Environment Canada Environnement Canada

PENTACHLOROBENZENE (QCB) AND TETRACHLOROBENZENES (TeCBs)

PROPOSED RISK MANAGEMENT STRATEGY

Chemicals Control Branch
Environmental Protection Service
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1.0 ISSUE

The first Priority Substances List of the *Canadian Environmental Protection Act* (CEPA) was published in February 1989. This list included Pentachlorobenzene (QCB) and Tetrachlorobenzenes (1,2,4,5-TeCB, 1,2,3,4-TeCB and 1,2,3,5-TeCB). Assessments were performed and completed in 1993. It was concluded that these substances did not present a threat to human life or health or the environment upon which human life depends. However, there was insufficient data to determine whether they did or could pose a threat to the environment.

The *Canadian Environmental Protection Act, 1999* (CEPA 1999), came into effect on March 31, 2000, replacing the original CEPA. Paragraph 64(a) under CEPA 1999 addresses immediate or long-term harmful effects on the environment and also includes effects on biological diversity. CEPA 1999 places more emphasis on pollution prevention and requires special treatment of persistent and bioaccumulative substances that are present in the environment primarily as a result of human activity.

On April 3, 2004, the Ministers of the Environment and Health published the *Follow-up Report on Five PSL1 Substances for Which There Was Insufficient Information to Conclude Whether the Substances Constitute a Danger to the Environment.* QCB and TeCBs were shown to cause both chronic and acute negative effects on benthic and soil-dwelling organisms. The report concludes that both QCB and TeCBs are toxic to the environment under paragraph 64(a) of CEPA 1999.

2.0 BACKGROUND

2.1 Characteristics of Chlorobenzenes

Pentachlorobenzene, CAS No. 608-93-5, and the three isomers of tetrachlorobenzene, 1,2,3,4-tetrachlorobenzene, CAS No. 634-66-2, 1,2,3,5- tetrachlorobenzene, CAS No. 634-90-2 and 1,2,4,5- tetrachlorobenzene, CAS No. 95-94-2, belong to the family of aryl halides that do not exist in nature and are prepared synthetically. As a general rule, the higher the degree of chlorine substitution in the benzene ring, the higher the melting and boiling points of the compound and the more thermally stable the compounds are.

2.2 Production, Import, Use and Sources of Chlorobenzenes

QCB and TeCBs are not currently produced or used in their pure form in Canada, and, currently, there is no domestic commercial demand for these substances. Formerly, they could be found in dielectric fluids used to top up polychlorinated biphenyl (PCB) transformers and in dyestuff carriers. These applications have either been discontinued (dye carriers) or are being phased out (dielectric fluids). A possible source of release may include dielectric PCB material still in use.

The principal current commercial use of QCB is as a chemical intermediate in the formation of pentachloronitrobenzene (also known as quintozene), a fungicide. QCB is present as an impurity in this fungicide. Pentachloronitrobenzene is currently used, but not produced, in Canada. QCB can also be found as an impurity in several herbicides, pesticides and fungicides currently in use in Canada.

Both QCB and TeCBs may be generated when organic compounds are burned or exposed to a large source of energy in the presence of a chlorine source. Through this mechanism, they may be formed and released to the environment as a result of waste incineration and barrel burning of household waste.

3.0 WHY WE NEED ACTION

QCB and all three isomers of TeCB (1,2,4,5-TeCB, 1,2,3,4-TeCB and 1,2,3,5-TeCB) are considered toxic to the environment because they are entering the environment in a quantity or concentration or under conditions that have or may have an immediate or long-term harmful effect on the environment or its biological diversity.

The chlorobenzenes under consideration in this strategy are known to cause both chronic and acute negative effects in controlled tests on benthic and soil-dwelling organisms. These chlorobenzenes have also been estimated to persist in sediment for longer than two years. Additionally, QCB and TeCBs may be subject to atmospheric transport from their source to remote areas and, therefore, are considered persistent in air.

Furthermore, these substances meet the criteria of persistence and bioaccumulation, and are present in the environment primarily as a result of human activity. The releases of these substances should be virtually eliminated as they are considered Track 1 substances under the *Toxic Substances Management Policy*.

4.0 EXPOSURE SOURCES

There are no known natural sources of QCB and TeCBs in the environment. There is no commercial activity involving the pure forms of QCB or TeCB in Canada. Below are the known sources of release in decreasing order of significance. An estimate of releases is shown in Table 4.1.

4.1 Major Sources of Release

The sectors responsible for the majority of releases are discussed in this section.

Barrel Burning of Household Waste

A recent report issued by the Burn Barrel Subgroup of the Dioxins/Furans Workgroup of the Great Lakes Bi-national Toxics Strategy has identified that a portion of the municipal solid waste stream is burned on site at residential dwellings in rural areas. The US Environmental Protection Agency (US EPA) has studied emissions from barrel burning. Emission factors applied by A. J. Chandler (2004) show that barrel burning emits far larger amounts of chlorobenzenes, much of which is found in the ash, than incineration and could be a potentially significant source. The estimated releases from barrel burning represent 42% of the total annual releases of QCB and TeCBs.

Dielectric Fluids

As identified by a 2001 Inventory and Technical Study (Cleghorn and Davies), some TeCBs, and trace amounts of QCB, are released to the environment when there are spills of dielectric fluids used for PCB transformers that contain these substances. Such spills would be expected to occur from in-use equipment as opposed to equipment in storage. Dielectric fluids that initially contained PCB products would have small amounts of QCB and TeCBs, while electrical transformers that were topped up with tri- and tetrachlorobenzene blends would contain larger amounts of both substances. It is estimated that 5.6 kg/yr of QCB and 37.5 kg/yr of TeCBs, representing 39% of total annual releases, come from the transformers topped up with these fluids. This estimate was calculated using Environment Canada's PCB inventory and the Thompson calculation method. It is lower than the estimates in the 1993 assessment reports as a revised calculation method was used and PCB equipment has continued to be taken out of service. When all of the existing PCB equipment is taken out of service (scheduled for December 31, 2007 for equipment containing 500 mg/kg or more PCB and December 31, 2014 for

equipment containing between 50 and 500 mg/kg, according to proposed draft regulations (Environment Canada, 2002)) the amounts released from spills tend towards zero.

Pesticides

QCB is used as a chemical intermediate in the production of pentachloronitrobenzene (also known as quintozene). Hexachlorobenzene, and thus QCB, based on assumptions by the U.S. Environmental Protection Agency (U.S. EPA, 1999), has been cited by the U.S. EPA (1997) as an impurity in quintozene, clopyralid, atrazine, chlorothalonil, dacthal, lindane, pentachlorophenols, picloram and simazine. None of these pesticides are produced in Canada. All but dacthal and lindane are currently registered for use in Canada under the *Pest Control Products Act*. Their use may result in the release of QCB into the Canadian environment.

The Pest Management Regulatory Agency (PMRA) has estimated that the release of QCB for 2001 was approximately 6.2 kg, which represents approximately 6% of the total annual releases of chlorobenzenes. This value was calculated based on available sales and production data and the level of QCB contamination in pesticides; as reported by the registrants; and the estimates of QCB contamination in the cases when registrant data were not available. It was assumed that all QCB contamination present in the technical grade active ingredients are transferred into end-use products, that all sales lead to use, and that all uses lead to entry into the environment. This estimate does not include releases of QCB from wood treatment.

Recent efforts of manufacturers to reduce chlorobenzene contamination in pesticides should result in a reduction of these levels.

TeCBs may be found in pesticides as a very negligible contaminant. This source contributes very little or insignificantly to the overall releases of TeCB.

Municipal Solid Waste Incineration

According to the 2001 Inventory and Technical Study (Cleghorn and Davies) waste incineration was identified as a potentially significant source of chlorobenzenes. New data (Chandler, 2004) suggests that controlled municipal solid waste incineration is not a large source of chlorobenzenes releases in Canada. Emissions from controlled municipal solid waste in Canada are regulated by the provincial/territorial governments.

There are some situations (primarily in Newfoundland) where municipal solid waste is incinerated in uncontrolled conditions that would emit far larger amounts of chlorobenzenes than controlled incineration. It is estimated that municipal solid waste incineration contributes approximately 5% of the total annual release of chlorobenzenes.

Hazardous Waste Incineration

QCB and TeCBs have been found in releases from hazardous waste incinerators and cement kilns burning waste-derived fuels. Recent investigation (Chandler, 2004b) indicates that, given the temperatures achieved in the hazardous waste incinerator, there is no scientific or practical basis for suggesting that flow-through emissions of QCB or TeCBs will occur. For the same reasons, any bottom ash residues leaving the incinerator are unlikely to contain QCB or TeCBs since these compounds would volatilize into the gas stream if present in materials charged to the furnace. The only chlorobenzenes released from hazardous waste incineration would therefore come from their creation in the incineration process. It is estimated that releases from this source represent approximately 4% of the total annual release of chlorobenzenes.

Wood Treatment

The 2001 Inventory and Technical Study indicates that QCB is contained in pentachlorophenol as an impurity. Pentachlorophenol is one of the five main wood treatment chemicals that are used in

Canada, but it is not manufactured in Canada. In North America, the only currently registered uses for pentachlorophenol are for pressure and thermal treatment of railway ties, utility poles, pilings and outdoor construction materials. Releases from treatment plants include air emissions, which are generally localized, and releases to water and solid wastes in various forms. Treated wood, such as in-service posts and pilings, also releases QCB while in use and once land filled. It is estimated that 2 kg/yr of QCB are released from wood treatment plants and in service utility poles. This source represents approximately 2% of the total annual releases of chlorobenzenes.

Table 4.1

Estimate of Releases to the Environment of QCB and TeCBs

	Releases (kg/y)			
	Air	**Water**	**Soil**	**Total**
QCB				
Sources				
Barrel burning of household waste	1.814		20.116	21.93
Wood treatment plants and in service utility poles	2.24		0.1	2.34
Pesticide use			6.2	6.2
Dielectric Fluid spill and cleanup	0 -< 0.001	0 -< 1.23	0 -< 4.42	5.6
Municipal solid waste incineration	0.364		2	2.36
Hazardous waste incineration	1.835			1.84
Magnesium production	1.449	.079		1.53
Solvent use	0.037			0.04
Long-range transport				n/a
Total				**41.8**
TeCBs				
Sources	**Air**	**Water**	**Soil**	**Total**
Dielectric Fluid spill and cleanup	0 -< 0.02	0 -< 9.71	0 -< 27.82	37.5
Barrel burning of household waste	4.265		20.116	24.38
Hazardous waste incineration	3.016			3.02
Municipal solid waste incineration	0.773		2	2.77
Magnesium production	0.364	0.139		0.50
Solvent use	0.037			0.04
Long-range transport				n/a
Total				**68.2**

4.2 Other Potential Sources of Release

Several other sources or potential sources were identified in the 2001 Inventory and Technical Study (Cleghorn and Davies). In some cases, the available data indicated that these sources contributed very little or insignificantly to the overall releases of QCB and TeCBs. In other cases, data was too scarce to allow a conclusion.

Magnesium Production

The formation of chlorobenzenes is likely to occur during various metals production processes. The magnesium production process includes an electrolytic process which entails carbon and chlorine in contact with each other at high temperature during the electrolysis of magnesium chloride with graphitic electrodes involving the injection of gaseous hydrochloric acid. Releases of QCB and TeCBs to air and water have been reported by the only magnesium plant in Canada using this process. Emission test data from this facility reported the release of 1.53 kg/yr of QCB and 0.50 kg/yr of TeCB. This represents less than 2% of the total annual releases of QCB and TeCBs.

Chlorinated Solvents

The 2001 Inventory and Technical Study (Cleghorn and Davies) indicates that neither QCB nor TeCBs have been detected in the emissions of the only chlorinated solvent manufacturing facility in Canada. However, small amounts of both substances are found in imported perchloroethylene and carbon tetrachloride. The two most important sources of releases for perchloroethylene are dry cleaning and solvent degreasing.

Assuming an average concentration of 5 ppb for both QCB and TeCBs in perchloroethylene, potential releases of QCB and TeCBs due to national use of perchloroethylene would be ~37 g/yr for each substance (Cleghorn and Davies, 2001). Carbon tetrachloride contains a similar amount of chlorobenzenes, but is now only used as a laboratory analytical standard and as feedstock, and, as such, any releases would be negligible.

Secondary Copper and Aluminum Processing

Chlorobenzenes may be formed during secondary copper smelting process (Cleghorn and Davies, 2001). The presence of chlorinated plastics in copper scraps used as a feed to the smelters and the reducing or pyrolytic conditions in blast furnaces are believed to increase the chlorinated dioxin and furan formation. It is likely that QCB and TeCBs could be formed similarly. The secondary aluminum manufacturing process is also suspected to emit QCB and TeCBs to the atmosphere, when remelt aluminum is degassed with hexachloroethane to control magnesium levels. No data were available for these sectors.

Chemical Manufacturing

Hexachlorobenzene (HCB), and thus potentially QCB and TeCBs (U.S. EPA, 1999), releases have been reported (Cleghorn and Davies, 2001) in the manufacture of sodium chlorate and sodium hydroxide by electrolysis when graphite electrodes are used. In these processes, the use of these electrodes has been eliminated in favor of metal electrodes capped with noble metal coating. These changes in the manufacturing process for sodium chlorate and sodium hydroxide have eliminated the potential for chlorobenzenes releases from this source.

Iron and Steel Mills

Iron and steel mill effluents were identified in the 1993 assessment reports as a source of both QCB and TeCBs. Dioxins and furans, as well as octachlorostyrene (OCS) and HCB are formed and emitted from electric arc furnaces and iron sintering plants, and it is therefore possible that

QCB and TeCBs may also be formed. There are very little recent data on the presence of QCB and TeCBs in either the effluents or the stack gases of this sector as these substances are generally not included in the parameters of tests done. One study (Environment Canada and Health Canada, 1993) identified QCB and TeCBs in the stack gases of one mill. The scarcity of data in this sector makes it difficult to conclude as to the importance of its releases.

Petroleum Refineries

Both QCB and TeCBs had been identified in the waste streams of petroleum refineries at the time of the assessment (1993). A study by the U.S. EPA in 1999 found no QCB or TeCBs in U.S. fuels. Changes in the manufacturing process of certain chemicals used in the refining process (ex: caustic soda) have made it unlikely either substance will be generated and emitted to the atmosphere.

Wastewater Treatment Plants

In the 1993 assessment reports, neither QCB nor TeCBs were among the chloryl substances detected in several surveys of municipal wastewater treatment plants in Ontario. QCB and TeCBs have been found in sediments near industrial sources and in the effluent from one wastewater treatment plant. The reason for finding QCB and TeCBs downstream of the wastewater treatment plant is not known. It could be due to their formation in the wastewater treatment plant, but is more likely due to their presence in influent to the wastewater treatment plant. For these reasons, the Inventory and Technical Study concluded that it is not appropriate to calculate discharges of QCB and TeCBs from wastewater treatment plants.

Textile Mills

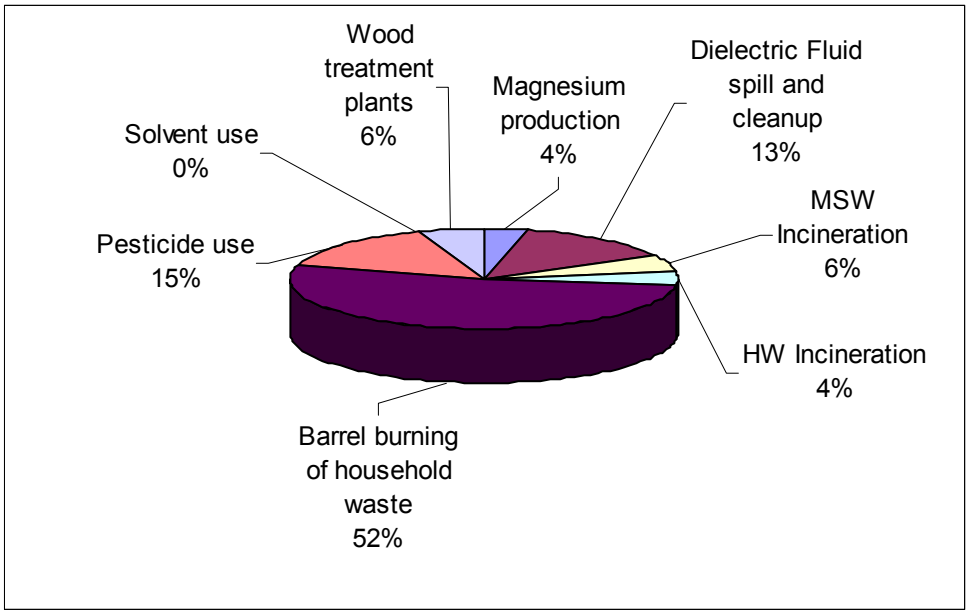
The 1993 assessment reports also found evidence of QCB and TeCBs in the waste stream of a single textile plant. The textile industry uses a large number and a wide range of chemicals, including dye carriers, caustic soda, sodium chlorate and carbon tetrachloride. The use of chlorinated dye carriers has been discontinued and changes in the manufacturing processes for the other chemicals have made it unlikely for them to contain either QCB or TeCBs as impurities. For these reasons, the Inventory and Technical Study (Cleghorn and Davies, 2001) concluded that the data do not support the presence of QCB or TeCBs in effluents from textile mills.

Long-Range Transport

QCB and TeCBs are semi-volatile and persistent substances. Therefore, they can volatilize out of products they are found in, such as pesticides or chlorinated solvents, and undergo long-range transport. For example, QCB from pesticide use outside Canada can enter the Canadian environment by this mechanism. This source is very difficult to quantify, as releases may be transported over some distance, deposit, then re-volatilize to be transported further, leading to double-counting of re-volatilized deposits. It is expected that actual releases from this source would be lower than those estimated in the 1993 assessments as the previous estimates double counted emissions from Canadian sources. Also, extrapolations were used in the previous estimates that are not considered to represent the national situation.

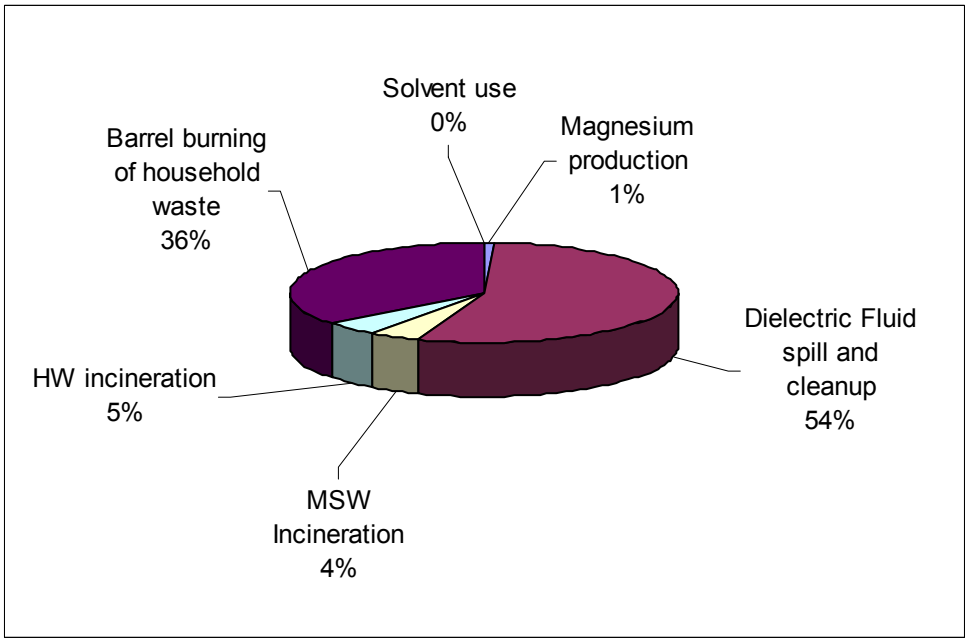
Although the contribution of long-range transport of QCB and TeCBs is not known, it should be noted that there are Canadian and international efforts under way, including Canada-wide Standards for dioxins and furans (Canadian Council of Ministers of the Environment, 2001, 2003, 2003b), virtual elimination of hexachlorobutadiene and other persistent organic pollutants (POPs) and the international POPs Convention, that are expected to reduce emissions of QCB and TeCBs.

Figure 4.1: QCB Releases by Source



Total releases: 41.8 kg/yr

Figure 4.2: TeCB Releases by Source



Total releases: 68.2 kg/yr

5.0 LEGISLATION AND STANDARDS

5.1 Existing Canadian Legislation, Regulations and Guidelines

5.1.1 Releases to Water

The Canadian Council of Ministers of the Environment has established an interim chronic exposure water quality guideline for the protection of freshwater aquatic life of 0.0018 mg/L for 1,2,3,4-TeCB and 0.006 mg/L for QCB.

Ontario regulations developed under the Municipal Industry Strategy for Abatement program require companies in the Organic and Inorganic Chemical Manufacturing Sectors to monitor and report chlorinated benzene levels to the Ministry of the Environment.

5.1.2 Hazardous Waste

The movement of wastes containing 8 ppm or more of chlorobenzenes is controlled under the *Export and Import of Hazardous Waste Regulations* (1992) and the *Interprovincial Movement of Hazardous Waste Regulations* (2002), and will continue to be controlled under the proposed *Export and Import of Hazardous Waste and Hazardous Recyclable Materials Regulations*.

5.1.3 Guidelines and Standards Targeting Other Chemicals Which May Also Impact Chlorobenzene Emissions

QCB and TeCBs, along with other chlorobenzenes (especially HCB), are often associated with the formation of dioxins and furans. The *Canada-USA Strategy for the Virtual Elimination of Persistent Toxic Substances in the Great Lakes Basin* (known as the Great Lakes Binational Toxics Strategy) requires the United States and Canada to virtually eliminate the Level 1 Substances which are classified as persistent, toxic and bioaccumulative. Dioxins/furans and hexachlorobenzene are classified as Level 1 substances and it is believed that the reduction of releases of these substances can result in the reduction of chlorobenzenes.

The development of Canada-wide Standards for dioxins and furans includes standards for priority sources such as incinerators and municipal waste combustion (Canadian Council of Ministers of the Environment, 2001, 2003). For those dioxins and furans sources that also emit QCB and/or TeCBs, the reduction in dioxins and furans releases afforded by the Canada-wide Standards will likely also reduce the releases of QCB and TeCBs.

Barrel Burning

In several Canadian jurisdictions, a regulatory approach to either prohibit open burning, including backyard and barrel burning of household waste, or permit it only under pre-approved conditions has been adopted. Legislation is used at both the provincial and municipal levels. Nova Scotia's *Solid Waste Resource Management Regulations, 2002* include a ban on open burning of municipal solid waste, including open burning in an uncontrolled teepee, pit or silo burner. Several municipalities and regional districts in British Columbia have passed bylaws that completely prohibit backyard burning or limit burning to dry, garden refuse under strict rules. The government of British Columbia provides municipalities with a model municipal by-law (B.C. Ministry of Water, Land and Air Protection, 1997) to regulate residential backyard burning.

Under the Binational Toxics Strategy for the Great Lakes, a strategy and implementation plan was developed to address the issue of barrel burning. This strategy was developed by the dioxins/furans Workgroup, Burn Barrel Subgroup and was finalized in February 2004. While the reduction of dioxin and furan emissions was the driving factor behind the development of this strategy, the reduction of several other toxic emissions, including chlorobenzenes, is an

acknowledged benefit of its implementation. Among the goals of the strategy is the sharing of knowledge and tools with other jurisdictions outside the Great Lakes area to help address this problem nationwide.

PCB Use, Storage and Disposal

After regulations prohibiting new uses of PCB-containing dielectric fluid were introduced in 1980 by Environment Canada, the amount of TeCBs imported for this purpose declined considerably. Revisions to existing regulations on use and storage of PCBs are currently being developed. The proposed *Polychlorinated Biphenyls (PCB) Regulations* will replace the *Chlorobiphenyls Regulations* and, while incorporating most of the original requirements, will add new provisions to end the use of PCBs and track their destruction.

The *Storage of PCB Material Regulations* (1992) will also be amended at the same time to set a time limit on the destruction of PCBs. Time limits on storage before destruction will also be set.

QCB and TeCBs are present in small amounts in the original PCB fluids used, and in larger quantities in the Tri- and TeCB blend used to top up the transformers. As these dielectric fluids are incompatible with new transformers, the gradual elimination of PCB equipment will also lead to their gradual elimination.

Wood Treatment

The substance of concern in the wood treatment industry is pentachlorophenol, which is a registered pesticide. This substance is one of the five pesticides targeted by the Wood Preservation Strategic Options Process. This process led to the development of the *Recommendations for the Design and Operations of Wood Preservation Facilities* (G.E Brudermann) in 1999 and the related facility and process assessment program. One of the objectives is to reduce or eliminate the release of wood preservative chemicals to the environment. A report on the results of the assessment program (Stevens *et al.,* 2001) indicates an average overall conformance level of 68% (36-93% range by criteria) for pentachlorophenol facilities. This conformance level implies a reduction of total chlorobenzenes released to the environment. The *Recommendations for the Design and Operations of Wood Preservation Facilities* was revised and published in 2004. Final conformance assessments are scheduled to be completed by 2005.

Waste Incineration

Canada-wide Standards for the reduction of dioxins and furans emissions from this sector have been developed by the Canadian Council of Ministers of the Environment and were agreed to by the Minister of the Environment (under s. 9 of CEPA 1999) in 2001 (municipal solid waste, hazardous waste, medical waste and sewage sludge incineration) and 2004 (conical municipal waste combustion). An 86% reduction in releases from municipal solid waste, hazardous waste, medical waste and sewage sludge incineration is expected by 2006. Conical waste combustion will be phased out in Newfoundland by 2008 and new conical waste combustors are prohibited in all jurisdictions in Canada. These efforts should also reduce the amounts of QCB and TeCBs generated by similar mechanisms and emitted from the same sources.

In Ontario, the Ministry of Environment amended Regulation 347 to phase out hospital waste incinerators by December 2003. Hospital wastes are now managed by sending them to a centralized waste incinerator with state-of-the-art technology or by alternative waste management methods.

Perchloroethylene Use

Regulations for the control of perchloroethylene, also deemed a toxic substance under CEPA 1999, were developed by Environment Canada and published in March 2003 for the dry cleaning sector and, in August 2003 for the solvent degreasing sector. By reducing the perchloroethylene releases from these sectors, the QCB and TeCBs releases will also be reduced.

Iron and Steel Mills

The Canada-wide Standards for dioxins and furans were developed to set a goal for reduction of dioxins and furans emissions from electric arc furnaces found in steel manufacturing and from iron sintering plants. They were developed by the Canadian Council of Ministers of the Environment and were agreed to by the Minister of the Environment (under s. 9 of CEPA 1999) in 2003. Implementation of the Canada-wide Standards for dioxin and furans emissions should also likely reduce the amounts of QCB and TeCBs generated by similar mechanisms and emitted from the same source.

5.2 Existing Legislation, Regulations and Guidelines in the United States

5.2.1 Releases as Solid Waste

QCB and 1,2,4,5-TeCB are listed as hazardous constituents under the U.S. *Resource Conservation and Recovery Act*, which requires anyone who generates, transports, treats, stores or disposes of wastes containing these substances to notify the U.S. Environmental Protection Agency (U.S. EPA) within 90 days. These two substances are also part of a list of persistent, bioaccumulative and toxic chemicals which was created to promote voluntary waste minimization efforts under the *Resource Conservation and Recovery Act*.

5.2.2 Releases to Water

Both QCB and 1,2,4,5-TeCB are listed as toxic under the U.S. *Clean Water Act*, and are classified as non-priority substances. National recommended water quality criteria exist for consumption of water and for consumption of aquatic organisms.

QCB, 1,2,4,5-TeCB and 1,2,3,4-TeCB are among the 22 bioaccumulative chemicals of concern identified for further regulation in the U.S. EPA's *Final Rule on the Water Quality Guidance for the Great Lakes System* (2000).

5.2.3 Toxics Control

Under the U.S. *Comprehensive Environmental Response, Compensation and Liability Act*, QCB and 1,2,4,5-TeCB are listed as toxic substances and National Response Center notification is necessary when either substance is released in quantities equal to or exceeding the Reportable Quantity of 2 270 kg for 1,2,4,5-TeCB and 4.54 kg for QCB.

Under the U.S. *Toxic Substances Control Act*, QCB and all three isomers of TeCB are covered by rules which require chemical manufacturers and importers to submit preliminary assessments that include general production, use and exposure information, as well as copies and lists of unpublished health and safety studies on each substance. Also under the *Toxic Substances Control Act*, the testing of 1,2,4,5-TeCB is required to develop health or environmental data.

Under the U.S. *Occupational Health and Safety Act*, 1,2,4,5-TeCB is included on the Right to Know List of 3 States: New Jersey, Pennsylvania and Massachusetts.

5.2.4 Transportation of Dangerous Goods

QCB and 1,2,4,5-TeCB are classified as hazardous materials under the U.S. *Hazardous Materials Transportation Act*, and as such they must be properly labeled and packaged for transportation. A spill notification procedure is also included.

5.3 Existing Legislation, Regulations and Guidelines in Europe

5.3.1 Releases to Water

Under the regulations of the Department of Environment and Transport and the Regions of the U.K., Scotland and Northern Ireland, it is prohibited to discharge QCB and 1,2,4,5-TeCB directly or indirectly to groundwater.

Under the European Community Water Resource Framework Directive, 1,2,4,5-TeCB is on the list of Dangerous Substances and its discharges into surface and groundwater are to be controlled. No control limits were reported.

5.3.2 Toxics Control

No specific regulatory controls were found for QCB and the three TeCB isomers in the U.K. and the European Union. However, in the European Union, the sale and use of plant protection products containing quintozene with more than 10g/kg of QCB is prohibited.

6.0 PROPOSED OBJECTIVES

6.1 Proposed Environmental Objective

The ultimate environmental objective for tetrachlorobenzenes and pentachlorobenzene is virtual elimination of their releases to the environment, as both substances meet the Track 1 criteria set in the *Toxic Substances Management Policy*.

6.2 Proposed Risk Management Objectives

The proposed short-term risk management objective is to prevent the reintroduction of penta- and tetrachlorobenzenes to the Canadian market.

The proposed mid-term risk management objective is to achieve the lowest level of releases technically and economically feasible from the most significant sources of chlorobenzenes.

7.0 PROPOSED RISK MANAGEMENT INSTRUMENT/TOOLS TO BE DEVELOPED

7.1 QCB/TeCBs and Products Containing QCB/TeCBs

Since pentachlorobenzene and tetrachlorobenzenes are persistent, bioaccumulative and toxic substances, a preventative approach is required to prevent their reintroduction into the Canadian market. In this case, a regulation is the only effective way to ensure this objective is met. It is therefore proposed that QCB and TeCBs be added to the *Prohibition of Certain Toxic Substances Regulations*, *2005,* which is proposed to replace the *Prohibition of Certain Toxic Substances Regulations, 2003*.

QCB and TeCBs are found as contaminants in certain chlorinated chemicals, therefore, concentration limits should be established, taking into consideration environmental risks and economic and technology factors. Consideration will therefore be given to the development of

guidelines to complement the regulations, where environmentally acceptable contamination levels of chlorobenzenes in products or mixtures can be recommended. Two regulations that came into effect in 2003 (Dry cleaning and Degreasing) will work towards reducing the use of perchloroethylene and its emission to the atmosphere. As a contaminant in perchloroethylene, chlorobenzenes emissions will also likely be reduced. No additional action is proposed for this sector.

In addition, because QCB and TeCBs meet the criteria of persistence and bioaccumulation and are present in the environment primarily as a result of human activity, Environment Canada will consider adding QCB and TeCB to the Virtual Elimination List along with their LOQ.

QCB and TeCBs are not on the National Pollutant Release Inventory. However, Environment Canada is considering adding them to the inventory in order to monitor progress towards the proposed objectives.

As chlorobenzenes are PSL1 substances, they are not subject to the time limits set out in CEPA 1999 with respect to publication of the proposed and final instrument. However, it is the intention to meet the 2 year objective for the publication of the proposed instrument after the publication of the assessment results, and then the 18 month objective for the subsequent publication of the final instrument.

7.2 QCB and TeCB Releases

Barrel Burning

Barrel burning of household waste is a complex problem as jurisdiction over this issue is mainly municipal. It has been recognized as an important source of dioxins and furans, and efforts to address the problem are being made by the provinces of British Columbia and Nova Scotia and through the Great Lakes Binational Toxics Strategy. As dioxins and furans are a human health issue, efforts to control these emissions will likely take a high priority. Any efforts to reduce dioxin and furan emissions from this source will also reduce chlorobenzene emissions.

Due to the various strategies in place for this sector, no additional action is recommended. It is recognized that providing residential waste management infrastructure as an alternative to open burning of garbage in rural areas remains a challenge.

Dielectric Fluids

Two existing regulations related to PCBs (*Storage of PCB Material Regulations*, 1992, and *Chlorobiphenyls Regulations*, 1991) are being revised to address the gradual elimination of PCB materials in use and in storage, and therefore the gradual elimination of other substances present as contaminants in them. No additional action is proposed for this sector.

Wood Treatment

Recommendations for the Design and Operations of Wood Preservation Facilities (Brudermann, 2004) are already in place. All but three facilities have complied with this voluntary program. A proposed pollution prevention planning Notice is currently being developed to address the three facilities that have not complied. No additional action is proposed for this sector.

Pesticides

Pesticides are regulated under the authority of the *Pest Control Products Act*, which is administered by the Pest Management Regulatory Agency (PMRA). The PMRA will manage QCB contamination in pest control products according to its Regulatory Directive *The Pest*

Management Regulatory Agency's Strategy for Implementing the Toxic Substances Management Policy (Dir99-03).

Under Directive 99-03, levels of micro-contaminants of concern in pest control products are reviewed to ensure that products, and the uses for which they are registered, do not pose unacceptable risks to people or the environment. The PMRA works in partnership with registrants to reduce/eliminate micro-contaminants of concern in line with the best available technology from a manufacturing perspective and encourages the development of new technology.

QCB occurs as a micro-contaminant in certain pest control products. PMRA's strategy with respect to QCB will likely mirror the steps followed for the risk management of hexachlorobenzene (HCB). These steps are likely to be:

- Identify all currently registered Technical Grade Active Ingredients containing QCB and estimate releases.
- Inform all registrants of these products and request action plans for the reduction of QCB, with the ultimate goal of virtual elimination.
- First round of requests will target the registrants of products containing 0.1 ppm or more (based on HCB strategy) of QCB and not already handled by another initiative.

Municipal Waste Incineration

QCB and TeCBs are unlikely to be found in the feed stream of municipal solid waste, and are therefore considered to be mainly products of incomplete combustion. Controlled incinerators using air pollution control systems designed to reduce mercury emissions through the use of powdered activated carbon should effectively control chlorobenzenes emissions. Uncontrolled incinerators, such as conical and pit burners, are planned to be phased out by 2008 under the Canada-wide Standards for dioxins and furans (Canadian Council of Ministers of the Environment, 2001, 2003). This strategy would eliminate this source of chlorobenzenes.

Hazardous Waste Incineration

Implementation of the Canada-wide Standards for Dioxins and Furans will be monitored by a committee of the Canadian Council of Ministers of the Environment (CCME) responsible for air management. The implementation of the Canada-wide Standards is expected to favourably impact emissions of QCB and TeCBs. Since this strategy is already in place, no additional action is proposed for this sector.

Iron and Steel Plants

Canada-wide Standards for dioxins and furans (Canadian Council of Ministers of the Environment, 2003b) are already in place. No additional action is proposed for this sector.

Metals Processing

As the information for these sectors is incomplete, further investigation may be necessary before determining if action is needed in these sectors and what that action may be. As the estimated releases from this sector are relatively minor, developing an action plan for this sector is not a priority at this time.

Long-range Transport

QCB and TeCBs are not currently listed on either the United Nations Economic Commission for Europe Protocol on Persistent Organic Pollutants (UNECE POPs) or the Stockholm Convention on POPs (UNEP). Both agreements allow for the addition of new compounds. The UNECE ad hoc Scientific Expert Group on POPs is currently preparing information for the UNECE on substances requiring review under the Protocol and substances which may eventually be considered for addition. Countries are sharing the burden of carrying out this work. The Netherlands has prepared an information dossier on pentachlorobenzene for the ad hoc Scientific Expert Group on POPs indicating that pentachlorobenzene can be regarded as a Persistent Organic Pollutant. According to the information gathered by the Netherlands for the preliminary risk profile of pentachlorobenzene, this substance meets the UNECE POP criteria for long-range transport, persistence, bioaccumulation toxicity and ecotoxicity.

Though the information dossier prepared by the Netherlands has not been put forward as a proposal to add pentachlorobenzene to the UNECE POPs protocol, it is expected that they will put this proposal through in the future. At this point, pentachlorobenzene is not expected to be a high profile dossier, though the issue may be pushed by the Netherlands.

There is no immediate expectation that pentachlorobenzene will be added to the Stockholm Convention. It is anticipated, however, that substances added to the UNECE POPs protocol will eventually be considered for addition to the Stockholm Convention.

7.3 Follow-up

There are a number of existing initiatives addressing incidental releases in various sectors. Follow-up will be conducted on progress made under these initiatives. If it is determined that insufficient progress is being made through existing initiatives, Environment Canada will consider taking further action to address those sectors.

7.4 Virtual Elimination Plans

A virtual elimination plan is an information gathering tool which may be used as part of a long term strategy. At this point, it is not expected that virtual elimination plans will be requested. This action may be taken later on, if necessary, to evaluate progress towards virtual elimination.

8.0 BRIEF OUTLINE OF IMPLEMENTATION PLAN AND PROPOSED CONSULTATION APPROACH

8.1 QCB/TeCBs and Products Containing QCB/TeCBs

An on-line consultation approach will be used to present this risk management strategy to the stakeholders. The documents to be consulted on will be made available on Environment Canada's website. The primary stakeholders will include:

- Municipal incineration facilities,
- Hazardous waste incineration facilities,
- Importers and users of perchloroethylene,
- Pest Management Regulatory Agency,
- Industry Canada,
- Agriculture and Agri-Foods Canada,

- Environmental non-governmental organizations (ENGOs).

The topics of discussion would include:

- the planned addition of the substances to the proposed *Prohibition of Certain Toxic Substances Regulations*, *2005,*
- the effect of the efforts currently in place regarding dioxins and furans and what their impact could be on chlorobenzene emissions.

9.0 NEXT STEPS / TIMELINE

Specific Risk Management Actions for Chlorobenzenes	**Goal**
Approval of Risk Management Strategy	Summer/Fall 2004
Beginning of stakeholder consultations	Winter 2005
Publish proposed *Prohibition of Certain Toxic Substances Regulations, 2005* in *Canada Gazette* Part I	Summer 2005
Publish final *Prohibition of Certain Toxic Substances Regulations, 2005* in the *Canada Gazette* Part II	Summer 2006

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