Pollutant Type: Gaseous Pollutants

Pollutant Name: Total gaseous mercury

Description of the metric

Mercury intake (from all pathways of exposure) is directly linked with a number of adverse effects on human health (see below). Total gaseous mercury (TGM) is an important gaseous air pollutant. In addition, when oxidized or associated with particulate matter, gaseous mercury can be readily deposited out of the atmospheric onto aquatic or terrestrial biosystems, where it is readily taken up into the food chain. Total gaseous mercury's potential for long range transport, toxicity, and ability to accumulate in organisms following deposition make it an extremely important global pollutant.

Major point sources of airborne mercury include coal-fired power plants, metal-extraction processes, waste incineration, chlor-alkali facilities, secondary scrap, recycling or smelting, cement production, and industrial production of inorganic chemicals. There are also many diffuse sources (e.g., residential fossil-fuel burning, internal combustion engines, artisanal gold mining, cremation (primarily due to dental fillings containing mercury) and accidental spills from mercury containing apparatus [Pandey et al, 2010].

Mass concentrations of total gaseous mercury are reported as nanograms of mercury per cubic meter of air, in ng/m³. Concentrations are reported with respect to a standard pressure of 101.325 kPa and standard temperature of 293.15 K [CEN, 2010].

Health Relevance

Exposure of humans to mercury occurs via food, air, water and soil. The most important source of exposure is food (especially contaminated fish and shellfish). Another important source is from teeth with amalgamated filings. It has been shown that indoor spaces may have high concentrations of mercury.

Elemental mercury is liquid at room temperature but if heated it evaporates and becomes highly toxic. Organic mercury compounds are the most toxic.

Human exposure to mercury is assessed thought biomonitoring, i.e. mainly assessing mercury levels in blood or hair. Thus the route of exposure is not clear in most studies assessing health effects. However, the most common route of exposure considered is food, and that exposure to airborne mercury is relatively unimportant. Studies which have assessed the effects of relatively low levels of exposure found that it has neurotoxic and cardiovascular effects. Neurotoxic effects include those on neurological development in children, loss of IQ points, decreased memory/attention/ language skills and spatial cognition. Inorganic mercury has been found to be nephrotoxic. There is no safe level and the International Agency for Research on Cancer classifies methylmercury as a possible carcinogen in humans (group 2B).

Some studies have estimated the population exposure to mercury (including all routes of exposure, via biomonitoring). The NHANES study found that >5% of US women had higher levels than the reference concentration of 5.8µg/L.

EC legislation, limit values (EU Directive 2004/107/EC)

Measurement of TGM is required by the Fourth Air Quality Daughter Directive at least at background stations. However, no target or limit value is specified, only a maximum expanded uncertainty for the measurements of 50 % is given.

Reference method for determination of the metric

The reference method Is EN 15852 relies on direct atomic absorption spectrometry (AAS, where it is assumed only gaseous elemental mercury (GEM) is measurement) or thermal desorption AAS or atomic fluorescence spectrometry following trapping of gaseous mercury species on a sorbent tube (where it is assumed both gaseous elemental and gaseous reactive mercury (RGM) are measured, i.e. total gaseous mercury). In most cases the proportion of RGM in TGM is small enough (< 1 %, apart from at some industrial, coastal and remote stations) such that GEM is a very good approximation of TGM [Brown et al, 2010].

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Author(s):	Richard Brown	NPL, UK
Co-author(s)	Klea Katsouyanni	NKUA, Gr
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