow disease). The costs to industry and consumers have been massive. A fundamental problem in attempts to address BSE as a health, economic and social risk issue to date has been the adoption of an incomplete approach to risk management. Following the BSE outbreak in England it was evident that the lack of inclusion of social impacts in the science advice to policy makers was an important flaw in the risk management system. This practice was repeated in Canada and other countries, as evidenced by risk assessments that primarily focused on the probabilistic risks of exposure and not on the consequences

1. Work performed

- 1) A proposal on Prion Diseases was funded by Network of Centres of Excellence. The new NCE is called PrioNet Canada. There are five research themes under PrioNet Canada, Prion Disease Risk Management being one of them. An integrated risk management framework to better address the risk issues imposed by prion disease is being developed at the McLaughlin Centre.
- 2) *Development of a conceptual Integrated Risk Management Framework (IRMF)*: IRMF is being developed taking into account issues like uncertainties related with BSE, public health, socio-economic outcomes, psychosocial impacts, stakeholder involvement in decision making, lessons from regional and national BSE risk management experiences and risk communication. These are the consequences that

may have been overlooked in the previous attempt to manage BSE as a risk issue leading to huge direct and indirect economic losses. The IRMF aims to provide a proactive approach for informed decision making for mitigating future impacts of prion diseases.

3) *Application of the Integrated Risk Management Framework*: Our risk management framework will be applied to the analysis of BSE risks in Canada, using the new information developed in this project. We will work closely with policy makers in the federal government (particularly the Canadian Food Inspection Agency, the Public Health Agency of Canada, Health Canada and Agriculture and Agri-Food Canada) as well as industry, community and other stakeholder groups to ensure that it meets Canada's risk management needs.

4) A full-time project coordinator, Dr. Shalu Darshan, was hired in 2006 to work on the PrioNet project.

1.1 Recommendations, where applicable, for further implementation of the activity

1) As part of PrioNet Canada's mandate, the center involves graduate students in developing the various above mentioned components of the IRMF.

2) To hold risk management satellite workshop preceding NeuroPrion 2007 in Edinburgh.

2. Interactions between the Centre and PAHO/WHO

1) Discussions with Elena Chambers, SDE's Collaborating Centers Coordinator, PAHO, and Dr. Albino Belotto, Unit Chief of the Health Surveillance & Disease Management Unit, PAHO, regarding possible collaborations on the PrioNet project to facilitate knowledge exchange activities.

**** Pharmacovigilance**

Pharmacovigilance is the science and activities relating to the detection assessment, understanding and prevention of adverse effects or any other drug-related problems. (WHO 2002). Pharmacovigilance is an umbrella term used to describe the processes for monitoring and evaluating adverse drug reactions (ADRs) following the introducing of new drugs into the marketplace, and is a key component of effective drug regulation systems. The role of pharmacovigilance is to monitor the effectiveness and safety of new and medically evolving treatments under real-life conditions post release, gather information about use in specific population groups notably children, pregnant women and the elderly and to gather information on the efficacy and safety of chronic use of drugs in combination with other medicines. This is achieved by most countries by monitoring Adverse Drug Reaction (ADR) via passive pharmacovigilance, however globally WHO's Drug Monitoring Program consolidates data from a number of National Centres.

Terms of Reference

We propose that the McLaughlin Centre has the capacity to pursue investigations in this dynamic field and wish to add this to our terms of reference.

Appendix – McLaughlin Centre Research Team

Listed below are selected members of the core research team located in the main office of the Centre in Ottawa, Canada. The McLaughlin Centre benefits from the expertise of a number of collaborators who are not listed here but who participate on various projects. These collaborators are affiliate scientists from fellow Canadian universities and from universities around the world. The Centre also has a number of Research Fellows who have a wide range of experience and academic backgrounds and who come from government and local, national and international organizations.

Daniel Krewski, Ph.D., MHA

Director

Daniel Krewski is the Director of the McLaughlin Centre for Population Health Risk Assessment where he holds the position of NSERC Industrial Research Chair in Risk Science. Dr. Krewski has been Professor in the Department of Epidemiology and Community Medicine in the Faculty of Medicine at the University of Ottawa since 1998. His professional interests are in epidemiology, biostatistics, risk assessment, and risk management and he has broad experience applied to national and international panels of experts in the fields of health, life sciences, chemical safety, cancer and environmental hazards. He has utilized his academic achievements and considerable expertise in conjunction with his analytical, communication and organizational skills to lead and collaborate with provincial, national and international organizations to define and create problem-specific solutions based on health and biostatistical evidence.

Sam Kacew, Ph.D., ATS

Associate Director, Toxicology

Sam Kacew is Professor of Cellular and Molecular Medicine at the University of Ottawa. Dr. Kacew is also Editor of the Journal of Toxicology and Environmental Health which has included a number of special issues highlighting the work of the McLaughlin Centre.

William Leiss, Ph.D., FRSC

Associate Director, Risk Communication

Executive in Residence

William Leiss is a Professor in the School of Policy Studies at Queen's University, NSERC/SSHRC Industrial Research Chair in Risk Communication and Public Policy, University of Calgary. Dr. Leiss is Executive-in-Residence at the McLaughlin Centre and was also a recipient of Officer of the Order of Canada in 2004.

Mustafa Al-Zoughool, Ph.D.

Postdoctoral Fellow

Mustafa Al-Zoughool is currently working as a cancer epidemiologist with the Centre. He is involved in several projects on cancer epidemiology and in risk management of prion disease in Canada. He completed his B.Sc. in Biology in 1996 from the University of Jordan, Jordan as well as his Masters degree in Analytical Toxicology in 2000. In addition, he completed his Ph.D. in Molecular Toxicology from the University of Cincinnati, Ohio in 2005. He finished one year of postdoctoral fellowship at the International Agency for Research on Cancer where he completed research on cancer epidemiology.

Daniel Bédard, M.Sc.

Project Coordinator

Daniel Bédard is a Research Project Coordinator at the McLaughlin Centre. His areas of interest include electromagnetic fields and health as well as Pharmacovigilance. He has coordinated the INTERPHONE Study in Ottawa, an international case-control study of cell phone use and tumours of the brain and

salivary glands. In addition, to the Canadian retrospective validation study, the Software-Modified Phone (SMP) study and the Base-Station study of output power levels emitted by cell phones. His main research interests are radio-frequency fields and health, adverse drug reaction and post-market drug safety and nutritional methodologies.

Angela Brazeau, B. Comm.

Business Manager

Angela Brazeau was appointed Business Manager for the McLaughlin Centre in December 2006. Angela has worked in an administrative capacity for the University of Ottawa for five years, first with the Centre on Governance working closely with the former Auditor General of Canada, Denis Desautels, and then as Administration Officer for the Institute of Population Health. She is a business graduate from the University of Ottawa, School of Management, and is currently working towards her Certified Human Resources Professional designation (CHRP) as well as her Masters in Business Administration (MBA).

Shalu Darshan, Ph.D.

PrioNet Project Coordinator

Shalu Darshan is a Research Coordinator at the Centre. Currently she is involved in coordinating research activities in Networks of Centres Excellence (NCE) funded project "PrioNet". The main goal of the project is to elaborate the etiology of prion diseases in Canada along with risk management strategies to deal with the challenges posed by prions through five research themes and their targeted core projects. She is directly involved in theme five addressing the prion disease risk management issue.

Nataliya Karyakina, Ph.D.

Project Assistant/Epidemiologist

Nataliya Karyakina is an epidemiologist at the McLaughlin Centre. Her academic background includes a degree in Medicine and a related Masters Degree in Epidemiology and Ph.D. in Medical Toxicology with a specialization in Pesticide Toxicology. Her research has a focus on multidisciplinary studies regarding the risk assessment and management of psychosocial aspects of possible chemical, biological, radiological and nuclear terrorist attacks/threats, technological disasters and emerging infectious diseases.

Judy McDonald, Ph.D.

Affiliate Scientist & Part-time Professor

Over the past 15 years, Judy McDonald has been a Part-time Human Kinetics Professor at the University of Ottawa, and has served as a Faculty Council Member in Health Sciences for six years. Original work with Olympic athletes has become the framework for her discipline in operational readiness assessments for high-risk workplaces. She has authored books on mental preparedness strategies or surgery, air traffic control, and policing. Her academic foundations are combined with extensive municipal experience in program management and public-private partnerships. Her pursuit is in applying this cross-disciplinary approach to other high-performance situations-where the standards of excellence have serious consequences.

Franco Momoli, Ph.D.

Postdoctoral Fellow

Franco Momoli is currently a postdoctoral fellow, with training in occupational epidemiology from McGill University. His research has involved work on occupational causes of lung cancer, on Bayesian modeling, and on issues surrounding the problems of multiple inference and confounder selection.

Yuanli Shi, M.D.

MD Research Associate

Yuanli Shi is currently a Research Associate at the McLaughlin Centre. Prior to joining the Institute of Population Health at the University of Ottawa in 1998, she was a Biostatistician in Institute for Cancer

Epidemiology, Danish Cancer Society. Yuanli has been trained in Applied Statistics at the University of Reading (1993-94) and University of Salford (1994-97) in England. Yuanli is interested in cancer, environmental epidemiology and risk assessment.

Suzanne Thérien

Assistant to the Director

Suzanne Thérien joined the McLaughlin Centre in August 2001 as the Assistant to the Director. Suzanne has been with the Centre since virtually its inception.

Michelle Turner, M.Sc.

Epidemiologist/Research Coordinator

Michelle Turner is an epidemiologist at the McLaughlin Centre. Her research focus is on environmental and cancer epidemiology as well as risk perception. She has a particular focus on the relation between allergic status and cancer occurrence and has recently evaluated the association between a history asthma and/or hay fever and cancer mortality in the American Cancer Society - Cancer Prevention Study II Prospective Cohort.

Michael Tyshenko, Ph.D.

Project Coordinator

Michael Tyshenko is a Research Associate at the University of Ottawa. His academic background includes a Ph.D. in molecular biology, a MPA in Public Administration and post-doctoral training in Policy Studies and Risk Communication. Dr. Tyshenko specializes in interdisciplinary studies combining molecular biology, science policy and risk communication focusing on emerging issues including: genomics, bioinformatics, zoonotic diseases and transmissible spongiform encephalopathy prion research.

Nagarajkumar Yenugadhati, MBBS

M.Sc. program, Epidemiology, University of Ottawa

Nagarajkumar Yenugadhati is a cancer epidemiologist at the McLaughlin Center. His master's thesis focused on identifying the occupational risk factors for lung cancer based on a British Columbia cancer study. Dr. Nagarajkumar is currently involved in several risk assessment projects in the fields of occupational cancer and environmental health, and clinical risk assessment projects at the McLaughlin Center for Population Health Risk Assessment.

Nawal Farhat

M.Sc. program, Epidemiology, University of Ottawa

Nawal Farhat is a student in the M.Sc. in Epidemiology program at the University of Ottawa. She has a background in Chemical Engineering (B.A.Sc) and Biochemistry (B.Sc.). She is currently working as a research assistant on policy case studies with PrioNet/University of Ottawa. Her interests include environmental health, biotechnology, and international health.

John Houle

Ph.D. in Computer Sciences, University of Ottawa

John Houle is a Ph.D. candidate in computer science at Carleton University. Scientific credentials consist of B.Sc. (biochemistry, Carleton), B.Sc. (computer science, Carleton), and M.Sc. (computer science, Carleton). Scientific research interests focus on computational molecular biology, molecular database mining, and supercomputer technologies. Future research objectives will concentrate on supercomputer-assisted rational drug design.

Roxanne Lewis

M.Sc. program, Epidemiology, University of Ottawa

Roxanne Lewis attended Queen's University in Kingston, Ontario, from 2002 to 2006 and graduated with a B.Sc. (Honours) in Chemistry. While at Queen's University, she was awarded three NSERC Undergraduate Student Research Awards to conduct research in chemistry (inorganic, organic, analytical and physical organic). Upon graduation, she was given an NSERC CGS M award. She is currently working towards a M.Sc. in Epidemiology under the supervision of Dr. Krewski.

Morgan MacNeill

M.Sc. program, Epidemiology, University of Ottawa

Morgan MacNeill is in her second year in the Master's of Epidemiology Program at the University of Ottawa. Morgan is currently working at Health Canada in the Air Health Effects Division where she assesses sources of exposure to a variety of air pollutants. Her personal research is also focused in the area of personal exposure to environmental contaminants. For her Master's thesis she is currently attempting to elucidate the characteristics of individuals carrying a high body burden of endocrine toxicants.

Daniel Rainham

Ph.D. in Population Health, University of Ottawa

Daniel Rainham is a Ph.D. student in Population Health at the University of Ottawa and a Research Associate with Environmental Programs at Dalhousie University. His doctoral research uses custom-designed wearable GPS technology to more accurately identify individual space-time patterns for population health research, and to assess the spatiality of health determinants. Building on his background in environmental science, Daniel is also conducts empirical studies of the associations between measures of ecological integrity and human health. Daniel's research is supported with a doctoral award from the Canadian Institutes of Health Research and financial support from the Centre.