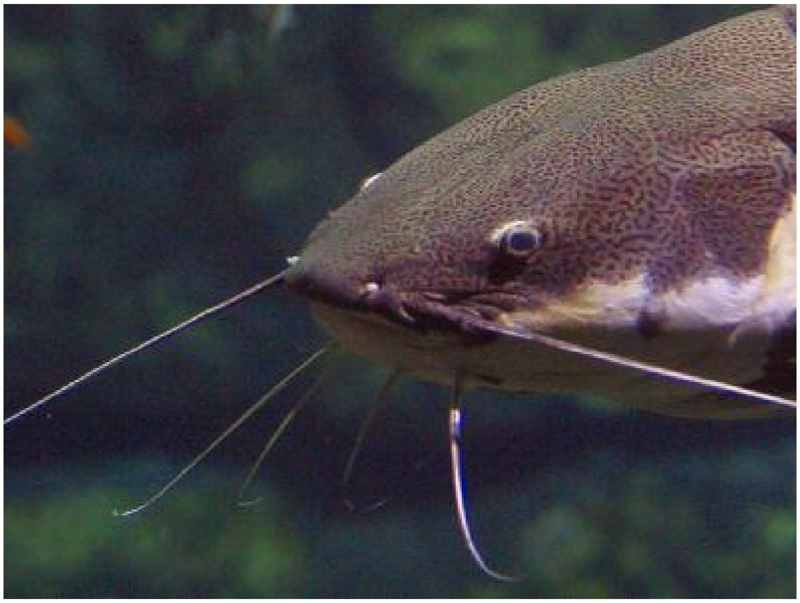

Chlor-alkali plants: Neratovice, Ústí nad Labem and Some Other Chemical Hot Spots in the Czech Republic

Report by
Arnika Association
and IPEN
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Chlor-alkali plants: Neratovice, Ústí nad Labem and Some Other Chemical Hot Spots in the Czech Republic

IPEN Mercury-Free Campaign Report

Prepared by Arnika Association (Czech Republic) and the IPEN Heavy Metals Working Group

Prague – 3 January 2013

Introduction

In 2009, the Governing Council of the United Nations Environment Programme (UNEP GC) decided to develop a global legally binding instrument on mercury to reduce risks to human health and the environment (UNEP GC25/5). The UNEP GC noted that mercury is a substance of global concern due to its long-range transport, persistence, ability to bioaccumulate, and toxicity. Its conclusions were based in part on the 2002 UNEP Global Mercury Assessment which noted that mercury is present in fish all over the globe at levels that adversely affect humans and wildlife. (UNEP 2002)

This report focuses on a chlor-alkali and PVC plant (Spolana Neratovice) and chlor-alkali and chlorinated solvents plant (Spolchemie Ústí nad Labem) in the Czech Republic. The chlor-alkali industry produces chlorine gas and alkali (sodium hydroxide)[a] by a process that applies electrolysis to saltwater. Some chlor-alkali plants use a mercury-cell process in which mercury is used as the electrolysis cathode. This occurs at both of the facilities named above. Mercury-cell chlor-alkali plants consume large quantities of mercury and are very polluting. A single mercury-cell plant may contain hundreds of tons of elemental mercury for use in production and may have even more mercury in its warehouses to replenish lost mercury. Both Czech chlor-alkali plants have been heavily contaminated by mercury and both are on the list of mercury contaminated sites.[b]

We examined levels of mercury in fish caught in Labe River (also known as the Elbe River in Germany) downstream from Spolana in Neratovice and Spolchemie in Ústí nad Labem to confirm whether use of mercury in these chlor-alkali plants resulted in food source contamination of fish. In addition, since local mercury releases become global problems due to long range transport we considered how the draft treaty text will address chlor-alkali plants such as those operating in Neratovice and Ústí nad Labem.

Materials and methods

Arnika – Toxics and Waste Programme conducted fish sampling of freshwater bream (14 samples) and crucian carp (2 samples) in collaboration with local fisherman using protocols developed by the Biodiversity Research Institute (BRI 2011). BRI measured mercury levels (total mercury content = THg) in fish samples in their laboratory in Gorham, Maine, USA. Arnika – Toxics and Waste Programme characterized the sites and provided information about their history and presumptive mercury sources.

[a] Spolchemie Ústí nad Labem produces also potassium hydroxide.
[b] An area of so called „Old Amalgam Electrolysis“ contaminated by mercury in Spolchemie Ústi nad Labem undergo remediation, while this contamination in Spolana Neratovice still waits for solution .

Results and discussion

There are only two chlor-alkali plants in the Czech Republic: Spolana Neratovice and Spolchemie Ústí nad Labem Both are located close to the major Czech river, the Labe (Elbe), which flows to Germany and into the North Sea. Spolana Neratovice has a production capacity of 135,000 t of chlorine per year and Spolchemie Ústí nad Labem has a capacity of 61,276 t of chlorine per year. The total capacity of electrolysis in Spolana is 230 t of mercury (Kuncova 2007), while in Spolchemie it is 210 t of mercury (Šuta 2005). Table 1 shows a basic overview about mercury releases and transfers by both Spolana Neratovice and Spolchemie Ústí nad Labem including the company providing remediation of old amalgam electrolysis in Spolchemie Ústí nad Labem.

Table 1: Mercury releases and transfers from Spolchemie Ústí nad Labem, Spolana Neratovice and the remediation company, Geosan in Ústí nad Labem. Source: Integrated Pollution Register data (IRZ 2012).

Year	**2009**	**2010**	**2011**
Facility/company	**Mercury releases to air per year (kg)**		
Geosan Group – thermal desorption in Spolchemie	-	-	-
Spolchemie Ústí nad Labem – chemical plant	33	32	30
Spolana Neratovice – chemical plant	72	99	95
Facility/company	**Mercury releases to water per year (kg)**		
Geosan Group – thermal desorption in Spolchemie	-	-	-
Spolchemie Ústí nad Labem – chemical plant	-*	-*	-*
Spolana Neratovice – chemical plant	12	13	10
Facility/company	**Mercury transfers in wastewater per year (kg)**		
Geosan Group – thermal desorption in Spolchemie	-	-	-
Spolchemie Ústí nad Labem – chemical plant	21	28	19
Spolana Neratovice – chemical plant	-	-	-
Facility/company	**Mercury transfers in wastes per year (kg)**		
Geosan Group – thermal desorption in Spolchemie	1,168	352	1,476
Spolchemie Ústí nad Labem – chemical plant	656	303	314
Spolana Neratovice – chemical plant	1,520	1,665	444

Notes: dash = below threshold value; *Spolchemie transfers wastewater to Waste Water Treatment Facility of Ústí nad Labem, which reported Hg in water releases as follows: 2009 – 6 kg/year, 2010 – below threshold value, and 2011 – 797 kg/year

Data from the PRTR system in the Czech Republic[c] provide a good basis for following the scope of mercury releases from specific facilities across the country including amounts of mercury transferred in wastes. From a comparison of releases and transfers at Spolana and Spolchemie with total reported releases and transfers for mercury it is clear that these two facilities and/or remediation of old environmental burdens in their area are together with the hazardous waste incinerator in Ostrava the single largest sources of mercury released into different environmental compartments in the Czech Republic.

[c] PRTR is called Integrated Pollution Register in the Czech Republic and has acronym IRZ.

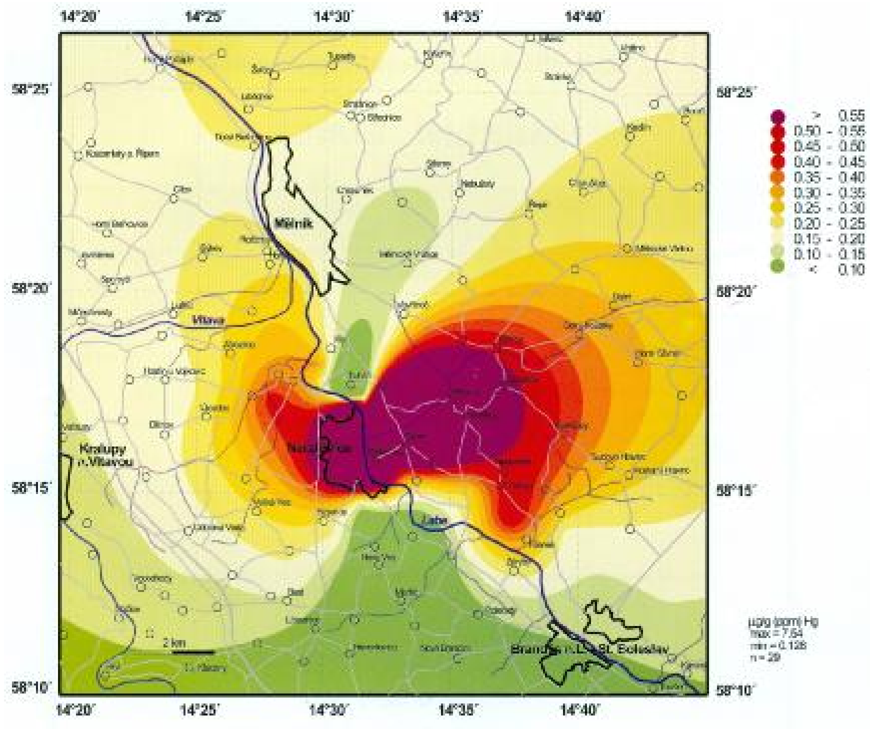

Figure 1: Determined and interpolated Hg concentrations in oak bark in the investigated area in the surrounding of Spolana Neratovice. Source: (Suchara and Sucharová 2008)

Serious mercury pollution in the area surrounding Spolana Neratovice has been demonstrated in several studies. Arnika has measured high levels of mercury in outdoor air at some points on the edge of both chlor-alkali plants (Arnika - Toxics and Waste Programme 2006). Even more visible is the longstanding burden by mercury on the results of measurements by Suchara and Sucharová (2008) in oak bark (see map in Figure 1)

Spolana Neratovice also contains an unresolved environmental burden – contamination of old amalgam electrolysis by both mercury and dioxins (PCDD/Fs). This can also be a significant source of mercury pollution into the Labe River through underground water as well as surface water flow during the rain. Mercury accumulated in the sediments of the Labe River downstream from Spolana is source of contamination of local fish. However, this contamination spreads further since contaminated sediments are carried into Germany and the North Sea especially during the floods like the large flood in 2002, when the area of the contaminated site in Spolana was flooded.

Levels of mercury in sediments in the Bílina River downstream from Spolchemie were up to almost 32 ppm. They decreased after the floods in 2002. The Bílina River also contains the highest level of mercury observed in benthos in 2010 among all Czech rivers (6,7 mg/kg). (MZe and MŽP 2011). The Bílina River is a tributary of the Labe River and flows alongside Spolchemie in Ústí nad Labem (see also map at Figure 2).

Fish for this study was sampled from the Labe River at 3 localities: Obříství, 2 km downstream from Spolana Neratovice; Valtířov, 7 – 8 km downstream from Spolchemie Ústí nad Labem and Děčín, 20 km downstream from Spolchemie. Děčín is also approximately 10 km from the German border.

Table 2: Mercury content of fish sampled in Labe River at 3 localities: Obříství, Valtířov and Děčín, downstream from chlor-alkali plants.

	Sample Size	Hg Mean (ppm, ww)	St Dev	Min Hg (ppm)	Max Hg (ppm)	Reference dose[d] (ppm)	Fraction of samples over Ref. Dose	Limit(s)[e] (ppm)
All fish samples	16	0.429	0.340	0.183	1.583	0.22	88%	0.5
Děčín – crucian carp	2	0.343	0.226	0.183	0.502	0.22	50%	0.5
All bream samples	14	0.441	0.358	0.195	1.583	0.22	93%	0.5
Děčín - bream	3	0.255	0.043	0.226	0.304	0.22	100%	0.5
Valtířov - bream	3	0.281	0.106	0.195	0.399	0.22	67%	0.5
Obříství - bream	8	0.571	0.435	0.277	1.583	0.22	100%	0.5

Abbreviations: Hg, mercury; ppm, parts per million or mg/kg; ww, wet weight; min, minimum; max, maximum

Table 2 shows that average mercury levels in bream samples were two-times higher than the US EPA reference dose of 0.22 ppm. They exceeded this level in 13 out of 14 samples (93%). Levels in crucian carp caught in Děčín were 1.5-times higher than US EPA reference dose, but the total number of samples of this fish species was very low (2 samples). Levels of mercury were much higher at the locality downstream from Spolana Neratovice in Obříství than downstream from Spolchemie Ústí nad Labem. Average mercury concentrations in fish from Obříství were more than 2.5-times higher than the reference dose. Three samples of fish (one crucian carp from Děčín and two breams from Obříství) also exceeded the EU maximum level for mercury in food. The mercury levels in bream from Obříství were more than three-times higher than the EU limit for mercury in fish, and more than 7-times higher than the US EPA reference dose.

Kružíková Maršálek et al. (2008) summarized long-term research of total mercury and methylmercury levels in muscles of indicator species of fish (chub, brown trout) from selected localities of free water in the Czech Republic during the years 2000 – 2007 and concluded that *"The highest mercury concentration in muscle was found in fishes from Skalka reservoir (2003) and Labe river in the locality of Obříství (2003)"*. In Obříství they found 1.6 ppm and 0.86 ppm in 2003 and 2004 respectively. They also found that except sites affected by industrial pollution levels, mercury in chub or brown trout were well below 0.2 ppm. In comparison with this broad research, this study shows continuing serious contamination of the locality in Obříství and increased levels of mercury also in fish from sites downstream from Ústí nad Labem. Overall, pollution of the Labe (Elbe) River can affect fish populations in its

[d] Figure derived from the reference dose used as U.S. EPA consumption guidelines for fish (0.2 mg.kg^{-1} methylmercury) based on the presumption that methylmercury counts for 90% of THg levels, limit value used by Canada is similar . Japan and/or UK use 0.3 reference dose. Source: US EPA (2001). Water Quality Criterion for the Protection of Human Health: Methylmercury. Final. EPA-823-R-01-001, Office of Science and Technology, Office of Water, U.S. Environmental Protection Agency Washington, DC: 303.

[e] Limit for mercury in fish issued by EU: European Commission (2001). Commission Regulation (EC) No 466/2001 of 8 March 2001 setting maximum levels for certain contaminants in foodstuffs (Text with EEA relevance). European Commission. Official Journal of the European Communities. EC 466/2001: L 77/71-13. Several other countries use the same limit value UNEP (2002). Global Mercury Assessment. Geneva, Switzerland, UNEP: 258.

ecosystem as suggested by a team of Czech scientists in 2009: "EROD and vitellogenin induction, and histopathologies of male gonads indicated harmful effects of aquatic pollution in fish from the Czech portion of the Elbe River." (Randak, Zlabek et al. 2009)

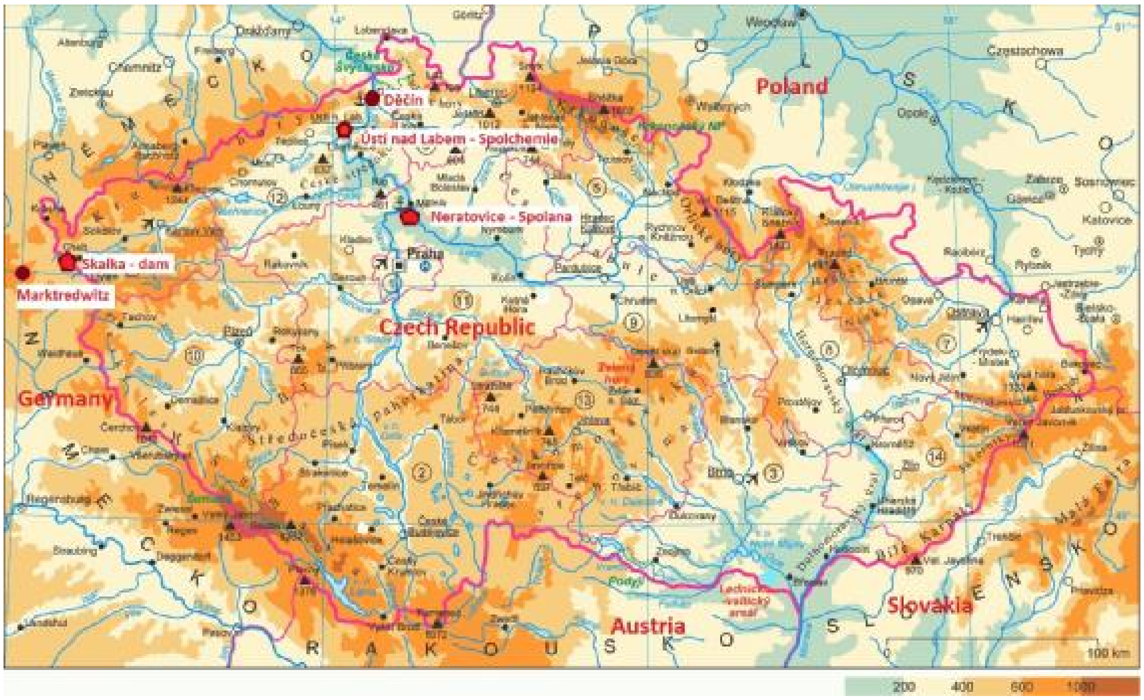

Figure 2: Map shows several chemical hotspots related to mercury contamination in Czech rivers, and locations of sampling of fish. Ústí nad Labem, Neratovice and Marktredwitz (in Germany) are contain chemical plants/contaminated sites and possible sources of pollution. Děčín is one of the localities for sampling of fish for this report. Valtířov and Obříství are sampling sites close to Ústí nad Labem and Neratovice. Skalka is a dam close to German borders, where there are high levels of mercury in fish due to mercury releases from a former plant for production of mercury-containing chemicals, which operated in the German town of Marktredwitz.

The Skalka dam in the Czech Republic (see map at Figure 2) consistently shows the highest levels of mercury in fish including bream. Maršálek, Svobodová et al. (2005) found average levels of mercury in bream of 0.96 ppm. According to the most recent findings there are levels of mercury up to 3.682 ppm found in eel *(Anquilla anquilla)* and up to 3.088 ppm in rapacious carp or asp *(Aspius aspius*) caught in 2011(Titl, Doucha et al. 2011). The likely reason for these high levels of mercury is trans-boundary pollution from the former chemical plant, Chemical Fabrik Marktredwitz, in Germany (see map at Figure 2), which produced inorganic and organic mercury compounds. This is another example of a mercury-contaminated site due to former chemical production affecting the environment in two neighbouring countries.

Chlor-alkali plants, contaminated sites, and waste and the mercury treaty

The chlor-alkali plants in Neratovice and Ústí nad Labem provoke questions about how the mercury treaty might mandate actions to eliminate mercury pollution of the environment and fish from chlorine production. Together with the demonstrated example of the plant in Marktredwitz, the cases of the two chlor-alkali plants heavily contaminated with mercury also provoke questions about whether the future treaty will properly address issues of contaminated sites and trans-boundary mercury pollution through surface and/or underground waters.

All releases and transfers of mercury from both chlor-alkali plants in the Czech Republic could be stopped if they phase-out mercury in chlorine production. According to current IPPC permits the phase-out should happen by the end of 2014 (Spolana) or 2015 (Spolchemie). However, Spolana Neratovice has asked Czech authorities for a longer period for conversion and intends to end mercury use at the end of 2020 (Techem CZ 2012). International talks will influence such procedures in all countries where chlor-alkali plants still use mercury. As shown in this study, many tons of mercury releases and subsequent fish contamination can be prevented by an early date for phase-out of mercury in chlor-alkali plants.

The current treaty text proposes elimination of mercury in chlor-alkali production in either 2020 or 2025. However, no agreement exists on whether countries have to identify and characterize mercury use at chlor-alkali facilities or whether to allow new mercury-using chlor-alkali facilities under certain circumstances in the future.

High levels of mercury in fish from Czech surface waters and trans-boundary transport of mercury through rivers between Germany and Czech Republic underline the importance of addressing contaminated sites. As stated by UNEP in the Global Mercury Assessment "Highly contaminated industrial sites and abandoned mining operations continue to release mercury." The report is even more specific about sediments: „ Contaminated sediments at the bottom of surface waters can serve as an important mercury reservoir, with sediment-bound mercury recycling back into the aquatic ecosystem for decades or longer." (UNEP 2002). Contaminated sites also contribute to re-mobilization and re-emissions of mercury, a significant source and pathway of mercury air emissions (Pirrone, Cinnirella et al. 2010); (UNEP Chemicals Branch 2008).

The current treaty text (UNEP (DTIE) 2012) does not require the cleanup of contaminated sites and leaves the matter to voluntary action.[f] Considering the lack of action at the contaminated site in Spolana voluntary action to address contaminated sites seems unlikely. This inaction has occurred although there are funds for cleanup and Czech Republic is part of EU with stricter legislation than most developing countries.

Data from the Czech PRTR show significant flows of mercury in waste transfers from chlor-alkali plants and/or remediation of their old environmental burdens. The current treaty text provides no guidance on a health-protective value that defines waste as hazardous (UNEP (DTIE) 2012).[g] In the case of both Spolana Neratovice and Spolchemie Ústí nad Labem, this would be helpful to insure protection of human health and environment from toxic mercury wastes. To prevent similar problems in the future, it would be helpful for the treaty to require the minimization and prevention of generating mercury-containing waste, but the current text does not do this (UNEP (DTIE) 2012).[h]

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[f] **UNEP**(DTIE)/Hg/INC.5/3; Article 14 para 1 "Each Party shall endeavour to develop appropriate strategies for identifying and assessing sites contaminated by mercury or mercury compounds."

[g] **UNEP**(DTIE)/Hg/INC.5/3; Article 14 para 1 "Each Party shall endeavour to develop appropriate strategies for identifying and assessing sites contaminated by mercury or mercury compounds."

[h] **UNEP**(DTIE)/Hg/INC.5/3; Not present in Article 13 on Wastes

This study also shows the need to make data about mercury releases and overall levels in the environment publicly available. Requiring a register of publicly available information which identifies these facilities and estimates their annual amount of Hg used is very helpful as we have demonstrated on data from the Czech PRTR.

To prevent continuous mercury pollution of surface water ecosystems and fish serving also as food for the local fishermen in Neratovice and Ústí nad Labem it is necessary to prevent further releases from the chlor-alkali plants, the contaminated areas and wastes into the local surface waters. Until this problem is addressed, mercury will continue to contaminate both the local area and contribute to global mercury pollution.

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