





Letter to the Editor

Hidden Lethal Hazard: Aluminum Phosphide Incidents in Türkiye

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Aluminum phosphide (AIP) is a toxic chemical extensively utilized for many years for its cost-effectiveness and accessibility, particularly in various insecticides and rodenticides available in tablet, pellet, granule, and powder formulations.¹ Upon exposure to moisture, AIP produces highly toxic phosphine gas (PH₃), which is absorbed rapidly through inhalation, dermal contact, and gastrointestinal routes.²

Despite being commonly associated with occupational risks for pesticide workers, exposure may extend to residents and cases of suicidal use. Phosphine, a colorless chemical with low water solubility, garlic/decaying fish odor, and autoignition properties, poses significant health risks. Inhalation is the primary route of exposure, with a half-life of 5 hours in daylight and 28 hours in darkness.² Symptoms of chest tightness, shortness of breath, dry mouth, recurrent vomiting, abdominal pain, fever, chills, weakness, dizziness, and incoordination may occur shortly after exposure.³ Exposure is associated with a high mortality rate due to rapidly developing shock, metabolic acidosis, cardiac arrhythmias, and acute respiratory distress syndrome.³ Emergency service personnel caring for affected individuals may also face the risk of contamination. Although suicidal use is common, many cases of acute accidental phosphine poisoning have also been reported.

Recent incidents underscore the potential dangers associated with AIP. A fire erupted in May 2023 at a port in the Derince district of Kocaeli during the unloading of AIP from a ship, leading to an approximately 6-hour intervention and widespread environmental smoke release.⁴ The burning materials were covered with soil. Authorities dispatched teams to the port, which subsequently disposed of unreacted chemical products at a waste treatment facility. The governorship started an investigation. Despite these measures, official statements regarding the extent of chemical substances burned, phosphine gas released into the atmosphere, and population exposure to the poisonous gas remain undisclosed. Additionally, a positive decision was made a few months later for an environmental impact assessment concerning the construction of chemical storage tanks at the port, raising concerns about potential AIP storage.⁵

Subsequently, in another incident in June 2023 in Ankara's Keçiören district, unauthorized and forbidden use of AIP for bedbug control resulted in the hospitalization of 7 people living in the same building. The fumigant containing AIP was placed in specific corners of the house. After being instructed not to use the house for three days, the residents left without notifying building management, resulting in tragic consequences. The day after the fumigation, the mother, father, and their daughter, who lived in the same building, were admitted to the hospital with symptoms including dizziness, nausea, vomiting, and abdominal pain.⁶ They were discharged with the diagnosis of food poisoning but returned to the emergency department upon the worsening of clinical findings in the 40-year-old mother and her 10-year-old daughter. Tragically, the mother and daughter died in the hospital.^{5,6} The forensic medicine institute determined that the mother and daughter died as a result of AIP poisoning.

Furthermore, at night in October 2023, it was revealed that the explosion occurred in a building in the Körfez district of Kocaeli, in the warehouse of a fumigation company. The incident was caused by AIP that reacts with water.⁷ Authorities dispatched teams to the scene. According to the governor's statement, the street was closed to traffic for 3 hours, and 43 people were evacuated as a precaution.⁸ Due to the chemical explosion, the teams intervened in the fire by wearing special clothing. While the fire was extinguished in a short time, medical teams treated the building residents who are affected by the chemicals and smoke. It was determined that the gas released by the explosion spread from the sewer and water drain lines to the streets and buildings. After measurements showed a decrease in chemical gas levels and determined that they were not harmful, citizens were allowed to re-enter their homes after signing a responsibility document. However, entrance to the incident building was not allowed. The teams disposed of the unreacted chemical products at

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a waste treatment facility. Fortunately, no one was injured or killed. On the other hand, it was detected that the relevant workplace had applied for a license from the municipality and the Ministry of Agriculture and Forestry, yet the application process remained incomplete.

These events illustrate the importance of preventable, non-suicidal accident risks. Therefore, accidental release into the environment is a preventable and mortal risk that needs to be carefully addressed in the case of phosphine exposure. The handling and storage of AIP require special precautions. Exposure to confined spaces where it's stored or used can be fatal. Its use as an insecticide in residential areas requires special precautions such as certified personnel, restrictions within 150 meters if fumigated, and measurements before re-entry into the area. The United States Environmental Protection Agency recommends banning its use within 30 meters of residential premises.⁹

The easy accessibility and widespread use of AIP show that there are control and inspection problems despite legal regulations. It is the primary duty of the public authority to take precautions to eliminate the risk of such incidents recurring with these and similar chemicals. First, chemicals that may pose significant health risks to employees and public health should be prevented from being imported into Türkiye through unregistered methods such as raw materials or waste to be disposed of. Any unknown and/or uncontrolled content should be evaluated in detail and stopped. Hazardous chemicals, especially those that react with water or air without requiring energy, should be rejected unless transported in appropriate packaging to reduce the risk. All procedural, complementary, legal, and occupational health and safety measures should be maintained at the highest level and enforced strictly. It's also important to educate first responders and medical teams in terms of patient intervention and occupational risks.

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