TerranearPMC Safety Share

Week of April 10, 2017 – Antimony

Antimony – during remediation and environmental investigations, it is one of those metals that is frequently on the list of "contaminants-of-concern" or COCs : Yet most of us know very little about this material.

Antimony is a chemical element with the atomic number 51. It's chemical symbol Sb, which comes from its Latin name, stibium. Further research shows that the name is derived from the Greek word, stibi, which, in turn, was known to the ancient Egyptians, that used the material, Sb2S3 (today known as Antimony Sulfide) as a cosmetic for painting the eyes. Aha! Now we can relate to those ancient Egyptian paintings of women with their highlighted eyes! It is this form of antimony that was used by the Egyptians for which antimony is mainly found in nature; Antimony Sulfide - as opposed to its pure form.

Elemental antimony is described as a lustrous metal and was initially and erroneously identified as lead. In the West, it was first isolated by the Italian metallurgist, Vannoccio Biringuccio, when he described the process to isolate pure antimony from ores in his manual on metalworking, *De la Pirotechnia*, published in 1540. An interesting side note is that this book was translated into English by Cyril Stanley Smith, a senior chemist on the Manhattan Project.

Antimony is quite soft, categorized in the *Mohs scale hardness* as "3." Therefore pure antimony is too soft to make hard objects. Nevertheless, coins of antimony were issued in China's Guizhou province in 1931 but the durability was poor and the minting was soon discontinued.

Antimony is a semi-metallic chemical element which can exist in two forms: the metallic form is bright, silvery, hard and brittle; the non-metallic form as a grey powder. One important property of antimony is that it is resistant to attack by acids. It is a poor conductor of heat and electricity, while stable in dry air. An unusual quality of antimony (and some of its alloys) is that it expands on cooling.

The abundance of antimony in the Earth's crust is estimated to be 0.2 to 0.5 parts per million. And even though, it is not abundant, it is found in more than 100 mineral species, of which Sb_2S_3 is the predominant ore mineral.

Very pure antimony is used to make certain types of semiconductor devices, such as diodes and infrared detectors. Antimony is alloyed with lead to increase lead's durability. Antimony alloys are also used in batteries, low friction metals, type metal and cable sheathing, among other products. Antimony compounds are used to make flame-proofing materials, paints, ceramic enamels, glass and pottery.

The largest applications for metallic antimony is an alloy with lead and tin and the lead antimony plates in lead–acid batteries. Alloys of lead and tin with antimony have improved properties for solders, bullets and plain bearings. Antimony compounds are prominent additives for chlorine and bromine-containing fire retardants found in many commercial and domestic products. An emerging application is the use of antimony in microelectronics.

People that work with antimony can suffer the effects of exposure by breathing its dust, when it becomes airborne, and – as a particulate - is listed as an upper respiratory irritant. Human exposure to antimony can take place by breathing air, drinking water and eating foods that contain it, but also by skin contact with soil, water and other substances that contain it. However, it is breathing in antimony when bonded to hydrogen (while in a in the gaseous phase), is what causes the most prevalent health effects.

Exposure to relatively high concentrations of antimony (9 mg/m^3 of air) for an extended period of time can cause irritation of the eyes, skin and lungs. As the exposure continues, more serious health effects may occur, such as lung diseases, heart problems, diarrhea, severe vomiting and stomach ulcers. At this time it is not known whether antimony can cause cancer or reproductive/ teratogenic effects.

Antimony is used as a medicine for parasite infections, but people who have had too much of the medicine or are sensitive to it, can experience severe health effects. And, as a result of these health effects, the medical community has learned a great deal regarding the dangers of exposures to antimony.

Antimony can be found in soils, waters and air in very small amounts. Antimony will mainly pollute soils. Through groundwater it can travel great distances towards other locations and surface waters.

Laboratory tests with rats, rabbits and guinea pigs have shown us that relatively high levels of antimony may kill small animals. Rats may experience lung, heart, liver and kidney damage prior to death.

Animals that breathe in low levels of antimony for a long time may experience eye irritation, hair loss and lung damage. Dogs may experience heart problems even when they are exposed to low levels of antimony. Animals that breathed in low levels of antimony for a couple of months may also experience fertility problems.

From an industrial hygiene perspective, both the OSHA permissible exposure limit and American Conference of Industrial Hygienists threshold limit value is established at 0.5 milligrams per cubic meter, based on an 8-hour time-weighted average exposure period. This means personal exposures to natural soil conditions would become an occupational health concern when approximately 1 kilogram of soil occupies a cubic meter of air: a most unlikely scenario. On the other hand, we would need an antimony/soil concentration of 50%, so that an airborne soil concentration would reach 1 mg/m^3 to equate to an occupational health concern. This would be an extreme antimony-soil contamination problem: one due to possibly pure antimony being disposed or spilled at a single location.

Those who claim to discover everything but produce no proofs of the same may be confuted as having actually pretended to discover the impossible - Archimedes