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The Toxicity of Arsenic and Its Compounds Encountered
in Inhibited Acid.

Inorganic compounds of arsenic may produce local effects on the skin or mucous membranes and cause systemic poisonings. Toxic effects are observed in the gastro-intestinal tract, the nervous system, the heart, kidneys, and skin. Industrially there have been numerous cases of chronic systemic poisoning, of dermatitis and of irritation of the mucous membranes of the nose.

Metallic Arsenic

K 3154 T 34.12-2

There are, apparently, no reported cases of poisoning from metallic arsenic, probably because so little is handled as such. Arsenic in any form would be expected to exert toxic actions if it gains access to the animal organism. Indications are that the arsenic dust, encountered in the containers for acid which has been inhibited with As_2O_3 , is of such a fine particle size that it may be inhaled and absorbed into the organism. It is impossible to say whether or not this fine arsenic may have an action from contact on the skin. In the absence of specific information, we recommend care to prevent exposure to this metallic arsenic.

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Arsenous Oxide

T 34.12-3 K 3155

This material presents hazards from local action on skin or mucous membranes and of systemic poisoning. The handling of As_2O_3 without precautions may readily result in chronic and even subacute intoxication, particularly where dust of As_2O_3 is formed.

This material, as dust, will irritate and even ulcerate mucous membranes of the nose. Sufficient exposure will result in local action on the skin.

Acute intoxication will result from taking this material orally. The lethal dose for a 150 pound man is estimated at 0.22 - 0.26 grams.

Cases of acute poisoning show a predominance of either gastrointestinal or nervous symptoms. Acute intoxication occurs from the ingestion of comparatively large amounts. The symptoms include pain in throat and stomach, retching and vomiting, diarrhea, skin becomes cold and clammy, cyanosis, slight jaundice, headache, cramps in legs, general weakness, pulse is small, weak, and irregular. Death occurs in a state of collapse. Urine is scanty and contains much albumin. In the so-called cerebrospinal type the gastro-intestinal symptoms are very slight or absent; there is headache, vertigo, spasms of leg muscles, stupor, delirium, and disturbances of sensation. General paralysis and collapse lead to death.

In so-called subacute forms one observes loss of appetite, fainting sensations, nausea, thirst, retching, shooting pains in stomach and bowels, vomiting and diarrhea. Urine is scanty and gives evidence of nephritis and there may be jaundice.

Various types of skin eruptions are observed. Later, peripheral neuritis may develop. In the more severe cases there is gradual weakness, the heart fails, cyanosis develops, and death occurs in delirium or stupor.

The most frequent poisoning is chronic in nature and seemingly may develop quite readily on exposure to arsenic compounds. Symptoms include general malaise, loss of appetite, colic-like pain in abdomen, vomiting, constipation, mild fever, eyelids are puffy, the face pale. There may be catarrh of nose, throat, and bronchi. Conjunctivitis may occur. Hair becomes dry and may fall out, the nails become brittle, and the skin shows various types of lesions. Headache and peripheral neuritis develop later, and even paralysis. The heart is also affected and undergoes fatty degeneration.

Arsenous oxide is readily absorbed from the stomach and may be absorbed through the skin in certain circumstances. Arsenic is distributed through all tissues of the body, and accumulates in the bones, particularly in chronic poisonings. Excretion occurs in exfoliating skin and hair, but particularly in urine and feces.

The handling of As_2O_3 in any quantity requires considerable care in order to prevent toxic effects.

In the case of solutions of As_2O_3 in HCl we have hazards from both materials. However, due to the smaller percent of As_2O_3 and to the dominant local irritating effects of the acid, the principle hazard is that of the HCl. The actual handling of acid containing As_2O_3 would probably not require greater precautions than that of the acid alone. Hazards will occur when the arsenic alone is encountered.

Arsine (AsH_3)

34.12 -10 K9885

There have been numerous cases of poisoning by AsH_3 in industry, particularly where reactions between acid and metal are encountered. Either the acid or metal had contained arsenic, which was reduced by the nascent hydrogen.

Arsine is an extremely toxic gas, attacking the red blood cells and the nervous system. The following figures are given in "Noxious Gases" by Henderson and Haggard:

Slight symptoms after several hours -----	30 p.p.m.
Dangerous for exposure of 1 hour -----	50 p.p.m.
Fatal to man in exposure of 30 minutes -----	250 p.p.m.

It is 10 to 20 times as toxic as carbon monoxide.

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The symptoms of acute arsine poisoning are due principally to the hemolysis of the red blood cells; the resulting anemia contributes. The symptoms begin a few hours after exposure, beginning with an indefinite feeling of illness and weakness followed by vertigo and faintness. Headache, nausea, and vomiting with epigastric pain develop. Cyanosis develops, and jaundice may appear. The urine contains hemoglobin or its decomposition products. The anemia may become very severe. If the acute effects are survived, death may occur later with kidney involvement in a manner resembling poisoning by As_2O_3 .

A chronic or subacute type of poisoning has been observed. Subjective symptoms are vague. Hemoglobin and albumin may appear in the urine. Diagnosis is made by analytical detection of arsenic in the urine.

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