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VIRTUAL ELIMINATION OF POLLUTION FROM TOXIC SUBSTANCES

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VIRTUAL ELIMINATION OF POLLUTION FROM TOXIC SUBSTANCES

INTRODUCTION

"Virtual elimination" is a goal that is applied to the prevention of pollution from toxic chemicals, but it seems to have no generally accepted meaning. It appears in a number of different contexts and is applied in various different ways, making it a difficult concept to understand.

For example, generally speaking it applies to the reduction of emissions (releases) of persistent toxic substances; but the idea of applying it also to the removal of these chemicals from the environment after release often occurs during discussions of virtual elimination. There are also different criteria for defining persistence. The prohibition of use is a powerful tool for achieving virtual elimination, but is not always practicable and, in the case of the *Canadian Environmental Protection Act 1999*, is a separate legal concept from virtual elimination, which leads to some confusion regarding how the Act is implemented.

This paper explores the origins of the concept of virtual elimination and the various ways in which it is defined and implemented.

ORIGINS OF THE CONCEPT

The origins of the concept of virtual elimination are unclear, but it seems to have first appeared during final closed negotiations leading to the 1978 update to the 1972 Great Lakes Water Quality Agreement (GLWQA) between the United States and Canada.(1) The Agreement states:

> … it is the policy of the Parties that:
>
> (a) The discharge of toxic substances in toxic amounts be prohibited and the discharge of any or all persistent toxic substances be virtually eliminated … .

(1) Lee Botts and Paul Muldoon, *The Great Lakes Water Quality Agreement: Its Past Successes and Uncertain Future*, Hanover [New Hampshire], November 1996.

The GLWQA was further amended by protocol in 1987, which strengthened the commitment to virtual elimination.

The fundamental document underlying cooperative management of the Great Lakes (as well as other boundary waters) is the Boundary Waters Treaty of 1909[(2)] (BWT), which states under Article IV:

> It is further agreed that the waters herein defined as boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other.

The BWT is also the legal basis for the International Joint Commission (IJC), which was set up under Article III to approve projects that would alter the natural flows and levels of boundary waters. Under the GLWQA, the Commission's mandate was widened and it was given specific powers, responsibilities and functions to assist in the implementation of that mandate. One of the Commission's functions is to report biennially on progress toward the objectives of the GLWQA.

DEFINING VIRTUAL ELIMINATION

By its Fifth Biennial Report to the Parties (1990), the IJC had become very concerned about the problem of toxic chemicals in the Great Lakes, and it urged the Parties to "take every available action to stop the inflow of persistent toxic substances into the Great Lakes environment."

In 1991, the Commission set up a Virtual Elimination Task Force to investigate the requirement of the amended Great Lakes Water Quality Agreement to virtually eliminate the input of persistent toxic substances into the Great Lakes Basin. In particular, the Commission asked the Task Force to provide advice on the contents and implementation of a virtual elimination strategy. The Task Force delivered an interim report in July 1991 and submitted its final report in August 1993.

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(2) *Treaty between the United States and Great Britain relating to boundary waters, and questions arising between the United States and Canada*.

In its charge to the Task Force, the IJC requested a definition of key terminology, including "persistent toxic substance," "zero discharge," and "virtual elimination." The Task Force did not provide specific wording for a definition of virtual elimination. Instead it offered some observations and conclusions as well as a set of guiding principles regarding virtual elimination. The Task Force concluded that to develop a strategy that was "necessary and right," the presence of persistent toxic substances had to be evaluated in addition to inputs into the Great Lakes Basin. This terminology differs from the policy statement in the GLWQA, which specifically refers to "discharge." The following are some of the observations made by the Task Force regarding virtual elimination (emphasis in the original):(3)

- Virtual elimination is an overall **strategy** that requires different approaches – some preventive, some remedial – to control or eliminate different inputs and *in situ* contamination.

- The virtual elimination strategy must apply to **all sources –** point and nonpoint – from **all media.**

- The virtual elimination strategy must apply to new potentially persistent toxic substances that may be created, as well as existing persistent toxic substances.

- The virtual elimination strategy also must apply to persistent toxic substances **already present** in the Great Lakes Basin Ecosystem. Once persistent toxic substances have been released into the ecosystem, it is not practical to completely remove them, especially from the open waters or the bottom sediments of the lakes, or from groundwater contaminated, for example, by leaking landfills. Therefore, the qualifier "virtual" is appropriate as applied to eliminating the presence of persistent toxic substances from the ecosystem.

- The virtual elimination strategy must **prevent** the deliberate input of any additional quantities of persistent toxic substances to the ecosystem. Given our technological capability to measure lower and lower concentrations of contaminants in the ecosystem, virtual elimination of existing persistent toxic substances may never be zero. Rather, the strategy challenges **us** to continuously strive to reduce the amount entering the environment, en route to fulfilling the Agreement's virtual elimination obligation.

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(3) Virtual Elimination Task Force, *A Strategy for Virtual Elimination of Persistent Toxic Substances (Volume 1)*. Presented to the International Joint Commission, Windsor, Ontario, August 1993.

The two main principles outlined in the Task Force's report were a) anticipation and prevention and b) remediation, treatment, and control. With regard to anticipation and prevention, it was stressed that the production and use of the most toxic persistent chemicals must be phased out (sunsetted)T[(4)] according to a negotiated but strict timeline.

The principle of remediation, treatment and control stressed that action is necessary to treat and control persistent toxic chemicals while they are being virtually eliminated, and that such chemicals already present in the Great Lakes must be addressed in addition to prevention and sunsetting actions.

Eight other principles were outlined, stating that the virtual elimination strategy should:

- adopt a precautionary principle;[(5)]
- address the complete life cycle of targeted chemicals;
- apply to all sources and pathways;
- apply to all media (air, land and water);
- apply globally;
- require use of the principle of reverse onus;[(6)]
- involve all stakeholders; and
- apply risk management to proposed response options.

The IJC's Sixth Biennial Report stated, in summary, that:

> … it can never be said that we can totally halt the input of persistent toxic substances into the system, or totally eliminate them. But humans can control what they do, so we can say that there should be –

(4) The IJC's *Sixth Biennial Report on Great Lakes Water Quality* (1992) defined sunsetting as a "comprehensive process to restrict, phase out and eventually ban the manufacture, generation, use, transport, storage, discharge and disposal of a persistent toxic substance" (p. 25).

(5) "Where there are threats of serious, cumulative, and/or irreversible damage, an incomplete understanding of the underlying science and an inability to arrive at a precise risk assessment value should not be used as a reason to postpone measures to prevent environmental degradation and to sustain the ecosystem resource" (Virtual Elimination Task Force (1993)).

(6) "The producer, user, or discharger of a substance bears the responsibility to demonstrate that neither the substance nor its degradation products or any byproducts are likely to pose a threat to the ecosystem" (*ibid*.).

> and shall be – zero discharge,(7) or input, of persistent toxic substances as a result of human activities. Seen in this light, the Commission believes that virtual elimination is the necessary and reasonable goal, and zero discharge, or nil human input, is the necessary and not unreasonable tactic for achievement of the virtual elimination strategy.(8)

THE BINATIONAL STRATEGY

The IJC's Seventh Biennial Report adopted the Task Force's work *in toto* and further recommended that:

> Governments adopt a specific, coordinated binational strategy within two years with a common set of objectives and procedures for action to stop the input of persistent toxic substances into the Great Lakes environment, using the framework developed by the Virtual Elimination Task Force.(9)

In response, the governments of Canada and the United States began negotiations toward a binational strategy. The Canada–United States Strategy for the Virtual Elimination of Persistent Toxic Substances in the Great Lakes Basin was signed on 7 April 1997. The Binational Strategy provided a framework for actions to reduce or eliminate persistent toxic substances, especially those that bioaccumulate, from the Great Lakes Basin.

The Binational Strategy established reduction "challenges" or targets for an initial list of persistent toxic substances targeted for virtual elimination: aldrin/dieldrin, benzo(a)pyrene, chlordane, DDT, hexachlorobenzene, alkyl-lead, mercury and its compounds, mirex, octachlorostyrene, PCBs, dioxins and furans, and toxaphene. It recognized that the goal of virtual elimination was long-term and therefore provided a framework for what the Parties described as "quantifiable reduction 'challenges' in the timeframe 1997 to 2006 for specific toxic

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(7) "Zero discharge means just that: halting all inputs from all human sources and pathways to prevent any opportunity for persistent toxic substances to enter the environment as a result of human activity. To prevent such releases completely, their manufacture, use, transport and disposal must stop; they simply must not be available. Thus, zero discharge does not mean less than detectable. It also does not mean the use of controls based on best available technology, best management practices, or similar means of treatment that continue to allow the release of some residual chemicals" (IJC (1992), pp. 16-17).

(8) *Ibid*., p. 17.

(9) IJC, *Seventh Biennial Report Under the Great Lakes Water Quality Agreement of 1978*, 1994 (Recommendation 3).

substances."[10] The challenge reductions, therefore, do not amount in and of themselves to virtual elimination but are interim goals toward that end.[11]

In Canada, the federal government and the Government of Ontario cooperate toward achieving the goals of the GLWQA through the Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA).

THE TOXIC SUBSTANCES MANAGEMENT POLICY

Between September 1994 and April 1995, the federal government held consultations toward developing a policy for managing toxic substances based on two discussion documents: *Towards a Toxic Substances Management Policy for Canada* and *Criteria for the Selection of Substances for Virtual Elimination*. The resulting Toxic Substances Management Policy (TSMP) was finalized in 1995.

The key management objectives as described in the Policy's Executive Summary are:

- virtual elimination from the environment of toxic substances that result predominantly from human activity and that are persistent and bioaccumulative (referred to in the policy as Track 1 substances); and

- management of other toxic substances and substances of concern, throughout their entire life cycles, to prevent or minimize their release into the environment (referred to in the policy as Track 2 substances).

The TSMP therefore has as its cornerstone the concept of virtual elimination. The Policy differs somewhat from the Binational Strategy and the Task Force's strategy as it explicitly excludes naturally occurring elements such as mercury, which is targeted under the Binational Strategy, from virtual elimination. It also targets for virtual elimination exclusively substances that meet the criteria for persistence *and* capacity to bioaccumulate (Track 1 substances). While the other strategies stressed that bioaccumulation was a particular concern, the goal was to target persistent and toxic substances for virtual elimination.

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(10) United States Environmental Protection Agency, "Great Lakes Binational Toxics Strategy," http://www.epa.gov/glnpo/p2/bnsintro.html, accessed 20 July 2006.

(11) For a detailed analysis of the parties' progress toward achieving their challenges, see *Great Lakes Binational Toxics Strategy: Assessment of Level 1 Substances*, December 2005, http://binational.net/ bns/2005/index.html.

The Policy outlines the criteria by which a substance is identified as persistent and bioaccumulative. These criteria differ from those recommended by the IJC and from those used in the 2001 Stockholm Convention on Persistent Organic Pollutants (POPS Convention). The IJC recommended that persistence be defined as

> all toxic substances: with a half-life in any medium – water, air, sediment, soil or biota – of greater than eight weeks, as well as those toxic substances that bioaccumulate in the tissue of living organisms.

Note that the IJC recommended that evidence for bioaccumulation be embedded in the definition of persistence, rather than having it as a separate and additional requirement for targeting for virtual elimination.

The POPS Convention defines persistence as a half-life of two months in water, six months in soil or six months in sediment. The GLWQA agreed to a definition of eight weeks in water. The TSMP definition raised these thresholds and requires a half-life of six months in water or a year in sediment or six months in soil in addition to meeting bioaccumulation criteria. These criteria agree with those of the Canadian Council of Ministers of the Environment (CCME) in its 1998 document *Policy Statement for the Management of Toxic Substances*. The TSMP and the CCME criteria were subject to public consultation, which were likely similar processes.

According to the TSMP, virtual elimination is to be achieved through pollution prevention strategies to prevent the measurable release of a Track 1 substance from domestic sources, in addition to allowing for remediation of substances already present in the environment. This is similar to the conclusion of the Task Force report, which also examined substances already present in the environment. One of the key words here is “measurable.” The Policy goes on to state:

> Measurable release limits will be developed as appropriate for a Track 1 substance to allow verification that no measurable release has been achieved and to allow enforcement of any regulations that may be developed. Limits will be based on the lowest concentration of a substance that can be accurately detected and quantified using sensitive but routine analytical methods.

The development of measurable release limits associated with substances was also specified in the *Canadian Environmental Protection Act 1999.*

VIRTUAL ELIMINATION AND THE *CANADIAN ENVIRONMENTAL PROTECTION ACT 1999*

The *Canadian Environmental Protection Act 1999* (CEPA 1999) gave a legislative basis to virtual elimination as outlined in the TSMP. Section 77(4) of CEPA 1999 makes virtual elimination mandatory:

> (4) Where the Ministers [i.e., the federal ministers of Environment and Health] propose to take the measure referred to in paragraph (2)(*c*) in respect of a substance and the Ministers are satisfied that
>
> (*a*) the substance is persistent and bioaccumulative in accordance with the regulations,
>
> (*b*) the presence of the substance in the environment results primarily from human activity, and
>
> (*c*) the substance is not a naturally occurring radionuclide or a naturally occurring inorganic substance,
>
> the Ministers shall propose the implementation of virtual elimination under subsection 65(3) of the substance.

Virtual elimination is defined in section 65(1) as meaning:

> … in respect of a toxic substance released into the environment as a result of human activity, the ultimate reduction of the quantity or concentration of the substance in the release below the level of quantification specified by the Ministers in the [Virtual Elimination] List referred to in subsection (2).

Thus the definition in the Act is closer to that of the GLWQA, which referred to virtual elimination of discharges, and not substances already present in the environment. Section 65 further describes how virtual elimination is to be implemented:

> (2) The Ministers shall compile a list to be known as the Virtual Elimination List, and the List shall specify the level of quantification for each substance on the List.
>
> (3) When the level of quantification for a substance has been specified on the List referred to in subsection (2), the Ministers shall prescribe the quantity or concentration of the substance that may be released

> into the environment either alone or in combination with any other substance from any source or type of source, and, in doing so, shall take into account any factor or information provided for in section 91, including, but not limited to, environmental or health risks and any other relevant social, economic or technical matters.

In practice this means that for a substance to be targeted for virtual elimination under CEPA 1999, a level of quantification must first be determined. In addition, the prescribed quantity allowed will be determined based on a number of factors, including economic and technological realities.

To date no substance has been targeted under CEPA 1999 for virtual elimination, and only one proposed, hexachlorobutadiene. Thus, while the Government of Canada partners with the governments of the United States and Ontario to virtually eliminate a list of agreed-on substances specified in the GLWQA and Binational Strategy,[(12)] it has not used section 65 of CEPA 1999 to do so.

COMMENTARY

Virtual elimination aims to reduce the level and risk associated with persistent and toxic substances to minimal levels. The goal is to be achieved using a number of tools.

In practice, banning the use, manufacture and importation of a substance is the most effective way to achieve virtual elimination of releases. Historical releases, international sources, and releases as byproducts of processing some of these substances make virtually eliminating them from ecosystems very difficult.

Some substances do not lend themselves easily to prohibitions and are therefore better phased out in an incremental fashion. The Binational Strategy clearly uses an incremental approach by setting achievable short-term targets. However, this approach will lead to virtual elimination only in as much as the targets are progressively lowered.

With respect to CEPA 1999, placing a substance on the Virtual Elimination List is mandatory for substances that the Ministers deem toxic, persistent, bioaccumulative and primarily man-made. The TSMP and CEPA 1999 both weakened the concept of virtual

(12) Some of these substances would not be targeted by CEPA 1999 as they are pesticides and therefore regulated under the *Pest Control Products Act*.

elimination somewhat by removing naturally occurring elements and substances such as mercury from the list of targeted substances and by raising recommended thresholds for defining persistence. They also target only substances that are persistent and bioaccumulative. This means that substances that are toxic and persistent but do not bioaccumulate are not targeted for virtual elimination under the Act. The GLWQA and the IJC recommendations, however, target all persistent toxic substances.

There are clearly also problems with the implementation of virtual elimination as defined by CEPA 1999. Prohibiting the use of a substance is a powerful tool toward achieving virtual elimination, but the prohibition regulations of the Act were set up in parallel to the (mandatory) requirements for virtual eliminations not as a method of achieving it. The Virtual Elimination List also requires that Levels of Quantification be identified before a substance can be added to the list. The fact that the virtual elimination sections and the prohibition regulations are not linked, and the requirement for Levels of Quantification, have likely been major impediments to the use of section 65 of the Act.

In the end, the effectiveness of the concept of virtual elimination should be measured by the reduction of persistent toxic substances in the environment, including in humans. The GLWQA is currently up for renewal and the Parties have asked the IJC to undertake public consultations. One of the comments received stated that the concepts of virtual elimination and zero discharge were being interpreted in a manner whereby “the perfect became the enemy of the possible.”

This view reflects the discussions of the Task Force, which spent a lot of time trying to define key concepts and in the end had to remind readers of its report that “the real challenge of a virtual elimination strategy was to achieve the goal of the Agreement, which is to restore and maintain ecosystem health,” not to arrive at precise wording. Thus virtual elimination remains a relatively vaguely defined goal to reduce, on an urgent basis, the substances that pose the greatest risk to environmental and human health. Moreover, the implementation of virtual elimination is, as is explicitly stated in CEPA 1999, to take into account “any other relevant social, economic or technical matters,” and thus remains dependent on the political will to do so.