Environment International 75 (2015) 1–10

Contents lists available at ScienceDirect

Environment International

journal homepage: www.elsevier.com/locate/envint

Interpretation of the source-specific substantive control measures of the Minamata Convention on Mercury

Mingqing You

Zhongnan University of Economics and Law, Hubei Water Affairs Research Center, 182 South Lake Avenue, East Lake High-Tech Development Zone, Wuhan 430073, China

ARTICLE INFO

Article history:
Received 25 November 2013
Accepted 28 October 2014
Available online 12 November 2014

Keywords:
Minamata Convention
Mercury
Source-specific
International environmental regime

ABSTRACT

Being persistent, toxic, and bio-accumulative, Mercury (Hg) seriously affects the environment and human health. Due to Hg's attribute of long-range environmental transport across national borders, especially through atmospheric transport, no country can fully protect its environment and human health with its own efforts, without global cooperation. The Minamata Convention on Mercury, which was formally adopted and opened for signature in October 2013, is the only global environmental regime on the control of Hg pollution. Its main substantive control measures are source-specific: its phasing-out, phasing-down, and other main substantive requirements all direct to specific categories of pollution sources through the regulation of specific sectors of the economy and social life. This Convention does not take a national quota approach to quantify the Parties' nationwide total allowable consumption or discharge of Hg or Hg compounds, nor does it quantify their nationwide total reduction requirements. This paper attempts to find the underlying reasons for this source-specific approach and offers two interpretations. One possible interpretation is that Hg might be a non-threshold pollutant, i.e., a pollutant without a risk-free value of concentration. The existence of a reference dose (RfD), reference concentration (RfC), provisional tolerable weekly intake (PTWI), minimal risk level (MRL) or other similar reference values of Hg does not necessarily mean that Hg cannot be regarded as non-threshold because such reference values have scientific uncertainties and may also involve policy considerations. Another interpretation is that Hg lacks a feasibly determinable total allowable quantity. There is evidence that negotiators might have treated Hg as non-threshold, or at least accepted that Hg lacks a feasibly determinable total allowable quantity: (1) The negotiators were informed about the serious situations of the current emissions, releases, and legacy deposition; (2) the UNEP Secretariat took the position that Hg is non-threshold and should be eliminated to the maximum; (3) European countries, the USA and other western countries were in a better position to regard Hg as non-threshold and push forward a global reduction of Hg emissions and releases to the minimum; (4) the negotiators took the Stockholm Convention on Persistent Organic Pollutants (POPs) as a model; and (5) a fairly large number of non-governmental organizations (NGOs) were organized under umbrella NGO networks such as the Zero Mercury Working Group (ZMWG) and the International POPs Elimination Network (IPEN) and made a significant contribution to the negotiation process. The interpretations for the Minamata Convention might similarly be used to interpret the source-specific approach of the Stockholm Convention on POPs and the national quota approach of global environmental regimes on stratospheric ozone and climate mitigation. These two interpretations focus on the features of the pollutants and for this reason may be useful for future negotiators of other international environmental treaties to select appropriate models. They also suggest that the source-specific approach may be adopted in the future for pollutants with similar features of being possibly non-threshold and without a feasibly determinable total allowable quantity.

1. Introduction

Mercury (Hg) is a persistent, toxic, and bio-accumulative heavy metal. It exists in the environment as elemental mercury (Hg^0) and various inorganic and organic forms. Methylmercury (MeHg) can biomagnify in the aquatic food web to levels that are up to one million times above the MeHg concentration in the surrounding water (Lambert et al., 2012). Predator fish and sea mammals are more likely to have higher MeHg concentrations. MeHg is estimated to account for 75–100% of total Hg in seafood (Japan FSC, 2005; WHO, 2003). MeHg can also bio-accumulate in rice if the paddy field is Hg-polluted (Feng et al., 2008; Lin et al., 2012; Zhang et al., 2010a,b). Hg can lead to serious adverse effects on the environment and human health. It can damage the central nervous system, thyroid, kidneys, lungs, immune systems and many other parts of the human body, even the human genes (Al Bakheet et al., 2013; UNEP, 2013b; US ATSDR, 1999). The food chain is the main route of exposure for human beings. Prenatal MeHg exposure

---

E-mail addresses: mingqing.you@fulbrightmail.org, hahamq@163.com.

http://dx.doi.org/10.1016/j.envint.2014.10.023

also occurs through maternal ingestion of Hg-contaminated rice, fish, and other aquatic foodstuff during pregnancy (Rothenberg et al., 2013). Currently there are still scientific uncertainties as to the adverse health effects of Hg. Further research may reveal that Hg can cause other adverse health effects by itself or in combination with other substances. Many countries list Hg as a toxic substance, for example, the United States Environmental Protection Agency (US EPA) (US EPA Website) classifies it as a persistent bio-accumulative and toxic (PBT) chemical.

Hg and its various compounds naturally exist in the environment but they are also emitted or released to the environment as a result of human activities. Although anthropogenic emissions and releases took place quite early in human history, the speed accelerated and the quantity increased significantly since the Industrial Revolution, with a slight decrease in some regions recently (Schuster et al., 2002; UNEP, 2013a). Anthropogenic emissions have been the driver for rising Hg emissions in the last ~200 years. The total annual Hg emissions to the atmosphere have been estimated to range from 5500 to 8900 t/year, of which only about 80–600 t/year, or about 10%, is estimated from natural sources while about 30% is estimated from anthropogenic sources and about 60% from re-emissions. The leading sectors contributing to the anthropogenic sources of emissions are estimated to be artisanal and small-scale gold mining (ASGM) and coal burning, which are followed by the primary production of non-ferrous metals (Al, Cu, Pb, Zn) and cement production. Although not all re-emissions should be traced back to human activity, human activity has nevertheless resulted in higher level of re-emission by increasing the environmental burden of Hg (AMAP/UNEP, 2013; UNEP, 2013a). As a result of anthropogenic emissions and releases, currently approximately 50% of Hg in the environment is from anthropogenic sources (Carpi, 1997; Mason and Sheu, 2002). This percentage is higher for Arctic areas, where an average of 92.4% of present-day Hg in wildlife is likely to be of anthropogenic origin (AMAP, 2011). Without global cooperation, the global total Hg emissions and releases will increase in the future, but disproportionately among different countries and regions, and among different sectors of the economy and social life (E.G. Pacyna et al., 2010; J.M. Pacyna et al., 2010; Rafaj et al., 2013; UNEP, 2013a).

Hg pollution is an international issue. Once entering the environment, Hg cycles between major environmental compartments and across national boundaries on a global scale for a long time (AMAP/UNEP, 2013; Lindberg et al., 2007). The atmospheric transport of Hg is rapid and the time scale for global mixing of the troposphere is estimated to be only about 1 year, limited principally by the exchange of air between the two hemispheres (Driscoll et al., 2013). Recent modeling studies suggest that a range of 10–80% of the Hg deposited to the United States is from domestic anthropogenic sources (depending on location), with an average of ~30% for the country as a whole, while the rest is derived from natural sources, foreign anthropogenic emissions, and the active legacy pool (National Research Council, 2010; Seigneur et al., 2004; Selin et al., 2007). Hammerschmidt and Fitzgerald (2006) suggest that reduction in anthropogenic Hg emissions to the atmosphere may result in proportionately lower levels of MeHg in aquatic organisms, including fishes consumed by humans. However, this suggestion is more applicable to the general trend within a large geographic area than the immediate change of a specific place. Because of legacy Hg deposition, the complex transport and cycling of Hg in the environment, and other reasons, a reduction in anthropogenic Hg emissions and releases does not necessarily lead to an immediate comparable reduction of Hg concentration in the environment and fish (Southworth et al., 2011; UNEP, 2013b). For example, there is a trend of increasing Hg concentration in some marine species in Canada and West Greenland despite reductions of the North American anthropogenic emissions (AMAP, 2011). Therefore, no country can fully protect its environment and human health with its own efforts and global cooperation is essential. In addition, international regulation is also needed to reduce the use of Hg for ASGM, one of the most highly toxic uses of Hg that disproportionately impacts developing countries (Davies, 2014).

The Minamata Convention on Mercury, which was finalized in January 2013 and formally adopted and opened for signature in October 2013, is expected to contribute significantly to the protection of health and the environment but will also inevitably lead to substantial economic and social costs in its implementation. The existing literature on this Convention is still insufficient and more research is needed on the implications of this Convention. Before the finalization of the text of this Convention, some authors advocated for cross-scale governance of Hg pollution at the global, regional, and local levels, including the options to address Hg pollution at the global level with a binding legal agreement or voluntary partnership (Selin and Selin, 2006), or discussed the knowledge-, power-, and interest-based instrumental leadership in adopting the legally binding approach to control Hg pollution (Andresen et al., 2013). After the text of the Minamata Convention was finalized in January 2013, Kessler (2013) acclaimed the Minamata Convention as a first step towards the control of Hg pollution after making a comprehensive review of the source of Hg and the negotiation process, but others are concerned with its insufficiency in controlling Hg pollution from dental amalgam or its weak restraint on industry (Mackey et al., 2014; Ngim and Ngim, 2013; Ottersen et al., 2014). As to the social and economic costs of regulating Hg, some authors discussed the implications of this Convention on ASGM, fish consumption, vaccine, and the teaching of dentistry (Clifford, 2014; Davies, 2014; Larson, 2014; Lynch and Wilson, 2014), though there is also much research on the benefits of regulating Hg (e.g., Amos et al., 2013; J.M. Pacyna et al., 2010; Sundseth et al., 2010; Swain et al., 2007; Trasande and Liu, 2011). Still other authors mentioned this Convention when discussing other issues. For instance, Söderholm (2013) mentioned the finalized text when comparing the positive list approach and the negative list approach of multilateral environmental agreements (MEAs). Currently, to the author's best knowledge, there is an insufficiency of in-depth discussion of the approach adopted by this Convention to regulate or control the global Hg pollution. This paper reviews the negotiation process of this Convention, indicates the contribution of the science community, summarizes the main substantive control measures of this Convention, reveals the source-specific approach of the main substantive control measures, and interprets why this Convention takes such an approach. This paper is part of an attempt to classify international environmental treaties according to the features of the pollutants and environmental issues and to match different types of pollutants and environmental issues with suitable models of international environmental cooperation mechanisms. This attempt is worth trying because of its potential for the systematization of the fragmental and overlapping international environmental treaties. This paper will focus on the substantive control measures, or substantive obligations, directly related to the reduction of Hg pollution. Some procedural arrangements are discussed here when assessing the possible effectiveness of substantive arrangements. Other procedural arrangements, such as dispute settlement and institutional arrangements, are not reviewed here.

2. Negotiation process and contribution of the science community

2.1. Negotiation process

Hg pollution and its adverse effects attracted international attention since the 1970s, first in the science community but much later among political leaders. In 1998, the Executive Body of the 1979 Geneva Convention on Long-Range Transboundary Air Pollution (CLRTAP) adopted the Protocol on Heavy Metals, effective as of 29 December 2003, to control transboundary airborne pollution of Hg, lead (Pb), and cadmium (Cd). As its current members are limited to European and North American countries, the 1979 Geneva CLRTAP cannot control Hg pollution at the global level. The same is true for the Arctic Council, who is concerned with Hg pollution but cannot solve this global issue alone. In 2000, the Arctic Council (2000) expressed its concern and called