

# Natural Gas Sector As A Significant Source of Global Mercury Supply and Emissions

Although mercury emissions from the natural gas sector have not been widely calculated or reported, information and data about natural gas processing certainly indicate that the natural gas sector could be a significant source of both global mercury supply and emissions.



Found naturally in all hydrocarbons, mercury has been recorded in natural gas fields around the globe at concentrations ranging from the low at  $0.01 \mu\text{g}/\text{m}^3$  to the high at  $5,000 \mu\text{g}/\text{m}^3$ , depending on the region. Although many processing facilities use mercury removal units (MRUs) to protect equipment vulnerable to damage caused by mercury, others do not. When plants don't use MRUs, some plant processes will extract mercury when separating other impurities and trace elements; up to half of the mercury in raw gas can be removed and emitted into the environment by these processes.<sup>1</sup> Even when facilities do use an MRU, some designs, such as those relying on silver amalgamation, can concentrate mercury into a waste stream "regeneration" gas that is burned on site, emitting the captured mercury into the environment.

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## Mercury Emissions from Natural Gas Processing Facilities Can Vary by Region

The magnitude of mercury emissions from natural gas processing plants depends on the mercury content of the gas before processing and whether mercury removal has been conducted. Eastern/Central Europe, North Africa, and Southeast Asia are generally considered the hotspots for mercury in natural gas since concentrations there are routinely above  $100 \mu\text{g}/\text{m}^3$  and can be significantly higher.<sup>2</sup> (See Mercury (Hg) Concentrations in Natural Gas by Region.) Plant operators may take steps to remove the mercury in regions with high

mercury content, at high volume facilities, and where specific equipment is vulnerable to adverse reactions from mercury, such as aluminum heat exchangers at liquefied natural gas plants. (Mercury can amalgamate with other metals commonly found at processing plants, causing equipment to get brittle and corrode.)

An MRU can be installed near the inlet of a gas processing plant. There are various types of MRUs that use different chemical and physical processes to remove mercury.

One common type of MRU is a bed or reactor filled with an absorbent, typically in the form of small beads or pellets incorporating various metals or compounds. As raw natural gas passes through



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the MRU bed, mercury is trapped on the pellets. The traditional MRU contains activated carbon beads coated in elemental sulfur. When activated carbon catalyst becomes saturated with mercury, it can be combusted at a retort facility where the mercury can be recovered, or, where regulations still permit, sent to a landfill.

For high mercury content gas, different materials are sometimes used, such as metal sulfide-based adsorbents or silver-based adsorbents. Saturated metal sulfide adsorbent can be sent to metal smelting facilities where elemental mercury can be recovered. Silver-based adsorbent captures mercury via amalgamation and the saturated adsorbent can be cleaned of mercury onsite via a regeneration cycle where heated gas is sent through the MRU to vaporize water and mercury. This hot regeneration gas will be cooled to precipitate water and some mercury, but even cooled, regeneration gas will have much higher mercury concentrations than the original raw gas. At some facilities, regeneration gas is then burned at the plant as fuel gas to run equipment and heat boilers, which can result in significant mercury air emissions.

Substantial air emissions of mercury may also come from vented/flared natural gas when it takes place prior to mercury removal.

### Limited, but Significant, Data on Mercury By-products from Natural Gas Processing Facilities

Available data on the quantity of by-product mercury produced from natural gas processing indicates its potential as a significant global mercury supply source. Two major vendors for MRUs have reported installing more than 100 units worldwide; it is unknown exactly how many more total units exist around the world. The Netherlands and Croatia have reported mercury recovery from natural gas production (24 metric tons for the Netherlands in 2002 and less than 2 metric ton per year from Croatia).<sup>3</sup> In Indonesia, it has been reported that a single gas field generates about 1 metric ton of elemental mercury per year.<sup>4</sup>

### Recommendations for How to Curb Mercury Emissions from the Natural Gas Sector

Natural gas production should be added to the list of mercury supply sources subject to global trade restrictions and storage requirements. We also urge that the natural gas sector be added to the list of priority sources of air emissions, subject to BAT/BEP measures. Since the recent United Nations Environment Program's air emission study did not evaluate natural gas production, the INC delegates may wish to further evaluate the potential magnitude of air emissions from the natural gas production sector prior to INC 3.

Mercury (Hg) Concentrations in Natural Gas by Region		
	Hg Concentration ( $\mu\text{g}/\text{m}^3$ )	2006 Natural Gas Production (billion $\text{m}^3$ )
<b>Southeast Asia</b>		<b>424</b>
Indonesia	200 - 300	
<b>Europe/Eurasia</b>		<b>1,205</b>
Netherlands /Germany	70 - 3500	
<b>Africa</b>		<b>363</b>
Algeria	50 - 200, 4500	
<b>South America</b>	0.01 - 120	<b>203</b>
<b>Middle East</b>	1 - 9	<b>486</b>
<b>North America</b>	0.001 - 0.05	<b>938</b>

Bingham, 1990; Mussig & Rothmann, 1997; US EIA, 2008

<sup>1</sup> Carnell, et al. (2007) A Re-Think of the Mercury Removal Problem for LNG Plants. Johnson Matthey Catalysts, Available at [www.jmccatalysts.com/ptd/site.asp?siteid=498&pageid=669](http://www.jmccatalysts.com/ptd/site.asp?siteid=498&pageid=669).

<sup>2</sup> Carnell & Openshaw (2004) "Mercury Distribution on Gas Processing Plants," 83rd Annual Gas Processors Association convention March 14-17, 2004, San Antonio, TX, USA.

<sup>3</sup> Maxson (2006) "Mercury flows and safe storage of surplus mercury," Concorde East/West Sprl for the European Commission. Environment Directorate, August 2006. Available at [http://ec.europa.eu/environment/chemicals/mercury/pdf/hg\\_flows\\_safe\\_storage.pdf](http://ec.europa.eu/environment/chemicals/mercury/pdf/hg_flows_safe_storage.pdf)

<sup>4</sup> "Management of Mercury from Oil & Gas Operation in Indonesia" Presentation by Rasio Ridho Sani on behalf of Republic of Indonesia Ministry of the Environment.

