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Mercury Pollution from Gas and Oil

The extraction of fossil fuels is well-known to cause significant emissions of toxic pollutants, but one chemical release from oil and gas production is less well studied. Researchers have been challenged in determining the extent of mercury pollution from fossil fuels extraction. The fossil fuels industry refuses to disclose data on the volume of mercury byproduct (waste) and on the fate of mercury waste produced by their operations, thus accurate monitoring remains a challenge.

This is especially troubling as it is likely that most mercury waste from the fossil fuels industry is sold on the global market and is diverted to the small-scale gold mining industry (often called artisanal and small-scale gold mining or ASGM), which is the leading source of global mercury contamination that harms human health and threatens human rights. In 2022 the UN Special Rapporteur on Human Rights and Toxics released a report exposing the extent of human rights abuse resulting from the use of mercury in ASGM[1].

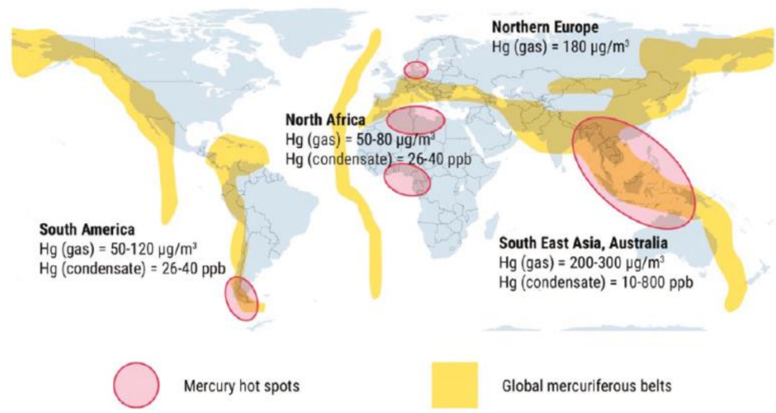
Estimates suggest that **300 tonnes of mercury per annum globally**[2] are produced as waste from oil and gas extraction, with **90 tonnes per annum** of that amount lost as toxic emissions and releases. The actual byproduct figures are likely much higher, given the industry secrecy and the volumes of mercury recovered from treatment facilities that capture the industry's waste (only a small fraction of their waste is treated to extract mercury).

While 300 tonnes annually is probably a significant underestimate, it is a large amount of mercury. It would be the equivalent of 34% of all mercury traded in 2020[3]. For comparison, the biggest mercury smuggling operation ever recorded was 200 tons trafficked from Mexican mercury mines to illegal gold mines in Bolivia, Colombia, and Peru, from April 2019 to June 2025 with 4 tonnes recently intercepted by authorities in Peru[4].

Where does the mercury come from?

Naturally occurring trace levels of mercury are entrained with oil and gas in the Earth's crust. While the mercury is at low concentrations, the sheer volume of extracted oil and gas results in significant quantities of mercury arising from the process. Different geological areas have varying levels of mercury in oil and gas with Southeast Asia and Australia having the highest concentrations.

FIGURE 1: MERCURIFEROUS BELTS AND HOTSPOTS MAP[42]



[1] https://digitallibrary.un.org/record/3983486
[2] Qa3 (2020), Unconsidered Mercury Emissions from the Oil and Gas Industry. https://www.qa3.co.uk/images/pdfs/Unconsidered_ Mercury_Emissions_from_the_Oil_and_Gas_Industry_July_2021.pdf
[3] These percentages are based on total weight of globally traded mercury published on the Chatham House, Resource Trade database https://resourcetrade.earth/
[4] https://eia.org/report/traffickers-leave-no-stone-unturned/

Far more mercury is extracted from gas than oil, primarily because mercury can critically damage gas extraction infrastructure (especially in offshore rigs), leading to metal embrittlement of the cooling equipment and catastrophic infrastructure failure. As a result, most gas extraction facilities are equipped with Mercury Removal Units (MRUs) fitted with adsorption beds and/or catalysts. The MRU's must be monitored to ensure the adsorption capacity has not been exceeded or the mercury will bleed back into the gas stream. When the MRUs reach capacity, the adsorption material must be replaced and the spent material (filled with mercury) becomes waste. This is one of the principal sources of mercury from gas extraction.

Other sources within gas extraction plants include *pigging equipment* and *slug catchers,* both of which are equipment and techniques for removing dense liquids and other substances from gas pipeline infrastructure on an extraction plant to keep the pipes clear. The volumes of mercury arising from pipe clearing operations can be significant. At Western Australia's Chevron Barrow Island gas production plant, a worker was draining the slug catcher in the Inlet Processing Area when the hose jumped and drenched the employee with contaminated mercury and benzene liquid, after 35 tonnes of mercury had been drained the day before. This is a large quantity of mercury from a single cleaning operation at a single plant, suggesting a global mercury arising from oil and gas production is much higher than 300 tonnes.

Oil extraction does not have the same infrastructure risks from mercury as gas extraction, but it does become a problem at the refinery level. It has been reported that mercury gathers in the low points of pipework in refineries (due to its density) and must be periodically removed. A major maintenance 'Turnaround' for refineries is usually conducted every 3-5 years and results in the removal of kilograms to tonnes of elemental mercury waste. This is separate from other mercury-bearing wastes in the refinery such as scale, sludges, slop oil and produced water and also distinct from metalwork contaminated by mercury through amalgamation processes or impacted by surface contamination. All these wastes, if treated, can yield more elemental mercury.

What is the fate of oil and gas byproduct mercury?

There is very little information on the fate of mercury removed from gas extraction platforms and oil refineries. The Minamata Convention has not prohibited selling elemental mercury produced from oil and gas operations on the global market and simple economic incentives suggest this likely occurs frequently, with high potential to be diverted to ASGM operations. If an oil and gas company chooses to send elemental mercury to a treatment plant and have it stabilised as mercury sulphide, they will incur the expense of treatment and an additional annual cost for storing the waste in a hazardous waste repository (long term storage/disposal). Instead, the company could choose to sell the mercury on the open market, which in 2025 would bring them around USD200 per kilogram[5] of income. Market economics would suggest that any company would sell their mercury waste unless some regulatory control compels them to stabilise and store it.

[5] https://www.scrapmonster.com/metal-prices/minor-metals/mercury/749

What is the fate of mercury from treatment of oil and gas waste?

According to mercury waste treatment companies, only a small fraction of all mercury bearing oil and gas waste is treated for mercury removal. The total amount of mercury recovered in treatment plants from the oil and gas sector has not been disclosed. The types of waste treated include drill cuttings, spent MRU adsorbents, pipe scale, sludges, slop oil, spent catalysts, and many other wastes. Various treatments can be applied with the objective of removal of the mercury from the solids and sludges. Once the mercury is recovered there are two options: a) stabilisation and long-term storage/disposal and b) sale on the open market. The most common and effective stabilisation method is to blend the elemental mercury with industrial sulphur to create mercury sulphide, a red powdery substance. The benefit of this process is that the mercury sulphide releases negligible mercury fumes and prevents the mercury from being used is ASGM.

As an example, Australia has a large oil and gas sector and two different companies have established mercury treatment plants primarily to service this industry sector. One of the treatment companies requires that any mercury recovered must be stabilised with sulphur and sent for permanent disposal at the Tellus, a below-ground hazardous waste repository[6]. The other treatment company sells the extracted mercury on the open market. In this case, most is sold to the Australian dental amalgam manufacturer SDI. There is no regulatory requirement to stabilise and dispose of recovered mercury in Australia. This suggests that unless regulations mandate disposal, treatment facilities can choose to sell their mercury on the open market where it can be diverted to ASGM.

Mercury emissions and releases from the oil and gas sector

The 2013 UNEP Global Mercury Assessment estimated that mercury releases from the oil and gas sector were significant, in the range of 7.3 - 26.4 tonnes. In 2018, UNEP updated the report and included an estimate of mercury emissions from *oil refining* (14 tonnes) but declined to estimate emissions and releases from the overall oil and gas sector due to the 'complexity' of the issue. However, a 2021 report by industry analysts Qa[3] made estimates a magnitude of order higher at 90 tonnes[7] per annum and suggested this may still be an underestimate.

Controls under the Minamata Convention

The Minamata Convention on Mercury came into force in 2017 to eliminate global mercury pollution, but controls on mercury from the oil and gas sector remain minimal. Parties to the convention are required to report mercury emissions and releases as part of their convention reporting requirements (Article 21). However, this is dependent on individual countries requiring companies to report their mercury emissions to government authorities. Few countries have national regulations requiring this reporting and the oil and gas industry generally refuses to disclose this information unless required by law. That is why the best information available is rough estimates from researchers. There is no restriction under Article 3 on mercury from oil and gas being traded on the global market for 'allowed uses' which includes ASGM. There are Minamata Convention Best Available Technique and Best Environmental Practice (BAT BEP) guidance documents for controlling emissions and releases for cement kilns, coal fired power plants, non-ferrous metal smelters, and waste incinerators but no specific guidance for the oil and gas sector. Even if there was BAT BEP guidance, it is not mandatory to use it.

There is a requirement under Article 9 for Parties to identify emission and release sources and take one of several measures to 'control and where feasible reduce' mercury emissions and releases. However, if

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[6] https://tellus.com.au/project/sandy-ridge-facility/

[7] https://www.qa3.co.uk/images/pdfs/Unconsidered_Mercury_Emissions_from_the_Oil_and_Gas_Industry_July_2021.pdf

the oil and gas sector continues to remain uncooperative in releasing information on its releases and emissions, then Parties cannot identify such sources and take measures to reduce them.

Finally, there is a possibility that mercury waste from oil and gas *may* be subject to Article 11 (Mercury Wastes). However, at COP 5 in 2023, a decision to set a concentration limit of ≥15 mg/kg Hg in waste as the international definition of 'mercury waste' was undermined by a clause inserted that allows any country to apply any concentration of mercury as its definition of mercury waste. This effectively prevented global harmonisation of a definition of waste contaminated with mercury. In countries that set a much higher limit or no limit at all, large volumes of mercury waste can go unrecorded and poorly managed. That aside, any mercury waste is required to be subject to environmentally sound management (ESM) by the Convention. This can mean, inter alia, that mercury can be recovered from waste and sold on the open market. Mercury recovery from mercury waste is considered ESM under the convention but the action of selling it on the open market is not addressed under ESM.

What needs to be done?

As long as oil and gas are extracted and refined, mercury will result as a byproduct. Until such extraction stops, measures must be taken to restrict the mercury. Any elemental mercury byproduct from oil and gas extraction should be sent for stabilisation and permanent disposal/storage and not permitted to be traded on the global market. This will prevent it from being diverted to small scale gold mining where it causes widespread environmental and human health impacts. While national governments can impose restrictions on the fate of mercury from the oil and gas sector within their jurisdiction, global controls are needed to override the influence of vested interests on national governments.

The Minamata Convention should be amended to:

- Prevent the sale of oil and gas mercury byproduct on the global market.
- Require all oil and gas mercury byproduct to be subject to stabilisation and permanent storage/disposal.
- Require all mercury recovered from the waste of the oil and gas sector to be stabilised and subject to permanent storage/disposal.
- Require all mercury emissions and releases from the oil and gas sector to be quantified and reported to national competent authorities annually and to be included in national reports to the secretariat. National governments should create mirror legislation of the Minamata Convention for oil and gas companies, mandating provision of this information as a requirement to operate.
- Mandate investigation and remediation of all mercury contaminated sites created by oil and gas extraction, oil and gas waste dumping, and infrastructure abandonment. Mercury recovered in these activities must be stabilised and subject to permanent storage/disposal.
- Create technical guidance for the oil and gas sector to implement Best Available Technique and Best Environmental Practice (BAT BEP) to control mercury emissions and releases.