AIR

Properties of LEAD

General

Elemental lead (Pb) is a heavy, soft, bluish metal, and occurs in nature in the form of ores. Once Pb is mined, processed, and introduced into the environment, it is a potential problem forever. There is no technology that will destroy lead or render it permanently harmless. Nearly all of the Pb in the environment is due to man's activities. The history of Pb use is quite extensive. Objects made of Pb have been excavated and dated around 6500 B.C. During the Roman Empire, Pb production was at 80,000 tons per year. In the industrial age of the 1800's, the use of Pb further increased. It was used for a variety of things including: utensils, food storage container lining, pottery glaze, water and sewer pipes, ink, and paint. Much of its usefulness is due to its plasticity and softness.

Pb in the ambient air exists primarily as Pb vapors, very fine Pb particles, and organic halogens such as Pb bromide and Pb chloride. The most common sources in the atmosphere are gasoline additives, nonferrous smelting plants, and battery and ammunition manufacturing. In 1985, motor vehicle emissions accounted for 81% of Pb emissions nationwide. Today, transportation is responsible for less than 30%. The national strategy for controlling Pb has been to decrease the Pb content in gasoline.

As of December 31, 1995, Pb was banned from use in gasoline. Pb emissions from stationary sources have been substantially reduced by control programs oriented toward attainment of the particulate matter and Pb ambient standards.

Pb is unique among the toxic heavy metals in that it is relatively abundant in the earth's crust. Natural sources of atmospheric Pb include soil erosion by wind, volcanic dust, forest fires, sea salt, and the decay of radon gas. However, the greatest risk of exposure is from man-made processes and products. Centuries of mining, smelting and the use of large quantities of Pb have resulted in extensive environmental contamination. Pb is present in food, water, air, soil, paint, and other materials with which the general population comes in contact. Each are potential pathways for human Pb exposure via inhalation or ingestion.

Effects

Lead poisoning was first written about by the ancient Greeks, and in the 1700's Benjamin Franklin described the toxic effects of Pb on tradesmen such as printers, plumbers, and painters. Today there are three major sources of lead poisoning: leadbased paint, drinking water, and urban soil and dust (depositions from paint, gasoline, and industrial sources). Exposure to Pb mainly occurs through inhalation and ingestion. Essentially, 75% of airborne Pb particles are less than 0.7 µm in diameter. Because of this small size, a large fraction of inhaled Pb may be deposited in the lungs. Studies show that up to 35% of

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OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

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inhaled Pb enters the bloodstream to be distributed throughout the body. Pb accumulates in blood, bone, and soft tissue. If Pb is ingested, 10 to 15% of it is absorbed into the body. Children and pregnant women absorb even more. Because it is not readily excreted, Pb can also affect the kidneys, liver, nervous system, and other organs.

Excessive exposure to Pb may cause anemia, kidney disease, reproductive disorders, and neurological impairments such as seizures, mental retardation, and/or behavioral disorders. Even at low doses, Pb exposure is associated with changes in processes of the body.

Children and fetuses are especially susceptible to low doses of Pb, often suffering central nervous system damage or slowed growth. Low-level Pb poisoning may have nonspecific symptoms such as headaches, abdominal pain, and irritability. High bloodlead levels in children may cause permanent deficiencies in growth and intelligence. In adults, high blood-lead concentrations may cause kidney disorders, infertility, and cancer. Extremely high concentrations (greater than 100 µg/dL) usually result in death. Studies also indicate a correlation between high blood-lead levels and increased blood pressure.

Standards

EPA has revised the averaging time and form of the lead NAAQS. These are the air quality statistics that are compared to the level of the standards to determine whether an area meets or violates the standards.

EPA changed the calculation method for the averaging time to use a 'rolling' three-month period with a maximum (not-to-be-exceeded) form, evaluated over a three-year period. This replaces the current approach of using calendar quarters. A rolling three-month average considers each of the 12 three-month periods associated with a given year, not just the four calendar quarters within that year. EPA has revised the level of the primary (health-based) standard from 1.5 micrograms per cubic meter (µg/m^3), to 0.15 µg/m^3, measured as total suspended particles (TSP).

EPA has revised the secondary (welfare-based) standard to be identical in all respects to the primary standard.

Regulatory Change

The ambient air monitoring regulations for lead were implemented in the 1970's when lead emissions from on-road mobile sources (e.g., automobiles, trucks) were the predominant source. These regulations were rewritten in 1998. The lead monitoring requirements of the 70's focused primarily upon determining the air quality impacts from major roadways and urban traffic arterial highways.

After the use of lead in gasoline was banned, this extensive monitoring was no longer necessary. In fact, EPA has reduced its requirements for measuring lead air pollutant concentrations near major highways, yet retains its focus on point sources and their impacts on neighboring populations.

On October 15, 2008, EPA substantially strengthened the National Ambient Air Quality Standards (NAAQS) for lead. The revised standards are 10 times tighter than the previous standards and will improve health protection for at-risk groups, especially children. EPA has revised the level of the primary (health-based) standard from 1.5 micrograms per cubic meter (µg/m^3),to 0.15 µg/m^3, measured as total suspended particles (TSP). EPA has revised the secondary (welfare-based) standard to be identical in all respects to the primary standard.

Scientific evidence about lead and health has expanded dramatically since EPA issued the initial standard of 1.5 µg/m^3 in 1978. More than 6,000 new studies on lead health effects, environmental effects and lead in the air have been published since 1990. Evidence from health studies shows that adverse effects occur at much lower levels of lead in blood than previously thought. In conjunction with strengthening the lead NAAQS, EPA is improving the existing lead monitoring network by requiring monitors to be placed in areas with sources such as industrial facilities that emit one half ton or more per year of lead and at NCORE sites in CBSAs with a population of 500,000 people or more.