

National Pollutant Release Inventory Submittal Form - Proposal for a Modification to the NPRI -

Please complete this form to propose a modification to the National Pollutant Release Inventory (NPRI) and forward to :

Attention: Co-ordinator for Proposals for Modifications (NPRI)

Consultations and Outreach

The National Pollutant Release Inventory

Environment Canada

9th floor, Place Vincent Massey

351 St. Joseph Blvd.

Hull, Quebec,

K1A 0H3

telephone : (819) 953-1656

fax: (819) 994-3266

E-mail: npri@ec.gc.ca

- Section 1 -

Name of contact: National Pollutant Release Inventory		
Organization Name: Environment Canada		
Address: 351 St. Joseph Blvd - 9th Floor		
City: Hull	Prov/Terr: QC	Postal code: K1A 0H3
Telephone: (819) 953-1656	Fax:	E-mail: npri@ec.gc.ca
<i>Please indicate the details of the proposal:</i>		
Modification Requested (X)	Substance Name & CAS # (if applicable)	Other (e.g. suggested threshold, reporting condition, other)
Addition of Substance	<input checked="" type="checkbox"/> Thallium and its compounds	50 kg M, T,O threshold
Deletion of Substance	<input type="checkbox"/>	
Change to reporting threshold	<input type="checkbox"/>	
Change to reporting condition	<input type="checkbox"/>	
Change to reporting requirements	<input type="checkbox"/>	
Other type of Modification	<input type="checkbox"/>	
Proposed timing for the Change (proposed year for implementation): 2004		
Industry Sectors to be affected by the change:		
<ul style="list-style-type: none"> - 17 Base metal smelters, - 23 Coal-fired power plants, and - 16 Cement manufacturers. 		
(see Sources of Releases under Decision Factor 2) for additional information.		

- Section 2 -

* This section must be completed for proposals for the addition or deletion of NPRI substances.

Decision Factors¹

1. Does the substance meet the NPRI criteria, that is:

- (i) Is the substance manufactured, processed or otherwise used (M,P,O)² in Canada?
- (ii) Is the substance of health and/or environmental concern?
- (iii) Is the substance released to the Canadian environment?
- (iv) Is the substance present in the Canadian environment?

The first two criteria are intended to be absolute, in the sense that a substance must be M,P,O in Canada, and of health and/or environmental concern, to be added to the NPRI; and similarly, if these criteria are not satisfied for a substance currently on the NPRI, it should be deleted.

The third and fourth criteria indicate that there should be reasonable expectation that a substance is being or may be released into the Canadian environment in order that it be added to or retained on the NPRI. In general, however, unless there is evidence or analysis to the contrary, it can reasonably be assumed that a substance that is M,P,O in Canada is likely to be released, and therefore present, in the Canadian environment.

1. Thallium meets the original NPRI criteria, that is:

(i) The substance is manufactured, processed or otherwise used (M,P,O) in Canada. For the purposes of NPRI, the definition of M,P,O includes by-products, which is how thallium is released in most cases, which includes coal-fired power plants and smelters. (See Sources of Releases - Decision Factor 2).

(ii) The substance is of health and/or environmental concerns. Information available in the open literature indicates that thallium is one of the more toxic metals. The estimated acute lethal dose in humans is in the range of 10 mg/kg bw. The initial signs of acute thallium poisoning generally include gastrointestinal irritation, nausea, vomiting, abdominal pain and diarrhea or constipation. Several days after exposure, additional symptoms occur, including alopecia (hair loss) and effects on the central, peripheral and autonomic nervous system, such as parasthesia, retrobulbar neuritis, ataxia, delirium, tremors, hallucinations and tachycardia. Death from respiratory failure is usually preceded by convulsions and coma.

Chronic exposure to thallium in humans and animals results in alterations of the brain, spinal cord and peripheral nerves. In both humans and animals, alopecia is the most common indicator of long-term thallium poisoning. In animal studies, thallium compounds produced testicular effects in male rats and slight fetotoxicity and significant impairment of learning ability in the offspring of treated female rats.

The United Nations Environment Program/International Labour Organization/World Health Organization jointly sponsored International Program on Chemical Safety (IPCS) published in 1996, an Environmental Health Criteria Monograph (EHC 182), along with the associated Health and Safety Guide (HSG 102), and both of which can be obtained from the attached link:

<http://www.inchem.org/documents/ehc/ehc182.htm>.

¹ These decision factors are applicable to candidate substances at both 10-tonne and alternate thresholds.

² For the purposes of the NPRI, the definition of M,P,O includes by-products. A by-product is an NPRI substance that is incidentally manufactured, processed or otherwise used at a facility and is released to the environment and transferred off site for disposal.

The following excerpt is from EHC 182:

“ The atmospheric emissions from industrial sources (e.g., cement plants using thallium-containing pyrite) have resulted in increased concentrations of thallium in biological samples (e.g., urine and hair) from the population living in the vicinity. A relationship was found between thallium concentrations in urine and hair and the prevalence of symptoms possibly indicating early health effects of thallium. The limited available data are not sufficient for determining an acceptable limit for emissions.”

The health concerns of thallium are supported by the fact that it is listed on the U.S. Toxics Release Inventory, which infers that the substance has met the U.S. EPA toxicity screening criteria.

Thallium is an environmental concern as well: The CCME Environmental Quality Guideline for Thallium (Aquatic, Freshwater) is 0.8 ug/L. Here are some other CCME Guidelines for comparison:

Arsenic - 5.0 ug/L
Mercury - 0.1 ug/L
Lead - 1 to 7 ug./L

This shows that thallium is similar in toxicity to some of the other heavy metals and therefore merits similar treatment in terms of alternate thresholds. Arsenic, lead and mercury are all reported in the NPRI at 50 kg with a 0.1% concentration threshold. (See Section 3 on ATH discussion)c.

(iii) Thallium would be released to the Canadian environment by the sources as indicated in Sources of Releases - Decision Factor 2.

(iv) Thallium is reasonably expected to be present in the Canadian environment. Besides that of natural processes, concentrations of thallium in certain parts of the environment might be elevated because of anthropogenic activities and releases.

2. *Do facilities contribute significant releases of the substance?*

There are various ways in which ‘significant’ can be characterized. The concept relates not only to the proportionate quantity of a substance released by NPRI reporting facilities, but also to the potential for health or environmental impacts. In other words, even if facilities do not account for a major proportion of total releases, facility releases may nonetheless be significant depending on such factors as location, timing, concentration, and the hazard associated with the substance.

2. Facilities do contribute significant releases of thallium to the environment.

Sources of Releases of Thallium and Thallium Compounds

Thallium is a soft and malleable heavy metal with a bluish-white colour. Thallium is a naturally occurring element, and is produced and used industrially only in small quantities (in 1987 and 1988 worldwide production was about 17 tonnes; in 1991 world-wide industrial consumption was 10 to 15 tonnes).

Thallium is used mostly in manufacturing electronic devices, switches, and closures, primarily for the semiconductor industry. It also has limited use in the manufacture of special glasses. Another important field of application is the use of radioisotopes in medicine for scintigraphy and the diagnosis of melanoma.

Thallium found in the environment can be either naturally occurring (which is beyond the scope of this discussion paper and the purposes of NPRI), or released through human activities. While thallium is not used on a large scale in industry, there could be significant releases of thallium into the environment around mineral smelters, coal-fired power plants, brick-works and cement plants using thallium-enriched pyrite. It is a trace contaminant of the raw materials and is contained in the flue dusts.

Data retrievals from the U.S. Toxics Release Inventory confirm the literature findings about these anthropogenic sources of releases of thallium. In 2000, there were 62 reports to account for the total on-site releases of thallium and thallium compounds at about 3.9 million pounds, and the bulk of the release quantities came from mining-smelter complex facilities and electric power plants, as shown in Table 1 below:

TABLE 1 - RELEASES OF THALLIUM AND THALLIUM COMPOUNDS (IN POUNDS) BY INDUSTRY IN THE U.S. FOR YEAR 2000

Industry	# Reports	Air Emissions	Surface Water Discharges	Underg.Injection	Releases to Land	Total
Releases						
28 Chemicals	3	1	-	-	-	1
32 Stone/Clay/Glass	1	2	-	-	-	2
33 Primary Metals	9	1947	342	-	178510	180799
No Reported Codes	10	-	-	-	1	1
Original industry subtotal		1950	342	-	178511	180803
10 Metal Mining	4	111	250	0	2757280	2757641
12 Coal Mining	8	-	0	-	24856	24856
49 Electric Utilities	23	9723	2043	-	589078	600844
4953/7389 RCRA/ Solvent Recovery	4	1124	-	-	293180	294304
New industry subtotal		10958	2293	0	3664394	3677645
Total		12908	2635	0	3842905	3858448

If the data results of the U.S. Toxics Release Inventory are any indication, then the releases of thallium from the similar Canadian facilities could be significant. The recent problems of exposure to workers at the Teck-Cominco smelter in Trail, B.C. provide an example of this reality.

3. Does inclusion of the substance support one or more of the objectives of NPRI?

The following are the NPRI objectives:

- To identify priorities for action
- To encourage voluntary action to reduce releases
- To allow tracking of progress in reducing releases

- To improve public understanding
- To support targeted regulatory initiatives

3. Inclusion of thallium does support some of the objectives of the NPRI. This will encourage voluntary action to reduce releases, allow tracking of progress in reducing releases, and improve public understanding. More specifically, it will allow for monitoring releases of thallium around industrial point sources, such that the citizens residing in the surrounding area can obtain accurate information regarding releases in their community and take action if those industrial point source releases reach a critical levels.

4. *Is the substance reported elsewhere? Or if it is reported elsewhere, is there nonetheless additional value in reporting to the NPRI?*

If a substance is reported elsewhere, the value of adding it to the NPRI, or of deleting it from the NPRI, would be considered in relation to whether:

- The information on the substance is as readily available to the public as it would be through the NPRI;
- The information is available at the facility level;
- The information is comparable in terms of quality and comprehensiveness as that required by the NPRI; and
- The type of data is comparable (e.g., absolute quantities versus concentration).

If a substance that is reported elsewhere is to be included or retained on the NPRI list, to the greatest extent possible, efforts will be made to consolidate reporting under the NPRI (assuming potential compatibility of data requirements)³.

4. Thallium is not reported elsewhere in a consistent and an accessible manner.

³ In sum, the NPRI is recognised as a key national emissions database; and where a substance falls within the NPRI's mandate, efforts will be devoted to ensuring a single window approach through the NPRI.

5. *Is the substance already on the NPRI in some form? If it is already on the NPRI in some form, is there nonetheless additional value in including it in another form?*

When considering adding a substance in another form (e.g., tetraethyl lead as a separate listing from lead and its compounds), the potential for double-counting will be avoided. For example, a compound will not be both listed as an individual substance, and included as part of an aggregate category. To the extent possible, substances will be listed with their Chemical Abstracts Registry (CAS) numbers.

5. Thallium is not on the NPRI in some other form.

Recommendations

Thallium meets all the decision factors for consideration as a substance for addition to the NPRI.

References

1. Toxics Release Inventory 2000 Data. U.S. Environmental Protection Agency.
2. Agency for Toxic Substances and Disease Registry (ATSDR) - Public Health Statement for Thallium. July, 1992.
3. Thallium: an environmental concern?
<http://www.nwri.ca/talk-green/thallium.html>
4. Borges, T. And Daugherty, M. 1994. Toxicity Summary for Thallium. Oak Ridge National Laboratories, Tennessee.
5. Chang, L. 1996. Toxicology of Metals. Lewis Publishers, N.Y.
6. Goyer, R. Toxic Effects of Metals. In: Casarett and Doull's Toxicology, The Basic Science of Poisons, Curtis Klassen 5th ed. (1996)

- Section 3 -

* This section must be completed for proposals for a change to the reporting threshold of a NPRI substance.

EC/NPRI believes that the conventional 10-tonne threshold would not meet the reporting needs for thallium; the substance must be listed at an alternate threshold (ATH). This requirement is reinforced when based on the four decision factors as set forth in the Draft Framework for Listing of Alternate Threshold Substances in the National Pollutant Release Inventory (February, 2002).

Decision Factor 1: Existence of a science-based justification.

While there is still much debate as to what constitutes an acceptable science-based justification (a guideline is still under development on when the hazard is high enough to truly warrant a lower reporting threshold for a substance), thallium can now at least be considered as a Category 2 substance designated for an ATH listing. This is because the substance has been determined to pose a hazard or risk to the environment or human health by at least one credible program using accepted screening level criteria, and in this case it is the U.S. EPA Toxics Release Inventory Program, the International Program on Chemical Safety (**IPCS**). Furthermore, CCME has developed a Freshwater Water Quality Guideline for the Protection of Aquatic Life for thallium at a level similar to mercury and lead, both of which are listed for NPRI at ATH.

Decision Factor 2: Costs and benefits of listing at an ATH, to the community, reporters and program administrators.

While the information is lacking on the detailed cost/benefit assessment (there is no legal requirement for a full-scale socio-economic cost/benefit analysis of an ATH substance listed for the NPRI), nevertheless, the resultant resource requirements for the NPRI and reporting facilities are expected to be manageable for the new listing of thallium at an ATH. This is because only a limited number of sectors or facilities (mainly the 23 coal-fired power plants, 17 base metal smelters, and 16 cement plants) would be required to report. The perceived benefits would include the provision of information on the release of thallium on a national basis that has not been available.

Decision Factor 3: Capability of reporting facilities to provide the required information at an ATH.

The impacted reporters are generally large facilities that would most likely have the resources and knowledge to handle the ATH reporting criteria determination, and to estimate their releases and transfers. Furthermore, the development of the LEAF spectrophotometer by the NWRI (see the Background Section) and its utilization could aid in the interpretation of data gathered for thallium by the reporting facilities.

Decision Factor 4: Significance of the release from reporting facilities

The need for an ATH is evident when the nature of the substance is that its small releases may be of more significance locally or regionally than on a national basis. This is typically true for the thallium releases as contributed by its major sources within small communities.

Because thallium is primarily a contaminant in a commercial chemical or product (See Sources of Releases under Decision Factor 2), and is not an incidentally manufactured substance, a "manufactured, processed, or otherwise used" (MPO-ATH type) reporting threshold can be adopted among the three different types of alternate threshold available: MPO thresholds, release-based thresholds, and activity-based thresholds.

Based on a limited internal data analysis for the power plants, the provision of historical data on thallium levels in the Columbia River by one smelter, and the reported annual thallium emissions by another smelter, EC/NPRI has determined that the threshold value of 50 kg would allow the capture of thallium reporting from these facilities (with the exception of one power plant). Given the fact that these are the major sources (facilities) of thallium releases in Canada, it is believed that the 50 kg threshold would be low enough to capture the other releases for the targeted capture rate of 80% to 90%.

Conclusions and Recommendations

Thallium (and its compounds) meets all the decision factors as a substance listed for NPRI. In addition, it meets the four assessment criteria for consideration as an ATH substance. It is proposed that an appropriate quantitative ATH level for the reporting of thallium (and its compounds) be established at 50 kg.

Rather than removing the 1% concentration exemption or lowering to 0.1% as done for the other heavy metals, it is proposed to maintain the concentration limit for threshold determination for commercial products at 1% for thallium and its compounds. This will be consistent with the WHMIS disclosure requirements for the substance.

As a reporting rule for substances with alternate thresholds, the reportable unit of release quantity for thallium and thallium compounds should be expressed in kilograms instead in tonnes.

Prepared by Wilf Jan

April 2003