



The International  
Bromine Council

[www.bsef.org](http://www.bsef.org)

## The role of Bromine in Reducing Mercury Emissions

## THE NEED TO REDUCE MERCURY EMISSIONS

Mercury is considered by the World Health Organisation as one of the top ten chemicals or groups of chemicals of major public health concern. It is a naturally occurring element that is found in air, water and soil, but exposure to it can be toxic to human health and poses a particular threat to children and pregnant women.<sup>1</sup>

Human activity is one of the main causes of mercury releases, with the burning of coal for power generation being the biggest single source of anthropogenic emissions of mercury into the air.<sup>2</sup> Despite global decarbonisation efforts, more than 40% of the world's electricity is currently generated by coal power plants.<sup>3</sup> According to the United Nations Environmental Programme, releases from power plants and industrial boilers represent about a quarter of mercury releases to the atmosphere.<sup>4</sup>

Once mercury is released into the environment, elemental mercury may be transformed into methylmercury that bio-accumulates in the food chain, for example through fish.

*“Exposure to mercury can be toxic to human health and poses a particular threat to children and pregnant women”<sup>1</sup>*

<sup>1</sup> WHO Mercury & health fact sheet, [www.who.int](http://www.who.int)

<sup>2</sup> UNEP Global Mercury Partnership, Mercury control from coal combustion, [www.unep.org](http://www.unep.org)

<sup>3</sup> International Energy Agency, [www.iea.org](http://www.iea.org)

<sup>4</sup> UNEP Global Mercury Partnership, Mercury control from coal combustion





*"a great ecological and human tragedy in the 1950s and 60s due to uncontrolled releases of mercury into local waters"*

## THE MINAMATA CONVENTION ON MERCURY

### A GLOBAL TREATY

The Minamata Convention on mercury is a United Nations treaty that commits the international community to reducing mercury emissions and taking other measures to control the supply and trade of mercury as well as mercury-added products and manufacturing processes in which mercury is used. Its signature was the result of a global acknowledgement of the potentially adverse environmental and health impacts of mercury.<sup>5</sup> The Convention is named after the Japanese city which witnessed a great ecological and human tragedy in the 1950s and 60s due to uncontrolled releases of mercury into local waters.<sup>6</sup>

The Minamata Convention requires signatories to control and where possible reduce emissions from coal-fired power plants and industrial boilers, the production of non-ferrous metals, cement and waste incineration. In addition to controlling emissions from existing installations, signatories must use best available techniques and best environmental practices to reduce emissions from new installations as soon as practicable, but no later than five years after the entry into force of the Convention for the Party in question.<sup>7</sup>

The Convention was adopted in 2013 by delegates from over 140 countries. Today it has 128 signatories, including the European Union and 26 EU Member States. On 18 May 2017, the EU and seven Member States ratified the Convention, bringing the number of ratifications to 51, just over the 50 ratifications needed for the Convention to enter into force. The Minamata Convention will now enter into force on 16 August 2017 and the first Conference of the Parties to the Convention will take place from 24 to 29 September 2017 in Geneva.

<sup>5</sup> UNEP Booklet: Minamata Convention on Mercury, October 2013

<sup>6</sup> UNEP Newscentre: "A town, a disease, a convention: A fitting tribute for the victims of Minamata", 3 July 2017

<sup>7</sup> Article 8 of the Minamata Convention on Mercury





## BROMINE REDUCES MERCURY EMISSIONS BY 90%

Bromine-based technologies have been proven to reduce mercury emissions in a cost-effective manner.

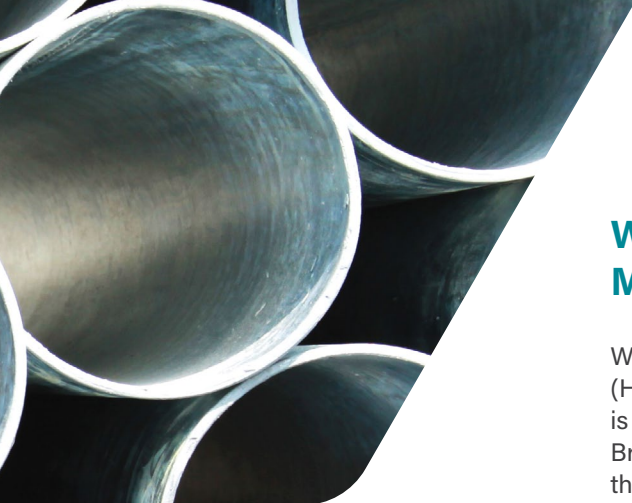
**In fact Bromine based products <sup>8</sup> can reduce mercury emissions from coal-fired power plants and other industrial installations in excess of 90% <sup>9</sup>**



*The use of bromine to reduce emissions from coal-fired and other large combustion plants is therefore a part of the solution to meeting the goals of the Minamata Convention.*

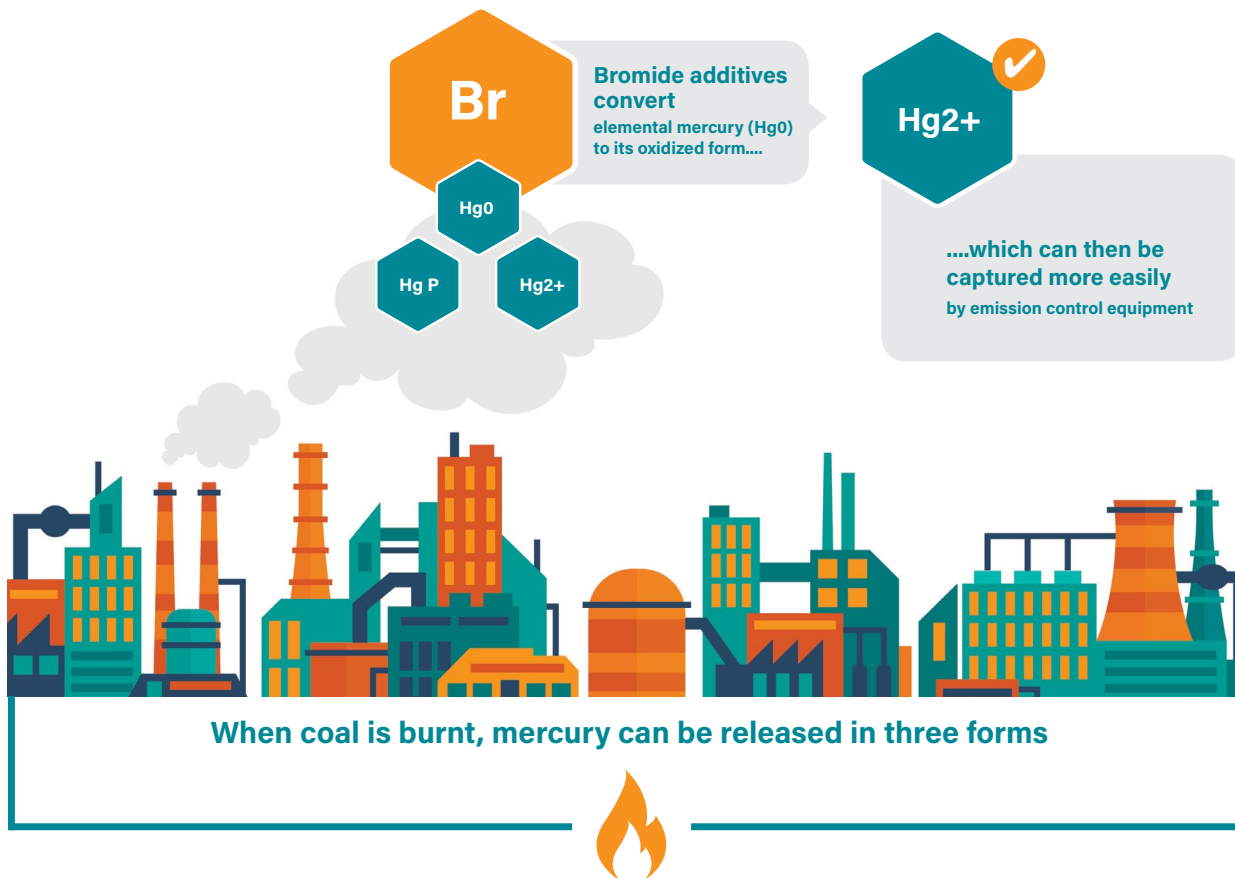
<sup>8</sup> When applied with or in combination with various mercury abatement technologies, bromine based products can, depending upon the capture technology, reduce mercury emissions from coal-fired power plants and other industrial installations far beyond 90%

<sup>9</sup> A.U.S. Government Accountability Office, 2009, Mercury Control: Technologies at Coal-Fired Power Plants Have Achieved Substantial Emissions Reductions



## WHY IS BROMINE EFFECTIVE TO COMBAT MERCURY EMISSIONS?

When coal is burned, mercury may be released in three forms: oxidized ( $\text{Hg}^{2+}$ ), particulate ( $\text{Hg P}$ ) and elemental ( $\text{Hg}^0$ ). Elemental mercury ( $\text{Hg}^0$ ) is gaseous at combustion temperatures which makes it difficult to capture. Bromide additives convert elemental mercury to its oxidized form, which can then be captured more easily by emission control equipment.



**Bromine-based compounds are versatile and can be added at different stages of the combustion process to help capture mercury:**

- ✓ to the fuel (coal)
- ✓ to the combustion chamber directly
- ✓ to the effluent gas downstream of the boiler
- ✓ to activate carbon which is injected into the effluent gas before the particulate collection device

After captured in emission control equipment, mercury compounds are carefully handled. This can be achieved in several ways. The method chosen will depend on the mercury abatement technology used as well as the type of installation.

For example, when bromine is used to capture mercury through activated carbon injection, the mercury will be removed with the fly ash that is driven out of the boiler with the flue gases. In some cases, the fly ash can be used as an aggregate in the construction industry. This is typically the case with hard coal plants, whereas the fly ash from lignite plants or waste incinerators is usually disposed of in underground mines, in accordance with the requirements of Council Directive 2011/97/EU.<sup>10</sup>

In the US, the fly ash will need to pass the Toxic Characteristic Leaching Protocol (TCLP) requirements to ensure that mercury and other heavy metals are within permissible release limits.

<sup>10</sup> Council Directive 2011/97/EU of 5 December 2011 amending Directive 1999/31/EC as regards specific criteria for the storage of metallic mercury considered as waste



## ABOUT BROMINE

Bromine's symbol is Br. It is part of the halogen group of the periodic table. Bromine is a reddish brown liquid. It is never naturally found in its elemental form but in inorganic compounds, known also as bromides, and in natural bromo-organic compounds. These are found in soils, salts, air and sea water.

## ABOUT BSEF

BSEF – the International Bromine Council, represents the major global bromine producers. Since 1997, the organisation has been working to foster knowledge on the uses and benefits of bromine-based solutions. BSEF strongly believes in science and innovation.

Through investments in research and development BSEF members create robust bromine-based technologies meeting the needs of society.



## OUR MEMBERS

BSEF champions bromine's many benefits around the world. Bromine-based solutions are essential to many of the most important advancements in science and technology.

The members of BSEF are Albermarle Corporation, ICL Industrial Products, Lanxess and Tosoh Corporation.



## FOR FURTHER INFORMATION CONTACT US AT

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