# Health Impact Assessment of PCBs, PCDDs and PCDFs in Relation to a Special Waste Treatment Center Incident in Alberta, Canada

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**Background**

The Special Waste Treatment Center (the "facility") is designed for the incineration of special wastes received from the province of Alberta and the rest of Canada. It is located approximately 12 kilometres north-east of the Town of Swan Hills, Alberta, Canada (Figure 1). The region is sparsely populated and sits on an isolated plateau with a natural and relatively undisturbed boreal forest ecosystem. Wild game and fish are abundant in the area and have been a traditional source for aboriginal people as well as a source of food and recreation for others. This is also extensive recreational land use.

Central to the operation of the waste treatment process for organochlorines is a high-temperature incinerator complex designed to destroy organic material contained in the liquid, solid and sludge waste received at the facility. This consists of a rotary kiln and two rocking kiln incinerators. Combustion by-products are scrubbed to remove particulate matter and acidic gases prior to being discharged to the ambient air through the stack. On October 16, 1996, a malfunction of a transformer furnace was discovered. This malfunction allowed some process gas to bypass the scrubber and to pass directly into the stack gas. This resulted in release of some process gases containing polychlorinated biphenyls (PCBs), PCDDs and PCDFs (PCDD/Fs) into the ambient air. It was not known how long the process gas had been escaping through the leak.

Concern over the distribution and extent of contamination resulting from this release led to some preliminary testing of wildlife harvested near the facility by the facility operator. A high level of PCBs was found in muscle and fat of one deer taken near the fence of the facility several weeks after release, prompting initial food consumption advisory issued by the health officials. More comprehensive investigations were implemented.

Ecologically-based investigations were conducted to determine the contaminant levels in the vicinity of the facility and the spatial and temporal distribution in air, vegetation, snow, water and sediment.[1-2] The company continued to carry out annual monitoring program on air

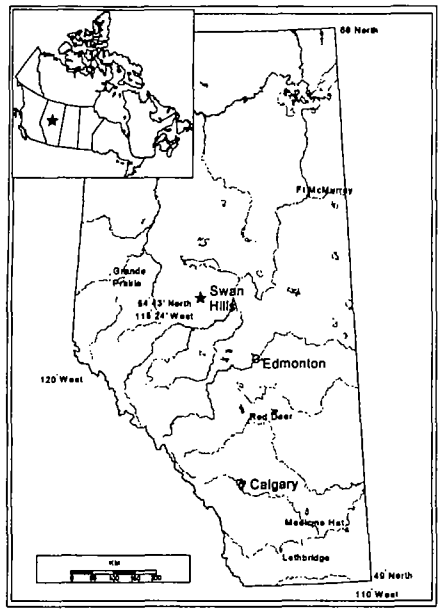


Figure 1 Location of the Special Waste Treatment Center

water, soil, vegetation, fish, voles and wild game.[3-4] The studies provided an ecological profile in the surrounding area.

In order to estimate potential human exposure to these organic contaminants, a detailed human health impact assessment was carried out. This assessment included wild game and fish monitoring programs and human blood sampling.[5-8] The primary goals of the assessment were to evaluate the potential for human exposure to PCBs and PCDDs/PCDFs through consumption of wild game and fish and to estimate the existing levels of these contaminants in the human population. This assessment was also designed to meet the requirements of public health intervention in the short term. A secondary concern was the degree to which contamination might affect wildlife, both as part of the ecosystem and as the basis for the region's recreational and traditional activities.

**Study Design**

The framework of the site-specific health risk assessment conducted is shown in Figure 2. Three sets of measured indicators were used for measuring human exposure (Figure 3). Environmental concentration measurements were used to assess contaminant concentrations in environmental media and potentially exposed food sources in an effort to track contamination through its ecological pathway to the human receptor. Human blood measurements (one of body burden indicators) were used to assess contaminant concentrations in the blood of potentially exposed human beings. Survey measurements were used to assess the demographic characteristics, dietary habits and activity patterns of potentially exposed human beings. The information from each study component was integrated in order to inform the public health interpretation and revise the initial food consumption advisory.

## Management and Communication

A process was established to manage the investigations. The work group undertook data collection, laboratory analysis, data analysis, data interpretation and data presentation. A specially constituted Science Advisory Committee, consisting of local, national and international experts, provided advice on direction of the study and assistance in interpreting results. A Public Health Advisory Committee carried out the human health risk management function. The communication team delivered the information to targeted audience and stakeholders through various channels including public media, local community meetings, direct mail and telephone.

## Summary of the Study Results

The results of the study, taken as a whole, indicated the following:

1. Levels of PCBs and PCDD/Fs were elevated in various environmental samples including spruce needles, snow pack, surface water sediment, brook trout, deer and moose collected from the area immediately adjacent to the Special Waste Treatment Center;
2. Preliminary analysis indicated that no statistically significant difference in human serum levels of PCBs and PCDD/Fs based on current detection limits was observed for residents living within a 100 km radius of the Special Waste Treatment Center relative to those living a reference area;
3. Preliminary analysis indicated that no statistically significant difference in levels of PCBs and PCDD/Fs based on current detection limits was observed between individuals who consumed wild game and fish taken from within a 30 km radius of the Special Waste Treatment and those who did not;
4. Food consumption advisories were issued by the health officials based on new evidence related to elevated levels of PCBs and PCDD/Fs in fish and wild game near the facility. The advisories remain in place as of July 1998.

## Acknowledgments

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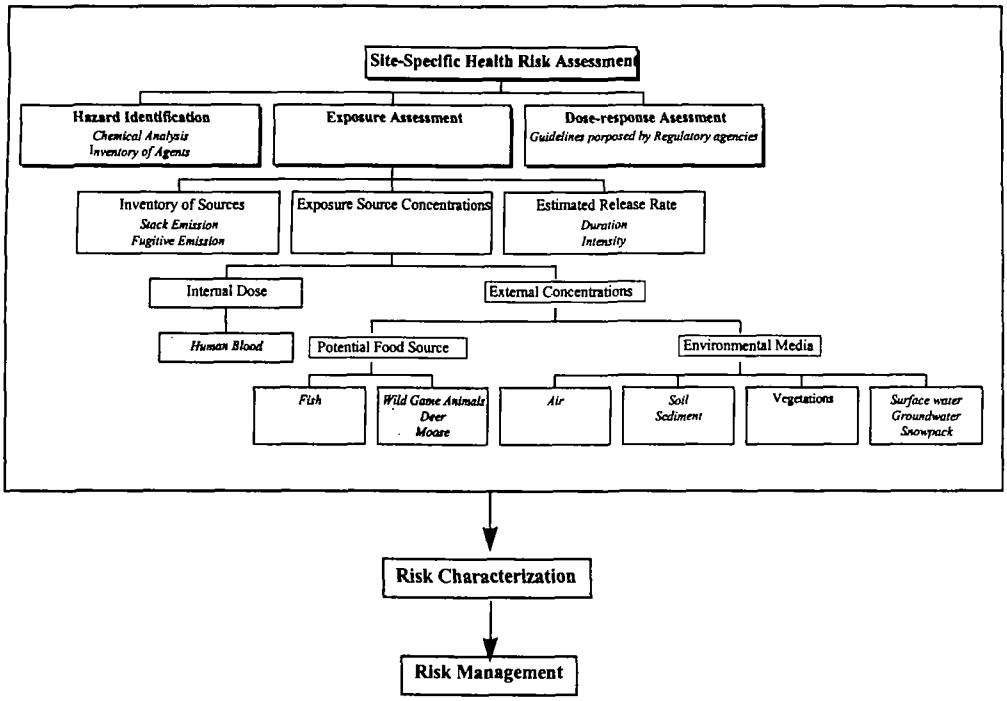


Figure 2 Framework of Site-Specific Health Risk Assessment

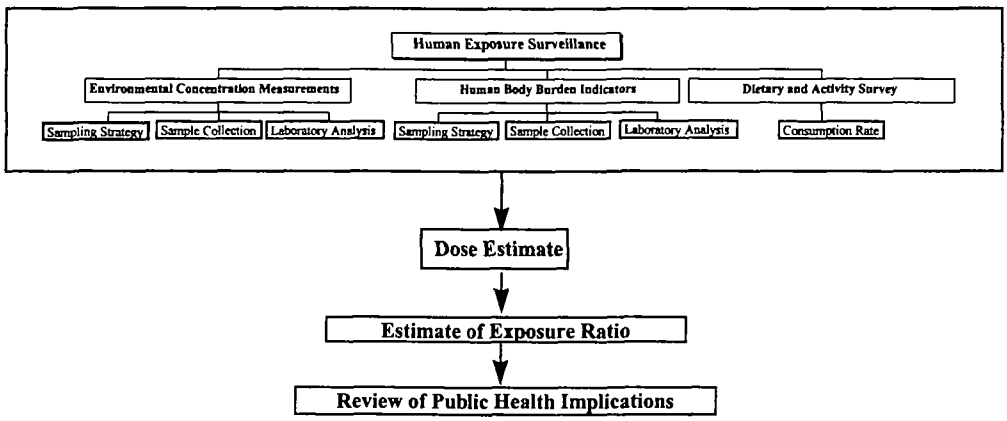


Figure 3 Study Design for Measuring Human Exposure