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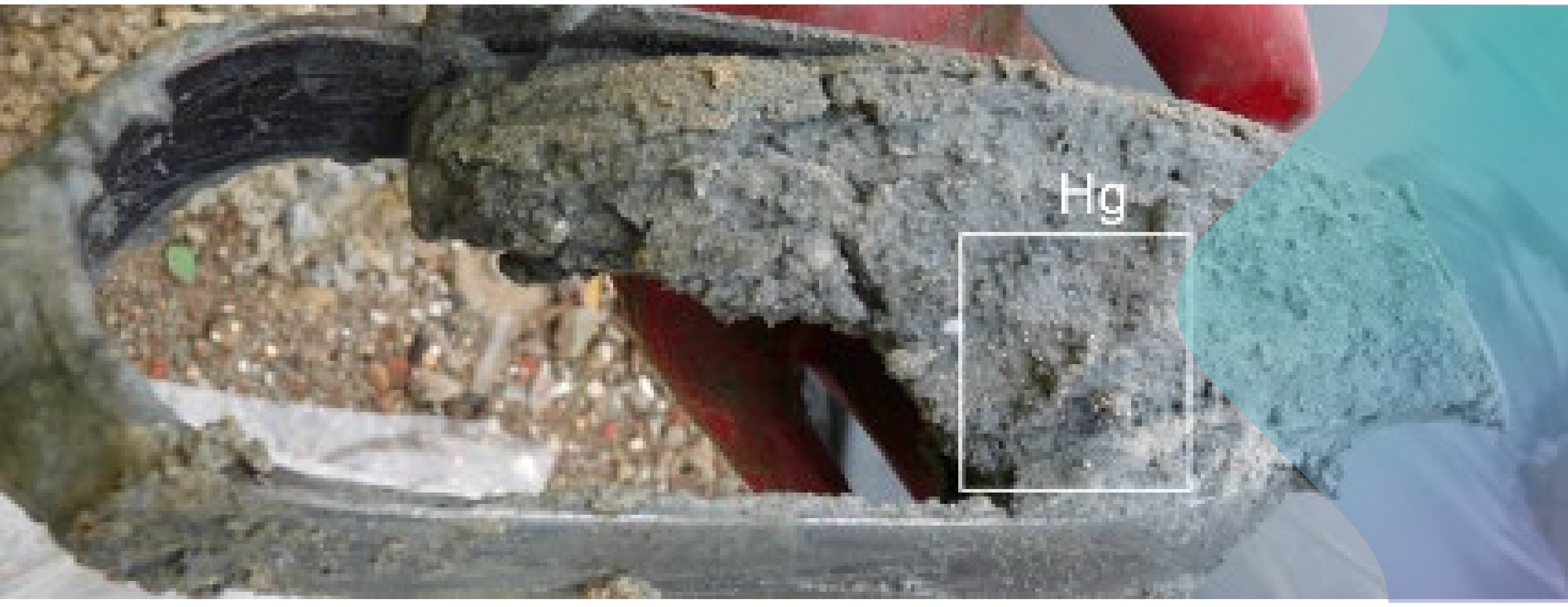

Mercury Impacted Sites - Call to action on abandoned Chlor-alkali sites

1.1.1 Introduction

On a global scale, the Vinyl Chloride Monomer (VCM) and Chlor-alkali chemical industries are only minor contributors to mercury (Hg) emissions. In 2015, emissions to air from these industries were estimated to account for 3.3% of global emissions[1]. The phasing out of mercury cell technology will reduce this further in the future. The Hg cell process currently accounts for about 8% of the global chlorine production capacity of approximately 60 million tonnes at around 75 plants worldwide (UN Environment, 2017a).

The reduction in mercury emissions from these industries has, to a large extent, been achieved through self-regulation, particularly in Europe and North America.
However, these industries have historically been responsible for major mercury losses. For example, the mercury consumption of Chlor-alkali facilities in the United States in 1990 was a staggering 220 tonnes annually[2] at up to 35 facilities. This equates to an annual loss of 6.2 tonnes per facility. The three most recently operating Chlor-alkali plants using mercury cell technology in neighbouring Mexico, which together produce 147,000 tonnes of chlorine annually, consume 5.7 tonnes per year[3].

UNEP estimates that contaminated sites release 8–33 metric tonnes of mercury annually to water and 70–95 metric tonnes of mercury to air[4]. The 2018 Global Mercury Assessment[5] recognises contaminated sites as an anthropogenic source for which emissions cannot yet be reliably estimated, and concludes that there is no detailed knowledge of the processes of secondary releases, which result from mercury initially released to terrestrial pathways.

[1] *AMAP/UN Environment, 2019. Technical Background Report for the Global Mercury Assessment 2018. Arctic Monitoring and Assessment Programme, Oslo, Norway/UN Environment Programme, Chemicals and Health Branch, Geneva, Switzerland. Chapter 3-1*
[2] Where Goes the Missing Mercury? As U.S. mercury controls tighten, attention focuses on mercury-cell chlor-alkali plants by Jeff Johnson March 15, 2004 | Chemical and Engineering news Volume 82, Issue 11.
[3] Acosta G., Inventario preliminar de emisiones atmosféricas de mercurio en México. Comisión para la Cooperación Ambiental (CCA) No. 3.2.1.04. 2001.
[4] United Nations Environment Programme (UNEP) (2013). Global Mercury Assessment 2013: Sources, Emissions, Releases and Environmental Transport. Geneva, UNEP Chemicals Branch. Available at http://wedocs.unep.org/handle/20.500.11822/7984
[5] United Nations Environment Programme (UNEP) (2019). Global Mercury Assessment 2018. Geneva, UNEP Chemicals Branch. Available at https://wedocs.unep.org/bitstream/handle/20.500.11822/27579/GMA2018.pdf?sequence=1&isAllowed=y

Figure 1 - Former mercury cell facility in North Macedonia

1.1.2 The sinks

Although current emissions have been reduced greatly, most Chlor-alkali facilities have been and continue to be sinks for mercury. Decades of mercury losses during production were not only emitted directly into the air and water: mercury also accumulated in mercury cell production buildings and other structures, such as the sewer systems, piping and in soil and groundwater.

Investigations of former mercury cell production buildings have identified mercury concentrations in the concrete, mortar and masonry of these facilities at levels of hundreds to thousands of mg/kg. Concentrations of up to 80,000 mg/kg have been reported in the concrete floors of the production facilities themselves[6]. Add this to mercury found in the soil and groundwater underneath the buildings and in the sewers and pipes, and it becomes clear that a substantial part of the historical mercury consumption of the Chlor-alkali industry was not emitted through the air and sewers, but remains present in the structure of the plants and the surrounding soil. This has been confirmed by various surveys that TAUW has carried out at industrial facilities in Europe.

1.1.3 The Minamata Convention

Article 12 of the Minamata Convention describes obligations in relation to contaminated sites:

(a) Each party shall endeavour to develop appropriate strategies for identifying and assessing sites contaminated by mercury or mercury compounds.
(b) Any actions to reduce the risks posed by such sites shall be performed in an environmentally sound manner incorporating, where appropriate, an assessment of the risks to human health and the environment from the mercury or mercury compounds they contain.
(c) The Conference of the Parties shall adopt guidance on managing contaminated sites.

To assist parties to the convention, the Secretariat of the Minamata Convention on Mercury has drafted guidance on the management of contaminated sites[7]. This guidance provides a high-level overview of the steps needed to manage mercury contaminated sites.

Figure 2 - Mercury present at an industrial facility

In heavily regulated environments, the specialised decommissioning of Chlor-alkali facilities can be dealt with by the industrial conglomerates involved. In countries with limited enforcement and/or a turbulent history, many of the former Chlor-alkali facilities have been left to deteriorate without proper site management. There is often no containment of the various contaminations, let alone any incentive for professional decommissioning of the facilities. Some examples are the Chlor-alkali facilities of OHIS in

[6] OLD ENVIRONMENTAL BURDENS IN CHEMICAL PLANT OHIS, SKOPJE, Update risk assessment report, ENACON s.r.o, 13/11/2009.

[7] Guidance on the management of contaminated sites, UNEP/MC/COP.3/8/Rev.1, 17 December 2019.

Skopje (North Macedonia) and the Vlora Mercury Hot Spot in Albania[8].

1.1.4 How to move forward?

A holistic approach to cleaning up (abandoned) mercury cell and Chlor-alkali facilities is needed. This holistic approach should first focus on the revitalisation of the site itself. A clean up alone will not bring obvious direct benefits to the community in the same way that redeveloping former industrial areas can revitalise local economies.

Unfortunately, the costs associated with the proper dismantling and remediation of former mercury cell and Chlor-alkali sites can almost never be covered in a budget-neutral or positive way: the value of the remediated land is usually much less than the costs of the clean up. This is especially true in countries with economies in transition. Without support from the authorities, these sites will remain derelict. This is the root of the problem. The available guidance on the management of contaminated sites lacks the depth required to address the complex issues associated with dismantling and cleaning the structures, remediation of the soil and revitalisation of these locations.

The steps required to move forward are:

- Limit access to the sites
- Create clarity on ownership of the site and responsibilities of the stakeholders
- Accept that (partial) demolition of the site is the easiest way to move forward
- Explore opportunities for the revitalisation of the site – setting boundaries for the market that reflect what is possible
- Create a detailed inventory of the contamination status of the building materials
- Clearly establish the status of the soil and groundwater, including in combination with other contaminants
- Ensure proper waste management is in place, prevent waste materials from ending up in uncontrolled landfills
- Ensure adequate health and safety measures can be implemented during demolition

1.1.5 In practice

The initial ideas are best generated locally, with limited guidance from the international community. After the scope is clear, the technical assessment and demolition can then follow, supported by international funding. Using Best Available Techniques and Best Environmental Practice will quickly pay off, as the costs of demolition and remediation are a multiple of project failures and uncontrolled actions. This will also help to build local demolition and hazardous waste handling and treatment capacity.

Figure 3 - Use of analyser to measure mercury concentration in air

A few examples of recently developed techniques include: remote sensing using drones, 3D modelling to visualise the facility and accurately establish quantities of contaminated materials, the use of XRF to sample on site and experiences from asbestos remediation to limit exposure during demolition.

[8] Contaminated site: Vlora Mercury Hot Spot in Albania, IPEN Mercury-Free Campaign Report Prepared by Eden Center (Albania) and Arnika Association (Czech Republic) and the IPEN Heavy Metals Working Group Tirana – 3 January 2013.

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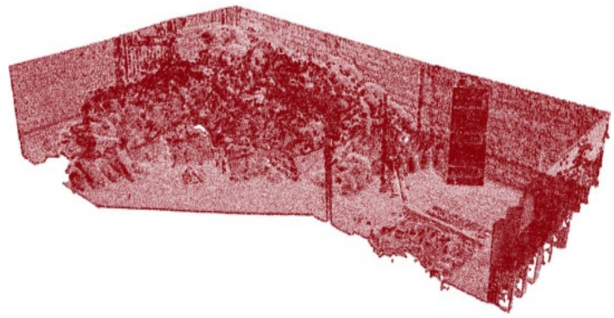

Figure 4 - 3D scan of hazardous wastes at former Chlor-alkali site in Turkey

For the demolition of Chlor-alkali sites in Europe, TAUW takes the following steps:

1. Desk study of buildings to identify areas most likely to be contaminated
2. Inventory of mercury contamination in walls, floors, pipes and sewers using a combination of XRF and laboratory analysis
3. 3D scanning of the building
4. Calculation of total waste quantities and classification and options for disposal or treatment
5. Investigation of status of mercury in soil and groundwater
6. Preparation of tender documentation for selective deconstruction, including the design of zoning, air locks and dust suppression
7. Supervision of the demolition
8. Preparation of tender documentation for soil and groundwater remediation
9. Supervision of the remediation

Figure 5 - 3D scan of Chlor-alkali site in Europe

These steps can be copied for sites in countries with economies in transition. A practical example of the revitalisation of a mercury cell and related Chlor-alkali site can help other countries move forward with these complex sites. This practical example should not only focus on the technical issues involved with the demolition and remediation of the location, as it can also serve as a pilot/learning experience to identify how the area can be revitalised as a whole by:

- Showing how complex, abandoned and failed industrial sites can be addressed
- Demonstrating that stakeholder involvement is essential to revitalise the site
- Showing the steps that authorities, site owners and other stakeholders should take in the site development planning investigation, procurement and supervision of the actions required to realise a redevelopment
- Developing national capacity for the controlled demolition and circularity of building materials
- Demonstrating how to reduce waste generation and asbestos management
- Providing insight into other contaminations and their interactions with mercury

The project results can be extensively documented in various forms (reporting, photography, video and animation) and made available on the established platforms.