PROGRESS UPDATES IN THE MANAGEMENT OF RISK RELATED TO DIOXINS AND FURANS UNDER THE CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA)

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Introduction

Under the Canadian Environmental Protection Act (CEPA), Health Canada undertakes multi-media assessments intended to determine and provide guidance on health risks posed by substances in the environment[1]. Accordingly, following a 1990 risk assessment, polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans, hereafter generally referred to as dioxins, were declared "toxic" under CEPA. Most exposure of the general Canadian population to dioxins occurs through the diet, with over 95 percent of intake from animal fats. However small amounts of exposure occur from breathing air that has been contaminated with trace amounts of dioxin, from inadvertent ingestion of contaminated soil, and from absorption through the skin. The latter routes may be of particular significance in point-source contamination scenarios such as those involving application of dioxin-contaminated pesticides.

Specifically regarding human intake, in 2005 Canada adopted on an interim basis, the JECFA (Joint Expert Committee on Food Additives - Food and Agricultural Organization of the United Nations and the World Health Organization) tolerable monthly intake for human intake of dioxins. This intake is 70 pg/kg bw/month, which represents an intake of about 2.3 pg/kg bw/day. The Food Directorate of Health Canada undertakes market basket surveys for cities across Canada, to provide current data on intake of dioxins through foods. In addition, the Canadian Food Inspection Agency conducts regular monitoring of dioxins in foods and animal feeds and has set a concentration limit of 20 ppt for dioxins in fish products and feeds. It has also established a dioxin traceback program whereby elevated levels of dioxins found in livestock fat triggers analyses of feed batches consumed by the livestock.

Regarding human biomonitoring, Health Canada conducts ongoing monitoring involving determination of levels of dioxins in maternal serum in various regions of Canada, and is currently compiling human exposure data from Canada, the United States and Mexico, to establish a North American databank on human exposure to dioxins. This will serve as a means of assessing baseline levels and evaluating trends of these substances over time, identifying populations at risk, and comparing and contrasting exposure among regions within North America.

Specifically with respect to management of dioxin sources in Canada, the Canadian federal Toxic Substances Management Policy requires that for substances which are toxic, persist in the environment, bioaccumulate, and result predominantly from human activity, the ultimate goal is virtual elimination[2]. Because dioxins satisfy these criteria, the management objective is virtual elimination of measurable releases of these substances into the environment. Measurable releases are defined as releases above the Level of Quantification (LoQ), which is the lowest concentration that can be accurately measured using sensitive but routine sampling and analytical methods. For dioxins released to air, that level is 32 picograms of toxic equivalents (TEQ) per cubic metre, and for soils, 9 picograms per gram.

Subsequent to the assessment of dioxins in 1990, the Canadian federal government embarked on a comprehensive program of risk management under CEPA focused on the reduction of risk to human health and the environment posed by these substances. Since that time, it is evident that substantial progress has been made in this effort as outlined below.

Management Initiatives and Results

1) Pulp and Paper Mills:

The Pulp and Paper Mill Effluent Chlorinated Dioxins and Furans Regulations (1992) which prohibit the release of effluent containing measurable levels of dioxins and furans. This required pulp and paper mills to implement process changes to prevent the formation of these substances. The Pulp and Paper Mill Defoamer and Wood Chip

Regulations (1992) limited the maximum concentration of unsubstituted dioxin and furan in defoamers, and prohibited the sale and import of wood chips made from wood treated with polychlorinated phenols. Subsequent to these regulations, releases of dioxins to water have been reduced by 99%, thereby achieving the goal of virtual elimination from the pulp and paper sector.

2) Canada-Wide Standards for Waste Incineration:
Endorsed in 2001, the standards specify emission limits of 80 pg TEQ/m^3 for dioxin release from existing biomedical, hazardous, and municipal incinerators (excluding conical incinerators), and 100 pg TEQ/m^3 from existing sewage incinerators to be achieved by 2006. There are over 100 such facilities across Canada, at that time estimated to release 41g TEQ/year. All new or expanding facilities must comply with these limits immediately. The most recent review of available dioxin emissions data from Canadian waste incinerators suggested that about half of existing incinerators had met these standards as of 2005. In addition, municipal waste incinerators and commercial biomedical waste incinerators have implemented control technologies which reduce levels of dioxins in exhaust gas to below the LoQ (32 pg TEQ/m^3).

3) Canada-Wide Standard for Conical Waste Combustion of Municipal Waste
Endorsed in 2003, this standard for conical waste combustion of municipal waste focuses on phase-out by 2008, of conical incinerators, predominant throughout Newfoundland and Labrador, which in 2003 numbered 58 with an total annual dioxin release of 44 g TEQ/year. By 2005, 24 conical incinerators had been closed resulting in close to a 52% reduction in emissions of dioxins and furans to the atmosphere from this source.

4) Canada-Wide Standard for Coastal Pulp and Paper Boilers:
Endorsed in 2001, the standard set release limits for dioxins for coastal pulp and paper boilers burning salt-laden wood, all 11 facilities located in British Columbia, and which generated total dioxin releases of 8.6 g TEQ/y. Limits specified were 100 pg TEQ/m^3 for facilities constructed after the standard came into place and 500 pg TEQ/m^3 for existing facilities. Emission tests conducted in 2004, showed that all facilities but one were below these release limits.

5) Canada-Wide Standard for Iron Sintering Plants
Endorsed in 2003, this standard sets a release limit of 200 pg TEQ/m^3 for dioxins for any new facilities and 200 pg TEQ/m^3 to be achieved by 2010 for the 1 remaining iron sintering facility located in Ontario, at that time estimated to release about 1.44 g TEQ/y. Emission tests undertaken in 2005 showed a release of 177 pg TEQ/m^3, well below the 2010 release limit.

6) Canada-Wide Standard for Steel Electric Arc Furnaces
Endorsed in 2003, the standard sets a dioxin release limit of 150 pg TEQ/Nm^3 to be achieved by 2006 and 100 pg TEQ/Nm^3 by 2010 for new and modified furnaces. There are currently 12 such facilities across Canada, at that time estimated to release about 7.7 g TEQ/year. Most recent estimates for the sector indicate total yearly releases of about 6.8 g TEQ/year, indicating some improvement in dioxin release reductions by this sector.

Other Initiatives
It is estimated that on-site combustion of residential waste, particularly in remote and northern communities, contributes significant releases of dioxins to the atmosphere. Jurisdictions are being encouraged to consider regulatory and non-regulatory approaches to minimize this practice. In response, a number of jurisdictions have implemented regulations or undertaken educational programs to deal with this issue.

Other sectors (i.e., base metals smelting, diesel fuel combustion, electric power generation, wood treatment) are subject to multi-pollution approaches which will ensure that dioxin and furan releases are minimized.

Conclusions

Our mandate under CEPA is the reduction of risk, and it is evident that the above management activities for dioxins are effecting considerable progress toward this goal. The national inventory of dioxin sources indicates that dioxin and furan releases have declined by more than 60 percent since 1990. Regarding levels in air, the federal-provincial National Air Pollution Surveillance Network has documented a declining trend for levels of dioxins and furans in ambient air in Canada. With respect to human exposure, levels of dioxin-like compounds measured in Canadian serum and breast milk surveys declined by about one-half from the 1980s to the 1990s. Moreover, based on total diet studies undertaken by Health Canada, current estimates of Canadian intake generally do not exceed 1 pg/kg bw/d, well below the present guideline level. In addition, a 2002 survey of Canadian fish products indicated that dioxin levels in all products were below the federal concentration limit.

References

1. Government of Canada. *The Canadian Environmental Protection Act* 1988.
2. Government of Canada. *The Toxic Substances Management Policy* 1995.