

Intel NM Chemical of the Month: May 2022

Phosphine

[The following material is from the websites of the National Library of Medicine, National Center for Biotechnology Information at the National Institutes of Health (NIH) and the Environmental Protection Agency (EPA).]

IDENTIFICATION AND USE: Phosphine is a colorless gas with a garlic-like odor. Phosphine is a fumigant, used indoors to control a broad spectrum of insects for non-food/non-feed commodities in sealed containers or structures. [It is also used as a doping agent for electronic components](#), in chemical synthesis, and as an intermediate for the preparation of several flame retardants.

Phosphine is a super-toxic gas with a probable oral lethal dose of 5 mg/kg or 7 drops for a 150-pound person. An air concentration of 3 ppm is safe for long term exposure, 500 ppm is lethal in 30 minutes, and a concentration of 1,000 ppm is lethal after a few breaths. (EPA, 1998)

Phosphine can explode with powerful oxidizers. The gas is heavier than air and may travel along the ground to an

ignition source. Container may explode in heat of fire. When heated to decomposition, it emits highly toxic fumes of phosphorus oxides. Reacts violently with: air; [boron trichloride](#); [bromine](#); [chlorine](#); [chlorine monoxide](#); [nitric acid](#); [nitric oxide](#); [nitrous oxide](#); [nitrogen trioxide](#); [silver nitrate](#); [nitrous acid](#); [mercuric nitrate](#); [nitrogen trichloride](#); [oxygen](#); and ([potassium](#) plus [ammonia](#)). Stable up to 131F. May become unstable at high temperatures.

HUMAN STUDIES: Direct contact with phosphine liquid may cause frostbite. Toxic exposures to phosphine have been documented as a result of grain fumigation, attempted suicide, and ferrosilicon decomposition. Potential symptoms of overexposure are nausea, vomiting, abdominal pain, diarrhea, thirst, chest tightness, dyspnea, muscle pain, chills, stupor or syncope, and pulmonary edema. A productive cough with fluorescent green sputum, acute dyspnea, and pulmonary edema may develop. Death may be preceded by tonic convulsions, which may ensue after apparent recovery. Death may occur after 1/2 to 1 hour of exposure at concentrations of 400 to 600 ppm. Serious effects may be produced by exposure to 5 to 10 ppm for several hours. Main histopathologic findings of fatal phosphine poisoning in the liver are fine cytoplasmic vacuolization of hepatocytes and sinusoidal congestion. Fumigant applicators had significantly increased stable chromosome rearrangements, primarily translocations in

G-banded lymphocytes. Less stable aberrations included chromatid deletions and gaps but these were significantly increased only during the application season, and not at later time points. Exposure of human lymphocytes to phosphine (1.4 to 4.5 ug/L) for 20 mins yielded increased chromosome aberrations after 96 hours of lymphocyte culture, indicating that the expression of genotoxicity of phosphine is delayed.