

Arsenic and lead leach out of popular fertilizer

Ironite, a widely available commercial and home plant fertilizer, releases enough lead and arsenic in standard leaching tests to be classified as a hazardous waste. The fertilizer's heavy metals also appear to be bioavailable, according to the results of some of the first independently conducted standard leachability tests published in this issue of *ES&T* (pp 5400–5404). These results provide crucial evidence for an ongoing risk assessment by the U.S. EPA that could lead to nationwide bans or restrictions on such products, according to EPA officials involved with the assessment.

Ironite is produced from the tailings of a former mine, now a proposed Superfund site, in Humboldt, Ariz. The fertilizer—a mixture of mine tailings, sulfuric acid, and urea—is popular with gardeners in the United States because the iron in the mine tailings greens up lawns and plants without promoting heavy growth, according to gardening specialists. A federal exemption allows mine-derived wastes to be sold as fertilizers, and fertilizer producers are only required to list nutrients on the labels of their products. As a result, gardeners using Ironite and other waste-derived fertilizers are not informed about potentially hazardous ingredients.

Several other studies have highlighted Ironite's exceedingly high concentrations of heavy metals—up to 3600 milligrams of arsenic per kilogram of fertilizer (mg/kg) and up to 2900 mg/kg of lead. Brajesh Dubey and Timothy Townsend of the University of Florida in Gainesville break new ground by presenting the leaching and bioavailability data.

Ironite's manufacturer, Ironite Products Co. in Scottsdale, Ariz., has maintained that its products are



BRAJESH DUBEY

Tests of Ironite fertilizer, which is made from mining waste, demonstrate that it meets the U.S. EPA's definition of a hazardous waste because it can be dissolved in the leaching procedure shown in the inset photo.

safe because the lead and arsenic they contain are not bioavailable. A technical report commissioned by the company indicates that these metals are present in the fertilizer as the minerals galena and arsenopyrite and that the elements in these forms are “very stable in the environment and not available in a form which is toxic.”

But Dubey and Townsend's results refute this claim. “Our results show that when Ironite is land-applied under very common, slightly acidic conditions, the heavy metals do leach out. We've also showed that some proportion of the lead and arsenic is bioavailable if the Ironite's consumed” by a child, says Townsend, who is a waste engineer.

Bioavailability is one of the main aspects of EPA's assessment, says an anonymous agency official. “The *ES&T* study is very valuable to us because it confirms and expands on some other evidence we have about the bioavailability of heavy metals in Ironite.”

Townsend and Dubey bought Ironite at several local stores and conducted leaching experiments following standard protocols. In addition, they evaluated the fertilizers for bioavailability using a test designed to simulate the gastric fluid in a child's digestive system.

Both lead and arsenic showed leaching behavior that varied by pH, with the highest amounts released under low- or high-pH conditions. The fertilizer itself is acidic, so leaching in water will result in high lead and arsenic concentrations in the leachate.

The fertilizer issue dates back to 1997, when an investigation by *The Seattle Times* created an uproar among environmental groups and state regulators by revealing that a number of fertilizers used by farmers and consumers contained high levels of lead, arsenic, and other heavy metals. Ironite contains the highest amounts of arsenic of all fertilizers tested by EPA as part of a preliminary risk assessment.

The presence of these trace metals has led some state governments, including those of Washington and Minnesota, to investigate potential safety and environmental concerns associated with Ironite, and EPA is soon to finish its two-year-long risk assessment.

Canada limits toxic metals in fertilizers, and Washington, California, Texas, and Minnesota are among the U.S. states that set lim-

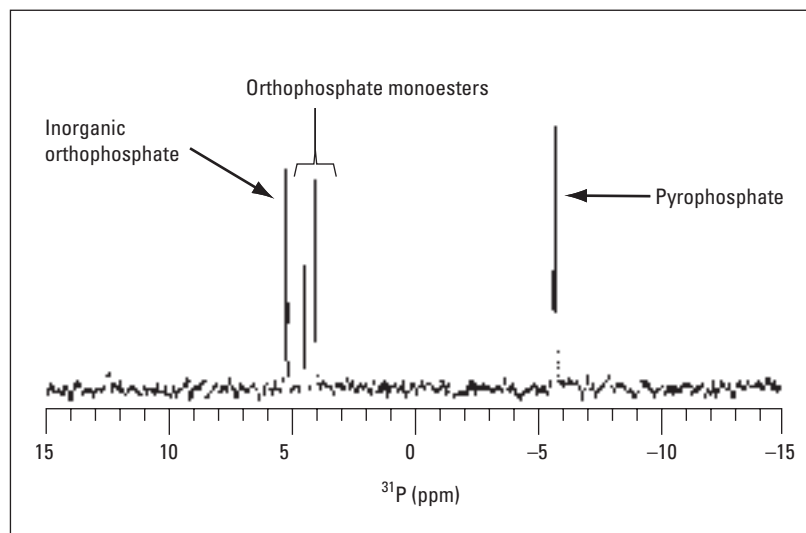
its. U.S. federal law requires that all hazardous waste be properly disposed of in regulated landfills. But Congress exempted mining-industry wastes from hazardous landfill disposal laws by means of a 1980 loophole called the Bevill exemption, which allows mining companies to dispose of waste by turning it into a useful product—in this case, fertilizer. —REBECCA RENNEN

Neglected forms of phosphorus play important role

During the past 30 years, most studies of phosphorus—the nutrient that fuels nuisance algal blooms in lakes—have focused exclusively on forms of soluble, reactive phosphorus thought to be most important to biological systems. But a more detailed look reveals that other forms of soluble phosphorus, which are hard to measure, constitute 50–100% of the phosphorus pool in some ecosystems and are more readily bioavailable than previously believed, according to re-

search presented in August at the Ecological Society of America (ESA) meeting in Portland. The new work is challenging conventional wisdom about nutrient limitation in coastal estuaries, the open ocean, and threatened ecosystems, such as Florida's Everglades, experts say.

Mining of phosphate rock for fertilizer has accelerated the global phosphorus cycle, leading to a 75% increase in phosphorus storage in land and freshwater ecosystems, says P. V. Sundareshwar, a biogeo-



Scientists are using ^{31}P nuclear magnetic resonance (NMR) spectroscopy to take a closer look at forms of phosphorus that can play a significant role in coastal ecosystems. They are finding that some forms, such as the pyrophosphate shown in this NMR spectrum (which is used in fertilizers and industrial processes), are biologically available.

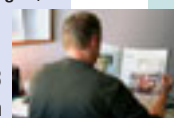
News Briefs

Curbing toxic pollution

The European Commission (EC) is calling for nine additional chemicals to be eliminated under two international treaties on persistent organic pollutants (POPs). The list includes four insecticides and industrial chemicals (chlordecone, hexachlorocyclohexane, hexachlorobutadiene, and pentachlorobenzene); three flame retardants (hexabromobiphenyl, octabromodiphenyl ether, and pentabromodiphenyl ether); polychlorinated naphthalenes, which are used for cable insulation and wood preservation; and short-chained chlorinated paraffins, which are used in metal-working fluids. The EC wants to push for a global ban under the 2001 Stockholm Convention on POPs and the 1998 POPs Protocol to the Convention on Long-Range Transboundary Air Pollution. For more information, go to http://europa.eu.int/comm/environment/pops/index_en.htm.

Balance or bias?

By following the time-honored journalistic formula for balanced reporting, reporters and editors at four top U.S. newspapers misrepresented the scientific community's understanding of human contributions to global warming, according to an analysis published in the journal *Global Environmental Change* (2004, 14, 125–136). "The continuous juggling act journalists engage in often mitigates against meaningful, accurate, and urgent coverage of the issue of global warming," write the researchers. From 1988 to 2002, a total of 3543 articles on climate change appeared in the *Los Angeles Times*, *The New York Times*, *The Wall Street Journal*, and *The Washington Post*. The researchers analyzed 636 articles. They discovered that 52.7% gave "roughly equal attention" to generally accepted scientific evidence and to skeptics' arguments.



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