

Module 2

Mercury and Industry





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K E Y M E S S A G E S

- Due to its unique chemical properties, mercury has been used in a wide range of industrial processes over the years. Currently most of it is used in:
 - Industrial processes that produce chlorine (mercury cell chlor-alkali plants), vinyl chloride monomer (for polyvinyl chloride (PVC) production, and polyurethane elastomers).
 - Artisanal and small scale gold mining (for more information on this, see Module 3).
- Trace amounts of mercury are found naturally in coal, oil and rock. Mercury is released unintentionally when coal is burned and metals are processed.
- Approximately 70% of man-made mercury releases to air comes from stationary combustion of fossil fuels, especially coal, and incineration of waste materials.
- Global mercury deposition has increased three times since the Industrial Revolution and regional and local deposition has increased up to ten times in some locations.
- Mercury emissions tend to be decreasing in North America and Europe. With growth in economic prosperity, mercury emissions tend to be rising in Asia and Africa.
- Pollution control equipment is available to reduce mercury emissions from major air sources significantly.



W H Y I S T H I S I M P O R T A N T T O Y O U ?

Facilities where mercury is used or released as a by-product can be major sources of mercury exposure for workers, surrounding communities and the global community.

Airborne mercury can be inhaled or deposited, leading to contaminated soil, water and fish.

Local releases of mercury may lead to high local levels of mercury.



W H A T C A N Y O U D O ?

✓ For the Public

- ✓ Be aware of industrial use and release of mercury in your area.
- ✓ Discarded mercury products and waste should never be burned, as the mercury will be released directly into the atmosphere.
- ✓ Governments can be asked to monitor major air sources to determine if pollution control equipment is needed to reduce mercury levels from local facilities.
- ✓ Governments can be asked to check mercury levels in local and imported fish and provide this information to the public.

✓ For Governments

- ✓ Obtaining accurate mercury emission inventories are an important first step towards controlling major air sources of mercury. Understanding sources will make it easier to develop cost-effective emission control policies.
- ✓ Encourage industries and retailers to switch to mercury-free products and processes.
- ✓ Regulate and monitor industries using mercury.
- ✓ Establish national or regional safe containment facilities for mercury containing waste.
- ✓ Take part in the UNEP Global Mercury Partnership.
Go to www.chem.unep.ch/mercury/partnerships/new_partnership.htm for more information.

Mercury and Industry

What industrial processes use and/or release mercury?

Intentional use of Mercury

Mercury continues to be used in a vast array of products (see Module 1) and is released at different stages of manufacturing and use.

Mercury continues to be employed as a catalyst in certain industrial processes to produce chlorine and caustic soda (in mercury-cell chlor-alkali plants), to produce vinyl chloride monomer which is used to make polyvinylchloride (PVC), and in the production of polyurethane foams. Alternative non-mercury processes exist for all of these industrial processes.

Mercury is also used and released in artisanal and small-scale gold mining (this is covered in Module 3).

Unintentional Releases of Mercury

Certain activities emit mercury during combustion (coal combustion, local trash burning or larger-scale incineration) and in processing of mineral ores (industrial smelting) and aggregates (cement kilns).

Approximately 70% of anthropogenic mercury in the atmosphere comes from stationary combustion of fossil fuels (especially coal) and incineration of waste materials.

How does the mercury get released from industrial processes that are intentionally using mercury?

For intentional uses, mercury is released through:

- > Emissions and wastes generated during the production of the mercury, (whether mined, by-product, recycled), used in the process (see primary mercury production case studies);
- > Process releases, e.g., fugitive air emissions;
- > Releases from trace or residual mercury in the products produced using a mercury process;
- > Releases during the recycling of wastes;
- > Release from wastes, sludge, residues, contaminated equipment and supplies produced during the process.

Older chlor-alkali and VCM production facilities that used mercury as a catalyst in the production process (including those that have been closed for many years) are typically sitting on heavily contaminated sites that continue to release mercury into the local environment for years to come.

How is mercury released unintentionally from industrial processes?

Coal Combustion

Mercury is present in the mined coal, from the weathering of volcanic rocks and the accumulation of mercury in ancient sediments. The mercury content of coal varies. Even the mercury content of coal from a specific country or region can be highly variable.

Although small quantities of mercury may be emitted while coal is stored and handled, most mercury is released from the combustion stack after it is burned. Boilers operate at temperatures above 1100°C and mercury in the coal is vaporized and released as a gas. Some of the released mercury gas may cool and condense as it passes through the boiler and air pollution control device. The fraction of the mercury in coal that is not emitted to the atmosphere during combustion is trapped in wastes such as bottom ash and recoverable fly ash.



In some regions of the world, coal is used for home heating and cooking. This is not an industrial process, but it is noted here to highlight that in certain areas coal is burned in simple, sometimes unvented, household stoves, directly exposing people to emissions of mercury, and/or other toxic substances and organic compounds. While the use of coal for these purposes is gradually decreasing as incomes rise and alternative fuels become available, there remain hundreds of millions of people who continue to be exposed to a range of risks from such practices. There are ways to reduce the mercury exposure of people who burn coal domestically. These include better ventilation, modified cooking/heating stoves, fuel switching and use of low-mercury coal.

Industrial Smelting

Mercury is produced as a byproduct of processing ore in mining. Metal is generally extracted from the ore by heating it to a temperature that releases the metal. As mercury has a lower boiling point than many other metals (such as copper, silver, lead, zinc and gold), the mercury is often released as a gas during the smelting process. Unless the mercury is captured by process equipment dedicated to this purpose, much of it will be released to the atmosphere and aquatic environments, and some disposed of to land. In some ores the concentration of mercury is high enough to make recovery for sale economical.

Primary mercury mining practice is now very limited globally. It is expected that current global mercury demand can be met through a range of other sources, beyond mining new mercury.

There are a large number of small-scale, artisanal smelting operations worldwide. Most do not have controls in place to prevent or control mercury emissions from their operations. In such cases workers generally have very basic tools and little in the way of personal protective equipment. Reportedly, some of the villagers who are involved in smelting have symptoms suggesting mercury exposure. Certain aspects related to this are considered in Module 3 on artisanal and small-scale gold mining.

Cement Production

The raw materials used for the production of cement contain trace concentrations of mercury. Mercury originates from three basic sources: naturally present in virgin raw materials (lime, coal, oil, etc.), in solid residues from other sectors (e.g., fly-ashes and gypsum from combustion of coal) often used as raw materials for cement production and in wastes sometimes used as fuels in cement manufacturing. The last two sources may significantly increase the total input of mercury to cement production, depending on materials.

Cement production is a good example of a source of mercury releases due to the use of materials with very low mercury concentrations, but consumed in very great quantities. The major pathway for mercury releases from cement production is to the air, and to a lesser extent to the soil, in wastes and residues, as well as in the cement product itself.

Incineration

Mercury is also released from waste incineration. See Module 1.

What are the risks?

For certain facilities, occupational exposures may be expected, although actual exposures to mercury might be less of a concern than a range of other pollutants that workers could also be exposed to, such as dust, gases, lead and cadmium.

Impacts on people living near operations result primarily from atmospheric emissions and sometimes effects related to leaching of mercury from residues (such as in some smelting operations).

Two key issues that local residents may be concerned about are mercury deposition and fish contamination in their area. For example, with regard to local deposition, it has been demonstrated that the most bioavailable mercury releases from coal-fired boilers fall closest to the source of emissions. Power plants can contribute about 30% of the locally deposited mercury. Hotspots with high

mercury levels have been identified where multiple local sources contribute more mercury than regional and global sources. Other sources of mercury, including naturally-occurring sources, can also raise background levels above those generally found. In some cases, fish consumption advisories may be needed.

Artisanal smelting must be assumed to have severe health effects on those doing the smelting (see Module 3), as well as significant hazards for those living in the general vicinity, perhaps up to one kilometer away, depending on the prevailing wind direction. Likewise, leaching of mercury to local water supplies, fish, other food sources and downstream users could have significant health impacts.

Is it possible to reduce mercury releases from existing facilities that use and/or release mercury?

Many steps can be taken at existing facilities, including “good housekeeping” measures and “best management practices”, to reduce mercury use and emissions for all sources.

The most effective method for controlling mercury emissions is to avoid using raw materials containing mercury. However, this may increase production costs and may not be economically feasible. For releases to the atmosphere, the height of the emission stack and velocity speed at which flue gases enter the atmosphere influence the distance the mercury travels before deposition. Likewise, the atmospheric chemistry present at the height of release, and the potential for reactivity over distance, may influence eventual exposures.

A useful starting resource in providing guidance on reducing mercury releases is the ‘Guide for Reducing Major Uses and Releases of Mercury’ UNEP 2006. This document is available at the following web address:
www.chem.unep.ch/mercury/Guidance-training-materials.htm .

The Basel Convention on the Control of Transboundary Wastes and their Disposal has developed relevant technical guidelines on environmentally sound management of waste that are a good starting point in addressing hazardous waste such as mercury. The following web-link provides a link to a number of Basel Convention technical guidelines: www.basel.int

What are the barriers to adoption of mercury-free processes?

Most of the resistance to change in industry is due to the cost (real or perceived) of switching to a mercury-free alternative. This is especially the case of mercury used in chlor-alkali production, and mercury catalyst used in the production of VCM for PVC. From the industry perspective, the costs of conversion include not only investment in research and new equipment, but also the cost of production

down-time, the cost of cleaning up previous soil and groundwater contamination on site, the cost of disposing of all contaminated equipment and construction materials, etc.. It is not surprising that many of these industries put off conversion as long as possible.

In some cases (chlor-alkali production) the mercury free membrane process is less expensive to operate once it is installed. In others (VCM), the non-mercury process is often significantly more expensive because it does not rely to the same extent on inexpensive local resources of coal. In the case of VCM, market forces are driving VCM production to countries where there is limited regulation associated with mercury and/or this particular production process.

What can governments do?

The development of a mercury use and emission inventory is a good first step in assessing the scope of the problem at the national or regional level. UNEP has developed the 'Toolkit for identification and quantification of mercury releases' to assist countries in undertaking such work. The toolkit is available at the following web address: www.chem.unep.ch/mercury/Toolkit/default.htm

Developing an emission inventory can be aided by joining the UNEP Global Mercury Partnership. The partnership is open to new partners, and joining the partnership can be an excellent opportunity to network with experts and build capacity.

Additionally, substituting processes without mercury for processes with mercury is one of the most powerful preventive measures for influencing the entire flow of mercury through the economy and environment. Governments must consider the social perspective, the human health and environmental impacts of industrial activities of mercury, as well as economic factors such as employment in decision-making.

Pollution control measures should consider a wide range of pollutants including mercury, particularly when considering the construction of new facilities.

Certain regulatory measures that may be considered include:

- > Requiring that any mercury contained in process wastes be recovered, such as in the chlor-alkali industry.
- > Prohibiting or restricting cross-border transport of mercury and other hazardous wastes.
- > Requiring that any mercury containing waste or materials stored on-site by an industry or commercial operation must be in air-tight and waterproof containers, and that the organization must have complete records, and a written plan and schedule for proper disposal of the materials. See Surplus Mercury Management section below.
- > Requiring industries using mercury to prepare a mercury balance each year

- > showing how much mercury entered the process and how much was emitted. Pollutant Release Transfer Registries can play a useful role.
- > Prohibiting primary mercury mining.
- > Prohibiting the disposal on land of any sewage sludge, fertilizer or other material that exceeds responsible international standards for mercury content.
- > Putting in place an environmental management strategy that includes responsible monitoring and enforcement of mercury regulations, tracking of all mercury movements (from raw material to process to product to waste), and periodic independent assessment.

Technical measures for dealing with mercury wastes may be divided into pre-treatment measures and emission control measures. Pre-treatment measures may include prohibiting or limiting mercury releases to the environment by separating mercury and mercury-containing items from household waste, hazardous waste and medical waste. Emission control measures could include:

- > Preventing or limiting mercury from industrial processes (such as chlor-alkali and metallurgic industry) from being released directly to the environment;
- > Applying emission control technologies to limit emissions of mercury from combustion of fossil fuels and processing of mineral materials;
- > Establishing national or regional safe containment facilities for mercury surplus and/or mercury containing waste;
- > Preventing or limiting the release of mercury from processes to the wastewater treatment system;
- > Preventing or limiting the use of obsolete technology and/or requiring the use of the best available technology to reduce or prevent mercury releases.

Surplus Mercury Management

Surplus mercury management facilities are designed to prevent mercury release to the environment and exposure risks to humans. There should be a well-ventilated, designated location for the storage of waste mercury collection drums. These steel drums must have liners and be placed on a concrete slab. Drums must be protected from rainfall and secured from theft and/or to protect against unauthorized opening. Broken and/or obsolete mercury medical devices may be placed in these drums along with mercury from clean-up operations (following facility mercury spill clean-up procedures). Such facilities should develop a waste mercury collection plan including procedures and outlining responsibilities. Before beginning there should be an established schedule for when the mercury will be removed for processing, proper management and disposal.

What can companies using and releasing mercury in their processes do?

It is very important for a company to have a good working relationship with its employees and the local community. If the relationship is good, problems can be more easily resolved, and the local community will be more inclined to support and trust the proposals and actions of the company.

As a start, any company that uses mercury in its operations should have a specific written plan for dealing with mercury. This plan ought not only to demonstrate compliance with all government regulations, but cover all of the issues listed below, together with deadlines or milestones for taking certain specific actions or meeting environmental standards, as necessary. In general, the management plan should promote ongoing reductions in mercury uses, releases, trade, and human exposure to mercury. At the same time it should also include emergency management procedures, such as how to deal with mercury spills (see Module 1) and with workers who have been exposed to high levels of mercury.

The company must determine what occupational exposures to mercury may be experienced by workers. It should have a program for monitoring air concentrations of mercury in the workplace, worker exposures and for dealing quickly with any evidence of harmful exposure. It should also have a plan for ongoing reduction and, if possible, eventual elimination of occupational exposures through changeovers to mercury-free products and processes.

Each company should have a fair idea, at any time, of the quantity of mercury used and released through its practices and products. It should be aware that releases may vary significantly depending on the production or process activity rate, the raw materials used, the age and maintenance of equipment and even the ambient weather conditions.

The factory management should also be generally aware of where its emissions are going – what part of its emissions into the upper atmosphere and deposited far away, what part into the local atmosphere and deposited locally, the direction of the prevailing winds, emissions to wastewater, etc. It is only in such a way that a company can have a reasonable idea of the possible impact of its mercury emissions on the local population and the environment.

Whatever the circumstances, the company should also develop a program for ongoing reduction of mercury emissions, possibly linked to the level of production, with milestones and target dates and annual reviews of its mercury monitoring and reduction strategies.

The company should have a good understanding of its mercury waste situation. How much mercury waste is generated, what type of waste (sludges, filtercake, tailings, ash, slag, etc.) is generated, what is the approximate mercury content of

the different types of waste, under what conditions may waste be stored? Furthermore, in order to manage mercury wastes adequately, the company has to know precisely where and how its mercury wastes are disposed of. For example, due to the known risks of mercury on human health and the environment, it is no longer acceptable merely to transfer mercury wastes to another person or company and forget about them. Are the mercury wastes going to a landfill, and if so, is it a municipal landfill or a special landfill? What is the chance that these mercury wastes may be burned on the landfill or elsewhere? What is the risk of mercury exposure to people who may be scouring a waste dump in search of reusable materials?

If the mercury waste is treated, what kind of treatment is used, and how is the waste disposed of after treatment? Is final disposal deep underground and no longer a concern, or is it possible that mercury wastes may still be burned or incinerated? With mercury emissions, the company ought to have a mercury (and other) waste reduction program that targets ongoing decrease of the volume and mercury content of wastes, as well as gradually improving treatment and disposal practices which meet gradually higher standards.

While some improvements referred to here may be obvious, other measures that may be implemented to achieve ongoing reductions in mercury occupational exposures, emissions and wastes are not always evident. There are increasing resources available to assist the company to move in this direction, such as:

UNEP (2005) Toolkit for identification and quantification of mercury releases
www.chem.unep.ch/mercury/Toolkit/UNEP-final-pilot-draft-toolkit-Dec05.pdf

UNEP (2006) Guide for Reducing Major Uses and Releases of Mercury.
<http://www.chem.unep.ch/mercury/Sector%20Guide%202006.pdf>

There is often a general concern that improvements of various types designed to reduce mercury releases will be prohibitively expensive. While this is true in some cases, there are frequently a great number of measures that may be taken for very little or no cost. Employees may be very happy to help out in various ways when they know that such measures can reduce mercury exposure to themselves or their community. Furthermore, the reduction or elimination of mercury or mercury wastes has often been shown to save money for a company because it no longer has to devote funds to filter flue gases or wastewater leaving the building or increases energy efficiency. The firm can also economize on costly mercury waste disposal.

CASE STUDY 7: SOUTH AFRICA MERCURY PRODUCTION: PROBLEMS IN A MERCURY PRODUCTION FACILITY	12-14
CASE STUDY 8: AZERBAIJAN THE STORAGE OF MERCURY WASTES	15-16
CASE STUDY 9: CZECH REPUBLIC MERCURY CONTAMINATION FROM A CHLOR ALKALI FACILITY	16-17

CASE STUDY 7: SOUTH AFRICA MERCURY PRODUCTION: PROBLEMS IN A MERCURY PRODUCTION FACILITY

In the 1970s Thor Chemicals operated a mercury-production facility at Margate, Kent, England. When excessive levels of mercury were found in the air and in workers' urine in the 1980s, the Health and Safety Executive of Great Britain threatened prosecution. Thor closed the Kent plant in 1987 and relocated to Cato Ridge, South Africa, a small, industrial village in the self-governing province of Kwazulu-Natal. The facility at Cato Ridge was to be a mercury reclamation operation and it began accepting mercury waste from the U.S. and UK, for treatment and recovery. The labour force employed at Cato Ridge was not trained in the dangers of occupational exposure to mercury.

Tests conducted as early as 1988 showed that nearby rivers and streams (drinking water sources) had mercury levels greater than WHO recommendations. The Environment Ministry announced in 1990 that South Africa would no longer import hazardous wastes. Nevertheless between 1991 and 1994, three U.S. companies shipped over 2500 drums of mercury waste to South Africa, without notifying the U.S. of these exports, as required under the U.S. Resource Conservation Recovery Act. One company eventually recalled 150 drums under intense international scrutiny from environmentalists.

In 1990 Earthlife Africa received reports of Thor workers "going mad". A doctor from the Industrial Health Unit (IHU) diagnosed mercury poisoning in four workers and further investigation revealed that 87% of workers had mercury levels that were above the safe limit. By 1992 two Thor workers had died of mercury poisoning, and an IHU study revealed that almost 30% were in danger of permanent health damage from it. The families of the deceased workers sued Thor in a British court and were awarded almost US\$2 million. Compensation for injured workers, however, has been much smaller and barely sufficient to cover their medical expenses.

It was discovered that Thor had not been processing the mercury waste, but storing it. In 1994 a visit to the site by delegates from the African National Congress uncovered a sludge pond brimming with 2500 tonnes of mercury, and three warehouses overflowing with more than 10,000 rusting and leaking barrels of mercury waste.

The discovery of catastrophic contamination levels around the plant convinced the Department of National Health to close Thor's recovery plant and incinerator in 1994. Thousands of tonnes of stockpiled waste remained on the site and Thor was allowed to continue producing mercury catalysts until 1999.

The Davis Commission of Inquiry was appointed in 1995 and produced a report in 1997 proposing that waste be disposed of through incineration. Environmental groups opposed this solution and called on the companies that originally exported the waste to South Africa to reclaim it. The incineration proposal was eventually rejected because of an inability to work out a cost-sharing agreement between the South African government and Thor.

In 2002 the South African government reopened the issue through environmental legislation. In March 2003, the Deputy Minister of Environmental Affairs issued a Directive ordering the company to clean up or face legal action in accordance with the National Environmental Management Act. After lengthy negotiations, Thor agreed to contribute US\$3 million towards the clean-up and the South African government agreed to contribute US\$300,000 towards the payment of Project Engineers to design and oversee the operation. The combined amount is sufficient to cover the first phase of the project, as total costs are estimated to be US\$9 million.

The first phase of the clean-up, launched in August 2004, involved a waste categorization process, followed by an assessment of the impact of different methods of disposal. Disposal options include: thermal retorting; disposing of waste at an appropriate disposal facility; sending the waste back to the producer and country of origin; transporting the waste to another country with adequate disposal facilities; and/or collecting the waste from warehouses, contaminated soil and buildings and storing it safely on site. The Davis Commission also plans to investigate how the incident was allowed to happen and how legislation could be developed to ensure that it does not occur again.

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CASE STUDY 8: AZERBAIJAN THE STORAGE OF MERCURY WASTES

Industrial enterprises, particularly the oil and gas mining industry, energy generation and transport sectors, are the main sources of pollution in Azerbaijanian cities such as Baku and Sumgait. The use of outdated technologies and equipment, along with insufficient pollution reduction measures, result in high local and regional contamination from mercury and other toxic substances.

The most serious problem in Sumgait is mercury pollution from two mercury-cell chlor-alkali plants. One of these stopped production in 1981, but the other continues to operate. Mercury loss in chlorine production there was at one time 1 kg per tonne of chlorine produced, although it has since decreased to 300 g/tonne. With up-to-date processes, this figure could be as low as 2-3 g/tonne.

Mercury released from the chlorine production process has been emitted to the atmosphere, released in wastewater and collected in solid waste. About 200,000 tonnes of slime containing 0.1% to 0.3% mercury has been collected before it flowed into the Caspian Sea. However, refined wastewater released into the Sumgait River has resulted in a high level of mercury contamination there. Initial research has shown that mercury has collected in the marine ecosystem and that the methylmercury levels in fish in the area could exceed safe limits. Treatment of the slime there has not been possible due to the lack of highly efficient clean-up technology, complex local geology and the proximity of the area to the water table and the Caspian Sea. The lack of infrastructure and funding has hampered proposed clean-up projects. Future use of this land will require a highly efficient soil clean-up method.

To prevent deterioration of the situation, the World Bank suggested halting chlor-alkali production and isolating the mercury-containing waste. A "Hazardous Waste Containment Area" for permanent burial of toxic wastes was built near Sumgait on the Absheron peninsula in July 2004. This area has been constructed in accordance with the international standards and is registered with the Ministry of Justice. It includes a 250,000 m² pit, isolated from the surrounding environment with a geomembrane polymer barrier. The current project includes clean up certain areas of the plant located in Sumgait and disposing of wastes from those areas at the containment area. So far, 40,000 m³ of mercury-containing waste (slime) has been disposed of there. Future expansion of the area is planned. This is the first hazardous waste containment area in Azerbaijan and is considered a good precedent for future efforts to contain other types of toxic waste currently stored at industrial sites.

A similar containment scheme may be considered for mercury-containing lamps. There are currently about 1,000,000 to 1,500,000 spoiled mercury-containing lamps in Azerbaijan. Currently the lamps are taken to landfills (sometimes even unofficial landfills), where they are broken and the mercury enters the soil. Procedures for phasing out the use of such lamps and controlling their disposal have not yet been fully applied due to the cost.

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CASE STUDY 9: CZECH REPUBLIC MERCURY CONTAMINATION FROM A CHLOR-ALKALI FACILITY

Mercury levels in soil, air, water and fish are dangerously high in the area surrounding the Spolana chemical plant near a town of 16,400 inhabitants in the Central Bohemian Region of the Czech Republic.

The Spolana plant is one of two chlor-alkali plants in the Czech Republic that are using the mercury cell chlor-alkali process to produce chlorine. The factory is scheduled to begin using a non-mercury membrane technology by 2015. Meanwhile, significant quantities of mercury continue to be used and released each year. Between 1994 and 2003, Spolana Neratovice produced over 700 tonnes of mercury-containing waste, which the company disposed of in its own hazardous waste landfill. During the eight years of operation between 1996 and 2003, more than one tonne of mercury was released into the air. In the ambient air in the vicinity of the new plant, concentrations of mercury ranging from 50 to more than 150 ng/m³ were detected.

At the Spolana site there is also an older mercury cell operation which was closed in 1975. It has not been maintained since that time and is another major source of mercury contamination. Although mercury has not been used for 30 years in the old plant, mercury concentrations of more than 950 ng/m³ were detected in the ambient air at that site.

In 2003 mercury concentrations were measured around both new and old facilities using a Lumex RA-915+ air analyzer. Buildings, the soil, groundwater and surface water at the old chemical plant are contaminated. The quantity of mercury in soil and construction materials is estimated to be 264 tonnes. The concentrations of

mercury in the soils in the vicinity of the old plant were more than 175 mg/kg and more than 400 mg/kg in the vicinity of the operational plant.

In 2003 the State Veterinary Institute analyzed seven freshwater fish from the nearby water basin where mercury concentrations ranged from 0.124-0.711 mg/kg – seven times higher than the limit allowed for freshwater fish. They were identified as not fit for consumption. The highest concentrations of mercury were found in fish caught downstream from Spolana.

In 2004 the Czech State Health Institute analyzed the mercury content of the blood, hair and urine in residents of the community. Blood mercury concentrations in residents living near the chloralkali plant were twice as great as levels in a control group and in the rest of the Czech Republic population. The symptoms most frequently identified were all related to the nervous system, typical of mercury exposure.

An Environmental Impact Assessment for Spolana and a decontamination process were prepared and agreed upon in 2004. The clean-up method will include encapsulating the mercury, demolishing the buildings and removing the surface layer of soil. The waste will go to a thermal desorption process to remove mercury and then the clean waste will go to the landfill. The costs are estimated to reach more than \$US 20 million.

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Euro Chlor website: www.eurochlor.org

IEA Clean Coal Centre web-site: www.iea-coal.org.uk/site/ieacoal/home

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www.chem.unep.ch/mercury/Toolkit/default.htm

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Governments have agreed that there is sufficient evidence of significant adverse impacts from mercury and mercury compounds to warrant action on mercury. This publication was developed to raise awareness in certain countries and regions amongst stakeholders on the effects of mercury on human health and the environment. It is hoped that it will assist citizens, governments and health care workers to build support and the capacity to take action to reduce or eliminate mercury uses, release, and exposure to mercury.

This is one of five modules.

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