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A Canadian Perspective on Endocrine Disrupting Substances in the Environment

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Although reproduction and development are major endpoints for environmental and human health assessments in many federal government programs, growing concern about risks posed by endocrine disrupting substances (EDS) has highlighted the need to detect subtle effects mediated through endocrine systems. Internationally, screening and testing programs in the United States, Japan and Europe, and the activities of international agencies such as the OECD, will have a profound influence on how Canada will address this issue in the future. It is critical that Canada be proactive, identify knowledge gaps from a Canadian perspective, and anticipate international developments that may influence Canadian policy. The complexity and urgency of the EDS question spurred the Five Natural Resource Departments Endocrine Disrupting Substances (5-NR EDS) Working Group to hold a multi-departmental, multi-stakeholder, workshop to address key issues in assessing risks of EDS to Canadians and the Canadian environment. The following is a summary of the major conclusions, research priorities and recommendations from the workshop held at the Grandview Inn, in Huntsville, Ontario, February 13–17, 2000.

Key words: **endocrine disrupting substances, human health, ecosystem health, multi-generation effects, screening and testing, risk assessment, research needs**

Introduction

Potential adverse impacts of substances in the environment that act on the endocrine systems of organisms continue to be a high-profile national and international issue. Laboratory research indicates that some drugs, pesticides, industrial chemicals, metals and natural compounds can alter the normal function of endocrine systems (National Academy of Science 1999; Di Giulio and Tillitt 1999; Kendall et al. 1998). Recent studies have impli-

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cated some of these substances in the alteration of aspects of growth, reproduction and development of animal species, including humans, in Canada and other areas of the globe (Foster 2001; Wade 2000a; Fox 2000; Fox 2001; McMaster 2001). It has been suggested that such changes may be associated with adverse responses in individuals or populations of organisms, although further research is needed to substantiate this linkage (Lister and Van Der Kraak 2001**;** Munkittrick 2001; National Academy of Science 1999). Chemicals suspected of having endocrine disrupting capability include a wide variety of chemical classes and mixtures; thus, there are implications for a large number of activities and programs in the federal government (Hewitt and Servos 2001; Bexton 2000; Servos et al. 2000).

The UK Royal Society (2000) concluded that endocrine disrupting chemicals "have the potential to impede progress toward sustainable development by their effects, for example, on water supply and biodiversity". In the 1999 Speech from the Throne, the Canadian Government recognized that "long-term economic and social well-being of every Canadian depends on the state of our natural environment…and Canadians have long recognized the underlying relationship between a healthy environment and a high quality of life." This recognition is reflected in the renewed *Canadian Environmental Protection Act, 1999* (CEPA 1999), which strives to enhance the protection of Canadians and the Canadian environment from exposure to toxic substances. CEPA 1999 now makes research on "hormone disrupting substances" a ministerial duty for both Environment Canada and Health Canada:

> *The ministers shall conduct research or studies relating to hormone disrupting substances, methods related to their detection, methods to determine their actual or likely short-term or long-term effect on the environment and human health, and preventative, control and abatement measures to deal with those substances to protect the environment and human health.* (CEPA 1999 article 3 subsection 44(3))

> *"hormone disrupting substance" means a substance having the ability to disrupt the synthesis, secretion, transport, binding, action or elimination of hormones in an organism, or its progeny, that are responsible for the maintenance of homeostasis, reproduction, development or behaviour of an organism.* (CEPA 1999 article 3 subsection 43)

Until recently the EDS issue was regarded as predominantly a "science issue " but it has evolved rapidly and there is increasing public pressure to translate the growing body of scientific information into action. The EDS issue is associated with considerable uncertainty and has therefore been linked to the debate over the Precautionary Principle in Canada as well as other jurisdictions (Commission of the European Communities 1999, 2000; Singh 2000). It has been recognized that we must be proactive so that we reduce this uncertainty and make decisions based on sound science. CEPA 1999 commits the government to implementing the weight of evidence approach as well as the precautionary principle in decision-making:

> *Whereas the Government of Canada is committed to implementing the precautionary principle that, where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation:* (Preamble CEPA 1999; paragraph 2(1)(a))

The EDS issue presents new challenges for scientific assessments of industrial chemicals (Sutcliffe 2001; Mihiaich and Guiney 2000; Granville 2000; Servos et al. 2001), pesticides (Moase and Delorme 2000; Ally 2000) and the Canadian environment (Munkittrick 2001).

There are also numerous international activities related to the EDS issue that have implications for Canada. The requirement in the United States to develop an approach for screening and testing for endocrine disrupting chemicals by the summer of 2000 has resulted in numerous activities in that country (U.S. EPA 1997; Timm et al. 2000). The OECD, in which Canada is an active partner, has initiated a program to harmonize testing and screening on EDS (OECD 2000; Brown and Parrott 2000; Wade 2000b). The EU has recently published a strategy for endocrine disrupting chemicals and has committed to develop a list of potential endocrine disrupting chemicals for further testing in the immediate future (Commission of the European Communities 1999; Lyons 2000). These activities will influence the development of public opinion and public policy on this issue in Canada (Parrott et al. 2001).

Soon after the EDS issue was recognized in the mid-1990s, federal departments held workshops and developed strategies and priorities for scientific research, e.g., Environment Canada's EDS strategy (Servos and Luce 1997). These activities helped guide development of research programs under the Toxic Substances Research Initiative and related research programs in industry and universities, such as the Canadian Network of Toxicology Centres. A working group on endocrine disrupting substances (5-NR EDS Working Group) was established in 1996 under the Five Natural Resources Departments (5-NR) Memorandum of Understanding (MOU) on Science and Technology for Sustainable Development to further facilitate and coordinate research on this issue among the five natural resource departments in the Canadian government (5-NR 2000). Although this group was very active and effective at sharing information, it was recognized that the breadth of the issue would require a coordinated federal response involving both research and regulatory scientists from government, industry, academia and public interest groups. This was emphasized in the 1999 Report of the Commissioner of the Environment and Sustainable Development to the House of Commons:

> *The evolving issue of endocrine-disrupting chemicals (EDCs) illustrates the need for a co-ordinated research plan"…* [and there is need to jointly identify] *"government–wide policy and regulatory questions that would guide research activities.* (Section 3.85)

Prompted by the urgency and complexity of the question, the 5-NR EDS Working Group hosted a multi-departmental, multi-sector workshop

at the Grandview Inn, Huntsville, Ontario, February 13–17, 2000. The participant were asked to document the current status of knowledge as well as address emerging issues associated with the scientific assessment of EDS in the Canadian environment (Servos et al. 2000). The papers in this special issue of the Water Quality Research Journal of Canada (36, No. 2) represent an overview of the current status of our understanding of the distribution and effects of EDS in Canada, as well as current approaches to testing and assessing their risk to Canadians and Canadian ecosystems. The major conclusions, knowledge gaps and recommendations identified as a result of the workshop are summarized and presented.

Workshop Objectives and Structure

The agenda of the workshop placed a major emphasis on reviewing the current status of science on the EDS issue in Canada, but also considered how the issue fits within the regulatory framework of the federal government. Consequently, the output of the workshop reviews and identifies knowledge gaps and research needs specific to the requirements of scientists and regulators to enable them to address this issue and conduct scientifically sound assessments of EDS in the Canadian environment. The specific objectives of workshop included: 1) to review the current research programs and initiatives in Canada, 2) to review knowledge and regulatory implications and needs of the federal departments, 3) to review current approaches to risk assessment and determine the adequacy of current approaches to address EDS in Canada, 4) to review international activities on EDS that may influence Canadian programs and policy and identify major knowledge gaps, and 5) to identify and prioritize research needs on EDS required to support assessments and policy development in Canada.

Participants at the workshop represented research and regulatory scientists from several federal government departments, academia, industry, and public interest groups (Table 1). The meeting consisted of a combination of formal presentations, breakout groups, directed discussions and plenary sessions. Although consensus was desirable, obtaining an accurate reflection of the opinions of the participants was the goal of the workshop, and the conclusions and recommendations strive to reflect accurately the predominant points of view as well as the alternatives. The details of the meeting structure and group discussions and reports are available in the proceedings of the workshop (Servos et al. 2000).

Major Workshop Conclusions

Participants of the workshop were asked to address the EDS issue under four major themes, guided by a series of specific questions. The responses and conclusions as well as identified knowledge gaps and needs were specific to Canada and considered unique aspects of Canadians and the Canadian environment, Canadian approaches to the management of toxic substances, and scientific expertise and capacity in

Table 1. List of workshop participants

Carl Alleyne	Health Protection Branch, Health Canada
Ariff Ally	Pest Management Regulatory Agency, Health Canada
Angela Bexten	Environmental Affairs Branch, Industry Canada
Christian Blaise	CSL, Environment Canada
Karen Brown	Environmental Conservation Service, Environment Canada
Scott Brown	National Water Research Institute, Environment Canada
Neil Burgess	Canadian Wildlife Service, Environment Canada
Kent Burnison	National Water Research Institute, Environment Canada
Pam Campbell	Independent Consultant
John Carey	National Water Research Institute, Environment Canada
Bruce Caswell	Canadian Chemical Producers' Association
Jorge Chedrese	University of Saskatchewan, CNTC
Steve Clarkson	Health Protection Branch, Health Canada
Gerard Cooke	Health Protection Branch, Health Canada
Peter Delorme	Pest Management Regulatory Agency, Health Canada
Wayne Fairchild	Marine Environmental Sciences Division, Fisheries and Oceans
Warren Foster	Center for Women's Health, Cedars-Sinai Medical Center
Michel Fournier	INRS – Institut Armand-Frappier, CNTC
Glen Fox	Canadian Wildlife Service, Environment Canada
Guy Gilron	ESG International
Geoff Granville	Toxicology and Product Safety, Shell Canada Limited
Don Hames	Regulatory Affairs, Dow Chemical Canada, Inc
Mark Hewitt	National Water Research Institute, Environment Canada
Alice Hontela	Dept. of Biological Sciences, University of Montreal, CNTC
Donna Houghton	Toxicology and Registration, Novartis Crop Protection Canada
Allan Jones	Endocrine Modulators Industry Coordinating Group
Dave Kane	Toxic Substances Research Initiative Secretariat
Karen Kidd	Freshwater Institute, Fisheries and Oceans Canada
Charalyn Kriz	Pest Management Regulatory Agency, Health Canada
Pat Krone	University of Saskatchewan, CNTC
Julia Langer	Wildlife Toxicology Program, World Wildlife Fund Canada
Suzanne Lesage	National Water Research Institute, Environment Canada
Gwynne Lyons	World Wildlife Fund United Kingdom
Jim Maguire	National Water Research Institute, Environment Canada
Des Mahon	Commercial Chemical Evaluation Branch, Environment Canada
Aspi Maneckjee	Environmental Substances Division, Health Canada
Pierre Martel	Pulp and Paper Research Institute of Canada
Lynn McCarty	Canadian Chlorine Coordinating Committee

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Table 1. *(continued)*

Barbara McElgunn	Learning Disabilities Association of Canada
Mark McMaster	National Water Research Institute, Environment Canada
Chris Metcalfe	Trent University, CNTC
Ellen Mihaich	Toxicology Department, Rhodia Inc.
Connie Moase	Pest Management Regulatory Agency, Health Canada
Kelly Munkittrick	National Water Research Institute, Environment Canada
Joanne Parrott	National Water Research Institute, Environment Canada
Alan Penn	Grand Council of the Crees (Eeyou Istchee), Cree Regional Authority
Emma Postlethwaite	Commercial Chemical Evaluation Branch, Environment Canada
Mike Rankin	Golder Associates Ltd.
Shane Renwick	Research Branch, Agriculture and Agri-Food Canada
Susan Sang	World Wildlife Fund Canada
Ken Sato	Environmental Conservation Service, Environment Canada
Mark Servos	National Water Research Institute, Environment Canada
Jim Sherry	National Water Research Institute, Environment Canada
Mimi Singh	Environment, Health and Safety, Canadian Plastics Industry Assoc.
Jack Soule	Research and Business Development Centre, DuPont Canada, Inc.
Donna Stewart	Great Lakes Programs (CWS), Environment Canada
Roger Sutcliffe	Commercial Chemical Evaluation Branch, Environment Canada
Gary Timm	Office of Science Coordination and Policy, US EPA
Ed Topp	Research Branch, Agriculture and Agri-Food Canada
Linda Toy	Plant Health and Protection Div., Canadian Food Inspection Agency
Taina Tuominen	Pacific and Yukon Region, Environment Canada
Glen Van Der Kraak	University of Guelph, CNTC
Lucie Veilleux	Environment and Energy, Canadian Pulp and Paper Association
Mike Wade	Health Protection Branch, Health Canada

this area of research. Only the major conclusions are presented here under the four major themes of the workshop, and details are available in the workshop proceedings (Servos et al. 2000).

Endocrine Disrupting Substances in the Canadian Environment

There is a concern in Canada that low level and/or multigenerational effects, possibly mediated through disruption of normal

endocrine function, are occurring and are currently not being detected. Effects on development and reproduction have been observed in wildlife in Canada, for example:

- deformities and embryo mortality in birds and fish exposed to industrial chemicals or organochlorine insecticides,
- impaired reproduction and development in fish exposed to pulp and paper mill effluents,
- abnormal development of molluscs exposed to antifouling substances (TBT) applied to the hull of ships,
- depressed thyroid and immune functions in fish-eating birds in the Great Lakes, and
- feminization of fish exposed to municipal effluents.

Some of the effects identified may not occur directly through an endocrine mechanism, or in some cases the mechanism is not yet known; however, this does not diminish the importance of effects or observations. Available data suggest a potential for these types of effects to occur in humans, although there is only circumstantial evidence that they occur in response to environmental contamination. For example, studies on mother-infant cohorts exposed to environmental contaminants through high consumption of contaminated fish suggest that there can be cognitive and neurobehavioral effects in infants due to prenatal exposure. Attention should focus on functional endpoints of growth, reproduction and development during critical life stages, rather than on a specific mode or mechanism such as receptor mediated responses.

In light of relatively recent results, traditional ecosystem monitoring and, to some extent, human health, monitoring programs have not used sufficiently sensitive endpoints related to growth, reproduction and development. Existing monitoring programs should be evaluated and modified to encompass new concerns, identify new issues, and complement mechanistic and toxicology studies.

Risk Assessment and EDS in Canada

Current risk assessment/management approaches in Canada can be used to identify effects produced via endocrine disrupting mechanisms, but subtle effects on growth, reproduction and development must also be considered. Risk assessment/management approaches require continuous improvement. Additional information required for risk assessments of suspected EDS includes information on sensitive life history stages; identification of windows of sensitivity, including exposure at this stage; possible presence and significance of delayed responses or effects; and significant development of the science of assessing effects of mixtures and mixture interactions. Both hazard and exposure are important criteria for assessing or prioritizing risks of EDS. Endocrine disrupting substances can be addressed within the existing Canadian legislation and regulatory frameworks, although a national risk management framework for EDS is needed to ensure consistent application of the Toxic Substances Management Policy (TSMP) and communication activities.

Continued effort is needed to detect and assess the potential effects of EDS in the Canadian environment. The following sites and sectors were considered the most important focus for EDS in the Canadian environment:

- municipal effluents,
- intensive agriculture, including pesticides and livestock production,
- textile mill effluents,
- pulp and paper sector (recent dramatic improvement),
- mining and metals,
- historically contaminated sites,
- identified areas of concerns (e.g., Great Lakes AOCs), and
- contaminants in the Arctic, including aboriginal foods.

International Activities and Implications for Canada

International activities will continue to have major implications for the EDS issue in Canada. Harmonization is needed to ensure minimum duplication and maximum benefit to the respective countries dealing with the question, without giving up the ability to set national priorities or addressing specific concerns which may differ from those accepted internationally.

It is critical that Canada participates in international efforts so that internationally accepted tests are applicable in a Canadian context, i.e., consideration of unique aspects such as climate, population, diet and chemical use patterns. Results of laboratory testing should be related to ecological significance in the environment and possible effects in human populations, especially with respect to sensitive life stages.

Application of Sound Science to the EDS Issue

Potential subtle effects on reproduction and development should be considered in our scientific assessments and screens for toxic substances. While in vitro information and studies are useful, they are not currently linked directly to or predictive of in vivo responses; however, this is expected to improve rapidly with additional research. Concern should focus on effects at the level of the individual (in vivo) or above. Functional impacts leading to a negative effect on one or more of survival, growth, development, reproduction, behaviour, immune competence or disease resistance should be monitored and assessed.

Each federal program may have slightly different requirements but the basic principles for testing and assessment should be the same. A tiered-testing approach that considers both hazard and exposure is advantageous and should be incorporated into Canadian programs once validated and accepted internationally. Estrogen, androgen, and thyroid hormones are reasonably conserved across vertebrate species. However, there are many species-specific differences in how hormones are regulated and function, and thus potential variability in responses of different species and large uncertainty in extrapolation among species are to be expected. Interactions with other chemicals should

also be considered when possible, despite the complexities and large uncertainties involved.

Large uncertainty is associated with scientific assessments related to the EDS issue and should be considered in developing risk management options. A weight-of-evidence approach based on the most credible information available should be used to make appropriate decisions to protect Canadians and the Canadian environment.

Knowledge Gaps and Research Needs

Knowledge gaps and research needs were identified in each of the breakout sessions during the workshop and separated into two main themes: EDS in the Canadian environment and risk assessment; and application of sound science to the EDS issue. They were summarized and then prioritized by participant voting (Table 2; see workshop proceedings for details; Servos et al. 2000). It should be underlined that gaps and needs identified were specific to Canada, and considered unique aspects of Canadians and the Canadian environment, our approaches to the management of toxic substances, and our scientific expertise and capacity in this area of research.

General Comments and Needs

Canada should support research to address critical knowledge gaps and ensure application of sound science to risk assessment and management of EDS in the Canadian environment. Research should continue to reduce the large uncertainty associated with scientific assessments of these types of substances and effects. Research in Canada should continue to focus on our strengths in field studies, identifying impacts, and defining cause and effect relationships. Research on the fundamental reproductive and developmental biology of humans, biota and ecosystems is essential to understand and detect subtle effects on growth, reproduction, development (and ultimately effects on populations), mediated through endocrine or other mechanisms.

Enhanced science-based monitoring programs are required to detect and evaluate the risk to Canadians and the Canadian environment from EDS. Existing monitoring programs should be enhanced to detect EDS, effects and concerns. Replication of international screening and testing activities should be minimized, and Canada should participate in international activities to ensure results are consistent and applicable to the Canadian environment. Continued coordination and collaboration of research in government, industry, academia, and public interest groups are essential, and interaction among research and regulatory scientists in each of these groups must continue. Programs such as the Toxic Substances Research Initiative (TSRI), the Canadian Network of Toxicology Centres (CNTC) and appropriate internal government and industry programs should be enhanced and focused on scientific assessment of EDS. Although Canadian scientists make major contributions to the EDS question internationally, the science capacity in Canada to address this issue is limited and should be expanded.

Table 2. Knowledge gaps/research needs identified for scientific assessment of endocrine disrupting substances in the Canadian environment

Priority[a]	EDS in the Canadian environment and risk assessment
1.	Calibrating or benchmarking the ecological relevance of EDS tests — taking them out of the laboratory and assessing their ability to detect impacts/adverse effects of EDS in the Canadian environment.
2.	Improve basic knowledge on the role of hormones in the development of nervous, reproduction and immune systems in human and relevant species.
3.	Improve understanding of role and importance of naturally occurring hormonally active substances in the EDS issue (with regard to testing).
4.	Comprehensive guidance on how to interpret and use scientific data in risk management decision-making frameworks.
5.	Definition of acceptable risk, adverse effect.
6.	Risk communication [need to enhance current activities.
7.	Development and recognition of endpoints for early life stage effects related to organizational changes (e.g., behaviour, immune, endocrine, etc.).
8.	Improve basic knowledge about early specification and development of endocrine and reproductive organ systems from fertilization onwards in vertebrates.
9.	Correct deficiencies in exposure and monitoring data.
10.	Improved understanding of effects of EDS on invertebrates.
11.	Development of mechanistic knowledge on the link between in vitro and in vivo responses.
12.	Understanding link between [screening] test result and adverse effects.
Priority[a]	**Application of sound science to the EDS issue in Canada**
1.	Establish connection between lab tests and actual world. Are tests predictive of real world effects? Are things happening in real populations that are not predicted?
2.	Linking screening/testing methods to ecological relevance (especially with respect to sensitive life stages).
3.	Development of a framework for risk assessment of interactions of EDS in mixtures and effluents.
4.	Better knowledge of exposure and dispersal of EDS in the environment.
5.	Better understanding of low dose effects and thresholds.
6.	Ability to separate effects of natural estrogens from effects of anthropogenic chemicals.
7.	Linking biomarker responses with adverse apical effects (growth development, reproduction).

(continued)

Table 2. *(continued)*

8.	Development of a framework regarding public values for risk management decisions.
9.	Enhanced monitoring effort for effects in the environment.
10.	Better knowledge of immune system effects.
11.	Mechanistic studies, including complications from mixed agonists (estrogenic in some tissues, anti-estrogenic in others).
12.	Develop a framework for risk assessment of cumulative exposures and effects rather than single compound approach.

[a] Priority established by voting of all workshop participants.

Recommendations

The EDS issue is broad in scope and as a result is linked directly to numerous other national environmental health issues, regulations and initiatives. Its complexity will necessitate a coordinated response from federal government departments, industry, academia and other organizations. Related activities in other jurisdictions, especially the United States, Japan and Europe, will influence development of public opinion and policy in Canada over the next few months and years. To address the issue effectively, Canada should establish national leadership and communication on the EDS issue, a better knowledge base of the exposure and effects of EDS in the Canadian environment, national and international harmonization of screening and testing protocols, enhanced scientific assessment, and action on priority substances.

National Leadership and Communication on the EDS Issue in Canada

A high priority should be placed on providing national leadership at the federal level on the issue of EDS in the environment. The EDS question is related directly to many other priority environmental health issues, including children's environmental health, persistent organic pollutants (POPs), CEPA, and regulation of pesticides. The issue has also been directly associated in Canada and other countries with the debate on the Precautionary Principle. A comprehensive and coordinated program of collaborative research, communication and regulation/policy development needs to be established. Federal departments, industry, academia and public interest groups should actively participate and collaborate in an effort to generate the knowledge necessary for scientifically sound assessments, regulations and policies. A national communications program should be established to provide scientists, policy makers and the public with current information on national and international developments and activities.

Establishing a Better Knowledge Base of the Exposure and Effects of EDS in the Canadian Environment

Canadian scientists have played an important role in EDS activities, conducting some of the most comprehensive field studies reported, e.g., effects of organochlorines in birds, reproductive effects in fish exposed to pulp mill effluents, and effects of chemicals on endocrine dependent responses such as smoltification in salmon. Canadian scientists, especially in the federal government, should utilize and emphasize the traditional strengths of Canadian science and programs in assessing effects on ecosystems to maximize contributions to international efforts. Limitations on available resources dictate that research programs must be focused and prioritized to maximize their effectiveness. Research programs should emphasize development of knowledge and tools to conduct more comprehensive environmental assessments, and apply these tools in field and laboratory studies to determine the extent to which Canadians and the Canadian environment may be affected. Scientists in Canada have considerable expertise in validating the relevance of specific responses and exposures in whole animals and populations, including humans. Emphasis should be placed on determining the relevance and acceptability of internationally recognized EDS responses and tests in the Canadian population and the Canadian environment.

The federal government should give priority to assessing those sites, sectors and populations identified as having the highest potential for adverse effects on functional endpoints related to growth, reproduction or development of biota through disruption of endocrine function, as well as other, not yet fully understood mechanisms. Endocrine disruption should be considered as only one of several mechanisms by which environmental effects can be mediated. Research programs should include both previously identified issues, such as industrial effluents and priority substances, and emerging issues such as intensive agriculture (pesticides and animal wastes), urban exposure (e.g., air, sewage, runoff), and new chemicals. Collaboration and partnerships with universities and industry should be employed to further research mechanisms and other critical areas that will enable scientific assessments of EDS in the Canadian environment.

National and International Harmonization of Screening and Testing Protocols

Development of screening and testing methodologies is recognized as an important research and policy area both within Canada and internationally. Enormous efforts are currently underway in other countries to develop and validate screening and testing methods for EDS. Canadians should participate in and support the efforts of international organizations, especially the OECD, to harmonize internationally accepted screening and testing methods to address this complex global issue. However, this should not be the emphasis of Canadian research programs. Canada should work with a variety of international agencies to validate and calibrate currently proposed tests for use internationally and in Canada, and ensure their applicability to the Canadian population and Canadian envi-

ronment. Duplication of the efforts of other countries should be actively avoided in order to maximize our contribution to international efforts.

Enhanced Scientific Assessment and Action on Priority Substances

Public perception of the EDS issue has evolved rapidly from scientific interest to seeking action to protect human and ecosystem health. CEPA 1999 requires research on "hormone disrupting substances" and application of both the weight-of-evidence approach and the precautionary principle to management of toxic substances in Canada. Although there are special considerations related to assessment of EDS, they can be addressed within current risk assessment/management frameworks with only minor adjustment for inclusion of new knowledge and testing protocols.

Priority substances such as PCBs, tributyltin, selected pesticides and industrial chemicals shown to have or suspected of having effects on growth, reproduction or development, possibly as a result of alterations of the endocrine system, should continue to be evaluated to determine their risk to the Canadian environment. Canada should act to implement current national or international agreements and protocols (such as the Protocol on Persistent Organic Pollutants) to reduce the exposure of these chemicals to the Canadian environment. Each federal department should take action to reduce the exposure and risk of EDS to Canadians and the Canadian environment.

Research on better assessment and management tools for this class of chemicals should be conducted to reduce uncertainty and lead to more effective remedial and risk reduction approaches. As internationally accepted screens and tests are validated and made available in the next 2 to 5 years, they should be integrated into the current regulatory framework, which considers both hazard and exposure in characterization of risk and formulation of risk management options. Environmental and human health monitoring programs should be modified and enhanced to build a capability to detect exposure and subtle effects on critical developmental stages of biota and humans.

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