

Science for Environment Policy

Coast around Alang-Sosiya shipbreaking yard in India 'strongly polluted' with heavy metals

The Alang-Sosiya shipbreaking yard in India is highly polluted with heavy metals, a study concludes. The researchers studied heavy metal contamination in sediments taken from the intertidal zone of the shipbreaking yard and compared them to a control site. The area was found to be 'strongly polluted' with copper, cobalt, manganese, lead and zinc.

As well as re-using materials, the ship recycling industry generates a large amount of waste, including petroleum, persistent organic pollutants, bacteria and heavy metals. Metals are of particular concern due to their toxicity to marine biota and persistence in the environment.

This study evaluated the extent of heavy metal pollution at the Alang-Sosiya ship scrapping zone in India, a global shipbreaking hub with an estimated annual turnover of US\$1.3 billion (€1.19 million) (2003 data). The yard extends approximately 14 kilometres and contains almost 200 separate shipbreaking plots, which together dismantle approximately 10 000 tonnes of material each day. Only half of these plots are active, the remainder are dormant due to the low price of steel during the past year.

This paper built on a previous study¹ which showed concentrations of some heavy metals at Alang-Sosiya to be over 25–15 500% higher than a nearby reference site. However, unlike the previous study, these researchers assessed the accumulation of heavy metals in the intertidal zone (the area between tide marks), where ships are broken down and a high degree of contamination can be expected.

The researchers assessed the concentration of heavy metals in two types of sediment: the bulk fraction (BF), which contains grains between 63 micrometres and 2 millimetres in size, and the fine-grained fraction (FF), which contains particles smaller than 63 micrometres. Heavy metals tend to be found primarily in the latter fraction, where they are also more bioavailable and thus more likely to enter the environment.

Sediments were collected in 2002 from 10 stations along the coast, as well as from two stations at either end of the coast (5 km either side of shipbreaking zone). Reference samples were taken from a site 60 km south of the coast.

The researchers measured the total organic carbon content of the sediments as well as concentrations of heavy metals, including cadmium, cobalt, copper, chromium, iron, manganese, lead, nickel and zinc.

The amount of carbon stored in the sediment was higher at all stations in Alang-Sosiya than the control, which the researchers attribute to the domestic waste dumped by workers and nearby villagers. Carbon content was also high at the sites either end of the shipbreaking zone, which suggests carbon spreads along the coast in sediment.

Concentrations of heavy metals were up to four times higher at Alang than the end sites, and up to 19 times higher than the control site. Concentrations of heavy metals were also generally higher in FF sediments, which confirms that heavy metals are bound more in this fraction than in the BF fraction (due to its high surface area and the presence of organic materials).

Continued on next page.



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2. Some naturally forming
minerals also contain heavy
metals. For example, haematite
and magnetite crystals contain
iron, and quartz crystals contain
silicon. These can all be found
naturally in sand.

Compared to previously reported concentrations for subtidal and marine sediments, all metals were more highly enriched in the intertidal sediment. This suggests that metals from ship recycling reach intertidal sediments first before being released into the sea.

Although sites within the shipbreaking region were most heavily polluted with heavy metals, the authors also found some heavy metal enrichment in the control region. They say this is likely due to the presence of crystals rather than anthropogenic activities².

The metals found at the highest concentrations at Alang were iron (137 990 parts per million), zinc (1222 ppm) and manganese (4643 ppm). By developing an index of geoaccumulation for the metals, the researchers were able to describe contamination in comparison to background levels.

Contamination with three metals — manganese, lead and zinc — along the Alang-Sosiya coast was described as 'strong to very strong'. Some metals were almost 100 times more enriched compared to their natural background levels. Overall, the authors describe heavy metal enrichment at Alang-Sosiya as 'relatively high'.

