UN environment programme

Assessment Report on Issues of Concern

Published September 2020

ARSENIC

1. Sources

Arsenic is a naturally occurring metalloid that is ubiquitous in the Earth's crust. It is present in various inorganic and organic forms. Arsenic and arsenic compounds are used intentionally in wood preservatives, pesticides, animal feed additives, pharmaceuticals, glass production, alloy manufacturing, electronics, and semiconductor manufacturing.

2. Why is it relevant?

Arsenic and many arsenic compounds are highly toxic to human health and many wildlife species. Once released to the environment, they persist and accumulate. Arsenic and arsenic compounds have been;

Identified by the World Health Organization (WHO) as one of 10 chemicals of major public health concern, and by the Global Chemicals Outlook II as an issue with emerging evidence of risks to human health and the environment;

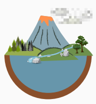
Classified as carcinogenic to humans. Long-term exposure to arsenic in drinking-water is causally related to increased risks of cancer and skin changes such as hyperkeratosis and pigmentation changes;

Associated with cardiovascular disease, diabetes, and adverse effects on the nervous, respiratory, immune and endocrine systems;

Shown to cause acute and chronic effects at concentrations ranging from a few micrograms to milligrams per litre. Aquatic and terrestrial biota have shown a wide range of sensitivities to different arsenic species.

Releases of arsenic and arsenic compounds to the environment may occur from both natural sources and anthropogenic sources, with anthropogenic sources playing a major role in the global exposure.

Natural sources include volcanic activity and, to a lesser extent, low temperature volatilization, weathering of rocks, exudates from vegetation, and windblown dusts.



Anthropogenic sources include fossil fuel and coal combustion, mining and smelting of metals, and sources related to the production, use, disposal and recycling of the metals and their related products.

The primary route of arsenic exposure is via ingestion of contaminated food and water.

Today, elevated contamination levels of arsenic and arsenic compounds in environmental media, wildlife and humans are a global phenomenon, resulting in major concern.

Human exposure to arsenic may also occur from arsenic-related industry activities and arsenic-containing products.

In an occupational setting, inhalation of arsenic-containing particles is a primary route of exposure with possible significant ingestion and dermal exposure in particular situations.

For more detailed information on arsenic, please see Chapter 4.1 of the ***Assessment Report on Issues of Concern*** and Part B, Chapter 1 of the ***Annexes to the Assessment Report on Issues of Concern***. Available on the UNEP website.

3. Existing instruments and actions

Arsenic-containing wastes are listed as hazardous wastes under the Basel Convention. As a result, they are subject to the Convention's provisions.

Some countries and regions have adopted legally binding instruments to restrict the use or presence of arsenic in one or more product categories, including anti-fouling systems, treatment of industrial waters, wood preservatives, fertilizers, animal feeds, toys, packaging material, perfume and cosmetics, and/or foodstuffs.

Legally binding instruments are further complemented by guideline values related to exposure. In particular, the WHO has established a provisional guideline value for arsenic in drinking water (10 µg/L) but not in air or through dietary exposure. Guideline values for arsenic levels in different exposure media (e.g. in occupational settings) have also been established in a number of countries.

Voluntary actions have also been taken in some places, for example, the phase-out of arsenic-containing animal feeds by some major manufacturers. Similarly, multiple third-party standards and certification schemes have included arsenic in their listings.

See Annexes for more

4. Challenges and opportunities

Addressing global exposure to arsenic and arsenic compounds is both critical and complex due to ubiquitous exposures around the world and the resulting significant human-health impacts and thus associated societal costs.

It requires different strategies for a wide range of sources, including uncontrollable to unintentional releases.

Some sources may influence places far away from the original sources through long-range transport via air and global trade of arsenic-containing goods. Meanwhile, substantial releases have been accumulated over centuries and are continuously being made.

Current instruments and actions, while important for addressing several particular issues in some specific countries and regions, are far from comprehensive in addressing current widespread exposure to arsenic and arsenic compounds at the global level.

Further international concerted actions that cover all major sources are urgently needed to address arsenic in an integrated and holistic manner, possibly through legally binding instruments.

Similarities among arsenic, mercury, cadmium and lead, in terms of their sources and challenges, need to be taken into consideration for future actions, particularly at the international level, in order to capitalize on any possible synergies.

For more detailed information on arsenic, please see Chapter 4.1 of the ***Assessment Report on Issues of Concern*** and Part B, Chapter 1 of the ***Annexes to the Assessment Report on Issues of Concern***. Available on the UNEP website.

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CADMIUM

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1. Sources

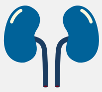
Cadmium is a toxic metal that is naturally found in the Earth's crust, generally at low levels. Cadmium and cadmium compounds are mainly used in nickel-cadmium batteries, alloys, coatings and plating, pigments in plastics, glasses, ceramics and paints, solar cells, PVC stabilisers and others.

It has been produced, used and released in large quantities, and thus intentional human uses have caused widespread, persistent contamination and exposure.

2. Why is it relevant?

Cadmium is highly toxic to humans and the environment at very low exposure levels. Cadmium and cadmium compounds have been;

Identified as one of 10 chemicals of major public health concern by the World Health Organization (WHO), and as an issue with emerging evidence of risks to human health and the environment by the Global Chemicals Outlook II;



Classified as carcinogenic to humans. Cadmium may also cause a range of other adverse health effects, mainly affecting kidney function;

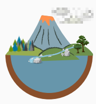
Linked to reduced lung function as well as damage to bones, with children particularly at risk;

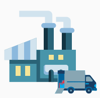
Shown to cause animals exposed in the environment to suffer from cadmium-induced kidney damage. Cadmium is especially dangerous to animals because of its high bioavailability and bioaccumulation potential.

Exposure to cadmium and cadmium compounds may occur both from natural and anthropogenic sources, with anthropogenic sources contributing substantially to current emissions.

Natural sources include volcanic activity and, low temperature volatilisation, weathering of rocks, exudates from vegetation, and windblown dusts.

Anthropogenic releases include fossil fuel and coal combustion, mining and smelting of metals, and sources related to the production, use, disposal and recycling of cadmium and cadmium-containing products (including phosphate fertilisers with cadmium as impurities).





Once released, cadmium persists in the environment, and reaches wildlife and humans through contaminated air, water, soil and foodstuffs.

Humans may be additionally exposed through house dust, tobacco smoking and cadmium-related consumer products. For the general, non-smoking population, the main exposure lies in the ingestion of food (about 90%).

In occupational settings, the main exposure route is via the respiratory tract; incidental ingestion of dust from contaminated hands and food may occur as well.

For more detailed information on cadmium, please see Chapter 4.3 of the ***Assessment Report on Issues of Concern*** and Part B, Chapter 3 of the ***Annexes to the Assessment Report on Issues of Concern***. Available on the UNEP website.

3. Existing instruments and actions

At the international level, governments have recognized "the significant risks to human health and the environment arising from releases of lead and cadmium into the environment" and requested cooperative actions on cadmium (e.g., UN Environment Assembly Resolution 1/5 and 2/7).

Other international actions on cadmium include the recognition of cadmium-related wastes as hazardous wastes under the Basel Convention, the United Nations Economic Commission for Europe's Protocol on Heavy Metals under the Convention on Long Range Transboundary Air Pollution—which addresses cadmium among other heavy metals, and the development of international guidelines for cadmium levels in air.

A number of countries and regions have taken actions to legally restrict, ban or set mandatory national standards for cadmium in specific uses, which are not being addressed internationally. For example, restrictions and bans on cadmium use in polymers, food-related items, specific electrical and electronic products and by setting legal limits for the unintentional presence of cadmium in different fertilizers.

Various other legally binding instruments and voluntary actions have also been used. For example, legal requirements to provide information to users and consumers, or voluntary limits on cadmium in fertilisers by the fertiliser industry. In addition, a large number of countries have looked at emissions and exposure media, and set up guideline values for different exposure media.

4. Challenges and opportunities

Cadmium has a capacity to cause significant adverse effects on human health and the environment at very low levels.

Efforts to date are likely to be inadequate to eliminate or minimize cadmium exposures from anthropogenic sources as a whole.

Addressing cadmium can be complex due to many other factors including the diversity and prevalence of sources around the world. Simply reducing cadmium demand by restricting or banning its use may not effectively limit its global production.

An increased demand for cadmium in some uses may help reduce its emissions in others. For example, as the demand for renewable energy sources increases, so will the use of photovoltaics and batteries that contain cadmium. These could eventually become a source of cadmium-containing wastes at the end of their lifetimes. Thus, future international concerted actions need to take such trade-offs into consideration.

Much can be learned from the global sound management of mercury, arsenic, cadmium and lead as the challenges associated with addressing global exposure them are generally similar. Further international concerted actions that cover all major sources are urgently needed to address cadmium in an integrated and holistic manner, possibly through legally binding instruments.

For more detailed information on cadmium, please see Chapter 4.3 of the ***Assessment Report on Issues of Concern*** and Part B, Chapter 3 of the ***Annexes to the Assessment Report on Issues of Concern***. Available on the UNEP website.

LEAD

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1. Sources

Lead is a toxic metal that occurs naturally in the Earth's crust. It may exist in both inorganic and organic forms.

The current global uses of lead are in batteries, rolled and extruded products, pigments and other product additives (e.g. for paints, cathode ray tubes, enamels and ceramics, PVC stabilisers), ammunition, alloys, cable sheathing and other uses.

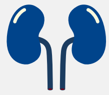
2. Why is it relevant?

Lead is a multi-system toxicant for which no safe level of exposure has been identified. It has a ubiquitous presence in the environment and wildlife and humans may be continually exposed to lead once it is released, via contaminated air, water, soil and foodstuffs (including herbal products and medicine).

Lead has been identified as one of 10 chemicals of major public health concern by the World Health Organization and as an issue with emerging evidence of risks to human health by the Global Chemicals Outlook II.

Exposure to lead can cause chronic and debilitating health impacts in all age groups, and children are particularly vulnerable to its neurotoxic effects.

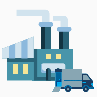
Inorganic lead compounds have been classified as "probably carcinogenic" to humans, however there is sufficient evidence of carcinogenicity in experimental animals.



Other health effects of exposure to lead include hypertension, renal failure, cardiovascular disease and stroke, especially among workers. Adverse effects of lead on the ecosystem have also been observed.

Exposure to lead and lead compounds may occur from natural and anthropogenic sources and releases from anthropogenic sources of lead substantially surpassed natural sources long ago.

Natural sources include volcanic activity and, to a lesser extent, low temperature volatilisation, weathering of rocks, exudates from vegetation, and windblown dusts.



Anthropogenic releases include fossil fuel and coal combustion, mining and smelting of metals, and sources related to the production, use, disposal and recycling lead and lead related products.

Lead and lead compounds persist in the environment in different forms once released. They may exhibit different environmental fate and transport characteristics depending on their forms.

Wildlife and humans may be exposed to lead once it is released, via contaminated air, water, soil, foodstuffs and lead related products.

Lead can enter the food chain through crops growing on contaminated land, from direct deposition onto crops, through food animals and fish living in lead-contaminated environments.

Workers may further be exposed through inhalation of lead particles, for example, during smelting and recycling

For more detailed information on lead, please see Chapter 4.5 of the ***Assessment Report on Issues of Concern*** and Part B, Chapter 5 of the ***Annexes to the Assessment Report on Issues of Concern***. Available on the UNEP website.

3. Existing instruments and actions

At the international level, in addition to the focus on lead paint, actions have focused on lead and lead compounds in petrol, batteries, ammunition and wastes, while some resolutions also referred to the wider sources of lead exposure (e.g. Johannesburg Plan of Implementation; UNEA Resolution 3/9). Among these areas, the phase-out of leaded petrol is the most successful one.

For lead in batteries, ammunition and wastes, international efforts are ongoing. Most importantly, lead-containing wastes including waste lead–acid batteries have been included as hazardous wastes under the Basel Convention.

Resolutions and recommendations have been adopted at other international forums with regard to environmentally sound management of waste lead–acid batteries and phase-out of lead ammunition for hunting and fishing. Efforts have also been taken to assist countries in taking actions, e.g. the development of guidance documents and tools.

National and regional instruments and actions have been more diverse both in terms of types and their respective scopes. Many countries and regions have taken actions to legally restrict or ban lead in a wide variety of specific uses that may go beyond those that are being addressed at a global scale.

A large number of countries have looked at releases from anthropogenic sources and exposure media that are not lead-specifics, and some countries have set up guideline values for different exposure media that are either legally binding or as recommended guidance values.

See Annexes for more

4. Challenges and opportunities

The dangers of lead and lead compounds have been known for over a century. Scientific evidence continues to show no safe levels of lead exposure for children and that very low levels of lead can cause severe adverse health effects all ages.

This knowledge has, for example, led to considerable international and national efforts to virtually eliminate leaded petrol worldwide. However, efforts to date are likely to be inadequate to eliminate or minimise lead exposures from other anthropogenic sources.

Considering the successful story of the global phase-out of leaded petrol, the international community as a whole can step up action to address lead exposure in a much more comprehensive manner. This message has been reiterated many times at different international forums since the World Summit of Sustainable Development in 2002.

Action needs to be taken not only to address sources that may result in exposure far away from the original sources through long-range transport via air, but also with regard to sources for which exposure may occur only locally or regionally.

Much can be learned from the global sound management of arsenic, cadmium and mercury. These elements can be successfully addressed with international actions.

For more detailed information on lead, please see Chapter 4.5 of the ***Assessment Report on Issues of Concern*** and Part B, Chapter 5 of the ***Annexes to the Assessment Report on Issues of Concern***. Available on the UNEP website.

UN environment programme

LEAD in PAINT

Assessment Report on Issues of Concern

Published September 2020

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1. Sources

Lead is a metal and a multi-system toxicant for which no safe level of exposure has been identified.

One major source of exposure, particularly for children, is through lead paint, or paint to which lead compounds have been added as pigments, drying agents or anti-corrosives.

2. Why is it relevant?

Exposure to lead can cause chronic and debilitating health impacts in all age groups, and children are particularly vulnerable to its neurotoxic effects The widespread use of lead has caused extensive environmental and human exposure across the globe.

Lead can be harmful to people of all ages, with children, infants and foetuses being particularly at risk. Health effects of lead, include reduced intelligence quotient scores and intellectual deficits.

The main sources of exposure for infants and children are food and drinking water, household dust, soil, and mouthing of products containing lead.

Workers are at high risk, of exposure as large quantities of lead can be released during manufacturing, application and removal of lead paint.

A significant proportion of housing in developed countries still contains legacy lead paint.

At the second meeting of the International Conference on Chemicals Management (ICCM2) in 2009 lead in paint was recognized as an issue of concern.

The Global Alliance to Eliminate Lead Paint (Lead Paint Alliance) was established and included in its business plan the target that by 2020 all countries should have legally binding controls on lead paint.

3. Existing instruments and actions

It has been more cost-effective, as well as more protective to public health, to stop the manufacture and sale of lead paint than to remediate homes and other buildings and deal with the health consequences of lead exposure after the fact, particularly as safer alternatives to lead compounds in paints have become available at similar cost.

A number of instruments are in place or are being developed to address the phase-out of lead paint from the market. As of 31 December 2020, 79 countries have legally binding controls to limit the production, import and sale of lead paints, which is 41% of all countries.

For more detailed information on lead in paint, please see Chapter 3.6 of the ***Assessment Report on Issues of Concern*** and Part A, Chapter 6 of the ***Annexes to the Assessment Report on Issues of Concern***. Available on the UNEP website.

3. Existing instruments and actions (cont.)

Legally binding instruments are complemented by other non-legally binding instruments, including voluntary standards and voluntary phase-out by major multinational paint manufacturers.

Intergovernmental organisations and the lead paint alliance continue to play an important role in phasing out lead paints, including organising awareness raising events, developing guidance and tools for policymakers who are interested in setting up legally binding laws on restricting lead paints, and assisting countries in developing legal limits.

4. Challenges and opportunities

The majority of countries have yet to remove all lead paints from their markets which may also impact other countries.

The scope of control measures may vary considerably among countries with legally binding or voluntary instruments. Not all these instruments are as protective as they are intended to be.

While lead paint regulations have been adopted and implemented in many countries, monitoring and enforcement is still an issue in some of these countries.

A number of Small and medium-sized enterprises (SMEs) and informal economy participants face obstacles in reformulating their paints, e.g. a lack of awareness and knowledge of where they may obtain lead-free raw materials.

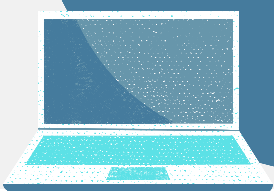
Stepping up global efforts is needed to ensure a complete phase-out of lead paint, including;

- Scaling up awareness-raising activities and technical assistance in establishing legal limits; and
- Establishing legally binding instruments together with the other uses of lead.

Efforts are needed to evaluate the effectiveness of control measures and improve them if necessary. Parallel efforts addressing the trade of lead pigments may also be useful in accelerating the phase-out in countries still using lead paints. At national scales, innovative initiatives to foster voluntary actions should also be considered and encouraged.

Efforts should be made to foster effective monitoring and enforcement in all countries, including ensuring the presence of necessary laboratory infrastructure and scientific and other capacities in developing and transition countries.

The specific needs of SMEs and informal economy participants should be taken into consideration when designing and implementing suitable instruments to address the sound management of lead in paint, e.g. by including components that provide technical and financial assistance to SMEs.



For more detailed information on lead in paint, please see Chapter 3.6 of the ***Assessment Report on Issues of Concern*** and Part A, Chapter 6 of the ***Annexes to the Assessment Report on Issues of Concern***. Available on the UNEP website.

1. Sources

Organotins are organic compounds that contain at least one tin-carbon bond. There are four main groups of organotin compounds, which are used in various applications.

Mono- and di-organotins are mainly used as heat stabilisers in Polyvinyl chloride (PVC) in a wide range of applications, including window frames and house siding, PVC pipes, food contact blister packs and water bottles. Tri-organotins are mainly used as biocides (e.g. in wood preservatives, in anti-fouling paints for boats and in textiles) and as pesticides. Tetra-organotins have been used as intermediates in the preparation of other organotins and as oil stabilisers.

2. Why is it relevant?

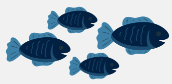
Depending on the organotin compound, studies have also shown that toxicity of organotins may increase with the number of organic functional groups (mono- < di- < tri-organotins). Tributyltin is considered among the most hazardous substances released into the marine environment

Organotins as biocides were identified by Global Chemicals Outlook II as an issue with emerging evidence of risks to health and the environment.

Exposure has been reported to cause skin, eye and respiratory irritation, neurological problems, and effects on the immune system.

Some organotins are highly neurotoxic, and others are immunotoxic.

Hepatic and hematological effects and reproductive and developmental effects have been reported in animals treated with some organotins.



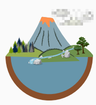
Endocrine disrupting potential has been observed for many organotins.

In aquatic environments, tributyltin compounds have been reported to lead to male sexual characteristics in female marine snails and have the potential to induce sex reversal in marine fish.

Organotins may be released to the environment at any point throughout their life cycles, e.g. direct releases from pesticidal uses, leaching from ship hulls and leaching from PVC microplastics.

As a result of their widespread use, releases and exposure to organotins are likely ubiquitous. Their degradation half-lives are on the order of months to years, and even decades, in soil and sediment.

Organotins have solely anthropogenic origins, with the exception of some methylated compounds made by bacteria.



Wildlife and humans are exposed to organotins through contaminated environmental media and foodstuffs. Accumulation in biota may occur for some organotins resulting in levels in tissues.

Humans may be further exposed to organotins through the use of organotin-containing products (e.g. via leaching from silicone baking containers). Organotins may also enter the foetus via the placenta.

Occupational exposure may occur during the production and processing of organotins and associated products.

For more detailed information on organotins, please see Chapter 4.8 of the ***Assessment Report on Issues of Concern*** and Part B, Chapter 8 of the ***Annexes to the Assessment Report on Issues of Concern***. Available on the UNEP website.

3. Existing instruments and actions

At the national and regional levels, many countries have taken action to address tributyltin in anti-fouling paints on ships before or in response to the International Convention on the Control of Harmful Anti-fouling Systems on Ships. Some countries and regions have gone further and set legal restrictions on more organotins in a wider range of uses.

Various uses have been restricted by regulatory agencies (e.g. use of dibutyltins, dioctyltins and tri-organotins) as anti-fouling as biocidal agents, in the treatment of industrial waters, and in different consumer products.

Some governments have used soft-law instruments by setting norms such as guideline values in different exposure media including air, soil and groundwater and during occupational exposures.

These actions have been complemented by voluntary industry phase-out through tools such as restricted substances lists and third-party standards and certification schemes.

4. Challenges and opportunities

Efforts have been made to address environmental and human exposure to organotins, particularly with regard to their use in anti-fouling paints on ships. However, current efforts are rather fragmented and likely not enough, as shown by continued contamination and exposure.

Ongoing uses of many organotins, including as biocides and pesticides, in many parts of the world remain significant and are of concern.

While further investigation may be needed to understand the magnitude of current exposure from these ongoing uses (including from PVC recycling), immediate actions can be taken by more governments and stakeholders to minimise environmental and human exposure to the large family of organotins.

Given the widespread use and contamination of organotins (and long-range transport potential of some organotins), international concerted action may also be warranted.

For more detailed information on organotins, please see Chapter 4.8 of the ***Assessment Report on Issues of Concern*** and Part B, Chapter 8 of the ***Annexes to the Assessment Report on Issues of Concern***. Available on the UNEP website.