

> FACT SHEET - CYANIDE AND ITS USE BY THE MINERALS INDUSTRY MARCH 2005

What is cyanide?

Cyanide is a naturally occurring molecule of carbon and nitrogen. Low concentrations of cyanide are present in nature - for example in many insects and plants, including a wide range of vegetables, fruits and nuts, where it provides protection against predators.

In addition, cyanide is present in much of the everyday environment to which we are exposed, for example in road salt, automobile exhausts and as a stabilizer in table salt. The largest source of mobile emissions of cyanide to the air is motor vehicle exhaust.

What is cyanide used for?

Cyanide is a widely used and valuable industrial chemical. According to the [World Health Organisation](#), over one million tonnes of cyanide (about 80 per cent of the annual production of cyanide compounds) is used in the chemical industry for production of organic chemicals such as nylon and acrylic plastics, in electroplating, metal processing, and photographic applications.

Cyanide Use in the Minerals Industry

One of the reasons for the high value placed on gold is its resistance to attack by most chemicals. One exception is cyanide, which dissolves the precious metal. This is necessary because many gold-containing ores comprise finely divided gold particles locked up within other minerals.

The gold extraction process must separate and concentrate the gold, but the low concentrations and particulate nature of the gold mean that purely physical extraction processes are neither economically viable nor quantitatively achievable.

Therefore, gold is usually separated from the other constituents of the ore by chemically dissolving it, and then extracting it in conjunction with physical processing (crushing, milling, gravity separation, flocculation).

Cyanide has been used in mineral processing for more than 100 years, yet less than one-fifth of global production of industrial cyanide is used in minerals processing. Around 20 per cent of global cyanide production is in the solid form, sodium cyanide, of which 90 per cent is used in minerals processing. Sodium cyanide is a white coloured salt that is soluble in water and smells like bitter almond.

Community and Environmental Health Risks

Cyanide is a toxic and hazardous substance, however proper management of cyanide ensures the protection of both human health and the environment.

Workers in industries that use or produce cyanide compounds are at risk of exposure. If cyanide is ingested in sufficiently high doses it can be poisonous, even fatal, to humans and animals. However, it does not give rise to chronic health or environmental problems when present in low concentrations.

Consumers are also at risk of exposure to cyanide when using household products containing cyanide, such as pesticides. People who live in areas of high motor vehicle traffic or close to chemical or other processing facilities are also at higher risk of exposure to cyanide. So too smokers and people who breathe smoke from burning trash.

Cyanide does not bio-accumulate, or build up, in humans or animals based on repeated exposure. This is because cyanide is transformed through natural physical, chemical and biological processes into other less toxic chemicals. In other words, cyanide decomposes when exposed to sunlight, air and other oxidants.

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Gold mining operations use very dilute solutions of sodium cyanide, typically in the range of 0.01% and 0.05% cyanide (100 to 500 parts per million). Technological developments are progressively enabling the industry to reduce its consumption of cyanide. Importantly, the industry also reuses cyanide by recycling it through the extraction circuit – this has both economic and environmental benefits by reducing the total amount of cyanide needed.

Cyanide is strictly controlled on mine sites and is only used by highly trained personnel equipped with the correct safety and health protective equipment.

Industry and Government Working in Partnership

Recent accidental cyanide release incidents, coupled with society's legitimate awareness and concern for the environment, have focused attention on the minerals industry's use of cyanide, in terms of operating performance and safeguards to protect the environment and community.

Following the accidental Baia Mare cyanide tailings release in Romania in 2000, the minerals industry emphasised its accent on continuous improvement in policies and systems for the safe transport, management and handling of cyanide. In this, the industry is committed to a global response.

Non-Regulatory Responses

- > The **International Cyanide Management Code** was developed by the minerals industry, government, NGOs and academia, under the auspices of the United Nations Environment Program (UNEP) and the International Council on Metals and the Environment – now the International Council on Mining and Metals (ICMM).

The Code assists companies employ stringent risk management systems to prevent harm or damage from the use of cyanide. Managing risks associated with cyanide involves hazard and risk assessment, sound engineering, careful monitoring and good site management practices in order to prevent and mitigate potential releases of cyanide to the environment.

While the administration and governance of the Code are being finalised by the ICMM, the world's leading gold mining companies have voluntarily committed to Code implementation and have set up internal processes to meet Code requirements.

See: http://www.minerals.org.au/cyanide/cyanide_code.pdf
<http://www.cyanidecode.org/thecode/cyanidecode.html>

- > The **Strategic Framework for Tailings Management** was developed in partnership between the Minerals Council of Australia and the Ministerial Council on Mineral and Petroleum Resources. The Framework provides a high level principled approach to tailings and cyanide management and is designed to provide a broadly consistent framework for tailings management across the various Australian jurisdictions.

The Strategic Framework is structured around a set of objectives and principles for the effective management of tailings, grouped under five key areas – stewardship, stakeholder engagement, risk management, implementation and closure.

See: <http://www.minerals.org.au/cyanide/tailingsf.pdf>

Regulatory Responses

As with other substances, cyanide is strictly regulated by government, predominantly at the State level through legislation covering mining, environmental protection, mine safety inspection, explosives and dangerous goods, and poisons.

To promote leading practice, the Australian Government, in conjunction with the minerals industry, published "**Cyanide Management**" as part of a series of documents on *Best Practice Environmental Management*. The handbook outlines best practice approaches to the management of cyanide in the Australian minerals industry.

See: <http://www.deh.gov.au/industry/industry-performance/minerals/booklets/cyanide/index.html>

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Technology Reducing Cyanide Risks

The level of understanding of the risks related to cyanide use in mining is growing rapidly, and improved techniques for cyanide management are constantly evolving.

Through partnerships with research institutions such as the Cooperative Research Centre for Sustainable Resource Processing and the Australian Centre for Minerals Extension and Research (ACMER), the minerals industry is heavily investing in research into alternatives to sodium cyanide and to processes that accelerate its natural breakdown in the residues of the mining process, including minerals tailings and other by-products.

While there is currently no commercially available, environmentally superior alternative to cyanide, the industry has implemented innovative new technologies including processes that enhance the destruction of cyanide (such as dedicated cyanide destruction processes), which substantially reduce cyanide concentrations, its toxicity and potential to impact on community and environmental health. (The link referenced below is to a technical fact sheet specifically about cyanide destruction processes.)

See: http://www.minerals.org.au/cyanide/cyanide_destruction.pdf

Continuous Improvement

The regulatory framework for the safe and effective management of cyanide is being reviewed by government, the minerals industry and other stakeholders, including neighbouring communities, through the [National Industrial Chemical Notification and Assessment Scheme \(NICNAS\)](#).

The minerals industry supports the ongoing development of measures that are based on sound science and are proven to be effective in further minimising the hazards and risks associated with chemicals.

In line with industry's commitment to addressing community expectations, the minerals industry is developing and implementing management systems and operational controls to continually improve its performance in relation to cyanide management, beyond the limits established by regulation.

References and Links

- > Logsdon MJ, Hagelstein K & Mudder TI (1999) *The Management of Cyanide in Gold Extraction* – International Council on Metals and the Environment (ICME)
- > Pincock, Allen & Holt (2002) *Pincock Perspectives: Issue 33*
- > Commonwealth of Australia: Environment Australia (1998) *Cyanide Management: Best Practice Environmental Management in Mining*
- > Minerals Council of Australia (2004) *Enduring Value: The Australian Minerals Industry Framework for Sustainable Development*
- > International Cyanide Management Code
- > International Council on Mining and Metals
- > Good Practice in Sustainable Mining
- > International Programme on Chemical Safety (IPCS)
- > Australia's National Industrial Chemicals Notification and Assessment Scheme - NICNAS