METAL
(HAZARDOUS AND NON-HAZARDOUS SCRAP)

DESCRIPTION: Metals are naturally occurring chemical compounds that make up more than 75% of the substances on the Periodic Table of Elements. They are typically: hard, shiny, opaque, malleable (able to be shaped without breaking), ductile (able to be drawn out into a wire), fusible (able to be blended with other substances by heat and/or pressure) and good conductors of both heat and electricity[1].

Metals have a huge variety of natural and technological uses. The most common 'base' metals can be shaped relatively easily, such as iron, nickel, lead, zinc and copper: they can also oxidize or corrode rapidly. Heavy metals have high density and are toxic or poisonous, such as mercury, cadmium, arsenic, chromium, and lead. Metals that resist oxidation or corrosion are called noble metals. Precious metals are rare and non-reactive metallic elements with high economic value, including gold, platinum and silver.

Metals can be blended with other elements to form new substances, called alloys, such as steel (iron and carbon) or bronze (copper and tin). There are more than 90 known metals, but many are extremely rare. Steel represents around 95% of all metal used by humans.

GLOBAL PRODUCTION/DISPOSAL: 1.6 billion tonnes of steel produced per year (2015)[2], aluminium (59 million tonnes)[3], copper (19.1 million tonnes)[4], zinc (12.8 million tonnes)[5] and lead (4.9 million tonnes)[6]. Other key metals include arsenic, cadmium, chromium, gold, mercury, and nickel[7].

COMMON SOURCES: Vehicles and transportation, construction and buildings, large equipment and machinery, steel shipping containers, packaging material (steel and aluminium cans), batteries, electronics and electrical equipment (precious metals such as gold and silver and toxic metals such as mercury, lead and chromium).

IMPACTS IF NOT MANAGED CORRECTLY: Some metals, such as lead, and mercury are toxic to humans and must be handled and disposed of sustainably to avoid them polluting the environment: the internationally agreed Minamata Convention (2013) is aiming to significantly reduce the use of mercury[8]. Some metals, in trace amounts, are essential for plant growth and animal/human health, but in high concentrations they become toxic.

Metals are finite resources: failure to recycle them may lead to insufficient supplies to meet the needs of future generations. Precious metals such as gold, silver and platinum are a particularly wasted resource if not recovered.

At the beginning of their life cycle, the mining, extraction and refining of metal typically involves significant energy use, emissions to air, water and land, and disruption to natural habitats. The chemical processes used can create both hazardous and solid wastes, including dangerous substances, such as heavy metals that can contaminate water bodies. All of these impacts can be reduced by adoption of circular economy principles that seek to recover and reuse metal wherever possible.

OPTIONS FOR REDUCING: Look for products that use less metal in their design and manufacture and maximise the lifespan of metal or metal-containing products and equipment (including vehicles). In many developing countries, buildings framed with readily renewable locally available resources such as timber (ideally certified sustainable timber) may be easier to source and cheaper to transport and build with than steel framed constructions. Select vehicles and other equipment with reduced or recycled metal components. As with other food packaging, avoid small single use tins or cans in favour of larger containers and avoid using aluminium foil as a disposable material, unless you know it can be recycled in your area. Purchase materials, particularly steel and aluminium, with high recycled content.

OPTIONS FOR REUSING: Metal products can be readily reused many times if regularly checked, cleaned, repaired and refurbished. Because most metal objects are energy and water intensive to produce, it is often preferable to repair and continue reusing metal objects than replace them. (One exception, when considering life cycle impacts of metal objects, may be equipment that uses energy, if much more efficient equivalent items become available. Motor vehicles eventually become more efficient to replace than repair indefinitely).

OPTIONS FOR RECYCLING: Metal – particularly steel – is the world's most recycled material, and can be recycled again and again without reducing the quality of the end product. Steel and aluminium cans can be recycled and ready to use again in as little as 6 weeks. Steel machinery and vehicles can be sold as scrap to a metal dealer. By using ferrous scrap rather than virgin materials in the production of iron and steel, CO_2 emissions are reduced by 58% and energy use by 56%.

Aluminium, which requires huge energy inputs to extract from its ore (known as bauxite) is even more cost effective to recycle: producing an object from recycled aluminium uses 95% less energy than to produce it from new materials. In 2015 the world recycled as much copper as was produced from mining and refining. Other metals used in electrical circuitry, batteries, vehicles and other applications can also be recovered: exploring take-back clauses with suppliers may be the most cost/effective solution for UN agencies. For more details, see the e-waste fact sheet in this series.

OTHER OPTIONS (LAST RESORT): Non-hazardous metal scrap should be separated to the extent possible and sold or donated.

- Highly degraded metals (badly rusted, for example) may be disposed of in landfills only as a last resort.
- Hazardous metals should be returned to the manufacturer where possible or, if no other options exist, placed in sealed containers and brought to engineered/sanitary landfills. Permits may be required to transport hazardous materials.
- Metal cannot be disposed of through incineration: heavy metals can interact with air to create dangerous pollutants, otherwise they remain in the 'bottom ash' and need to be disposed of as a mixed hazardous waste.
- Open dumping must be absolutely avoided.

DID YOU KNOW?
On average, the United States processes enough ferrous scrap daily, by weight, to build 25 Eiffel Towers every day of the year.

OTHER COMMENTS: Recycling of valuable elements contained in e-waste such as copper and gold has become a source of income in the informal sector of developing and emerging industrialized countries. However, primitive recycling techniques such as burning cables to recover the copper wire exposes both adult and child workers and their families to a range of hazardous substances. E-waste-connected health risks may result from direct contact with harmful materials such as lead, cadmium, chromium, brominated flame retardants or polychlorinated biphenyls (PCBs), from inhalation of toxic fumes, as well as from accumulation of chemicals in soil, water and food.

Some metals, including lead, mercury and cadmium are classed as hazardous substances and are subject to the control procedures under the Basel Convention for any transboundary movements (import, export and transit). Hazardous substances must be transported in sealed containers and in accordance with local and international guidelines and regulations on the transport of dangerous goods (e.g. UNECE guidelines, IATA regulations). These may require specific labelling, allowed quantities, documentation, licences and permits. They may also be subject to legal restrictions on disposal in the country of origin.

Recycling codes for **steel and aluminium**

ENDNOTES

1 University of Washington, website: https://depts.washington.edu/matseed/mse_resources/Webpage/Metals/metals.htm.

2 World Steel Association, 2015, website: https://www.worldsteel.org/en/dam/jcr:1568363d-f735-4c2c-a1da-e5172d8341dd/World+Steel+in+Figures+2016.pdf.

3 International Aluminium Institute, 2017, website: http://www.world-aluminium.org/statistics/.

4 US Geological Survey, 2017, website: https://minerals.usgs.gov/minerals/pubs/commodity/copper/mcs-2017-coppe.pdf.

5 US Geological Survey, 2017, website: https://minerals.usgs.gov/minerals/pubs/commodity/zinc/mcs-2017-zinc.pdf.

6 US Geological Survey, 2017, website: https://minerals.usgs.gov/minerals/pubs/commodity/lead/mcs-2017-lead.pdf.

7 US Geological Survey, 2008, *The Global Flows of Metals and Minerals*.

8 Minamata Convention on Mercury, 2017, website: http://www.mercuryconvention.org/Convention.

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