cation for such exposure tests is blood, limited use has been made of biopsy specimens of lung, skin and fat, but these are not very practical for periodic sampling The excretory products most frequently analyzed are urine and breath, sweat, the other major excretion product, is not well adapted for exposure tests (Table 38–A)

The pulmonary ventilation rate of an average worker may be taken as 20 liters per minute (L/min) or approximately 10,000 L in an eight-hour working day If the air contains one milligram per liter (mg/L) of some harmful material, the maximum amount that can be absorbed in one day is 10 gm Likewise, the same total dose would result from an exposure of one hour to a concentration in air of 8 33 mg/L

The employee's exposure to gases and vapors is usually limited to his working hours The time spent away from work is usually more than adequate to permit complete elimination of the volatile material in the body before the beginning of the next daily exposure Except for highly soluble substances, such as methyl alcohol, or with reactive gases whose detoxification products are eliminated slowly, there would be no accumulation of gases and vapors from daily exposure

Henderson and Haggard's book on noxious gases (see References) treats the subject of respiration and absorption of gases and vapors in great detail, and the reader is urged to consult this reference for specific details

Harmful materials or their detoxification products are eliminated from the body through the respiratory tract, the intestinal tract, the urinary tract, and, in some cases, the sweat glands (Table 38–A)

Most volatile organic compounds are eliminated in a matter of hours or, at most, days

Many of the poisonous elements, however, can be stored for long periods of time in various parts of the body Chronic toxicity damage is unlikely to have an even distribution throughout the body In many cases the organ affected is the liver or kidney, and in a number of substances, both the liver and bones In toxicity studies with radioactive isotopes, the organ which suffers the most severe damage and appears to contribute most to the toxic effect on the body as a whole is called the critical organ The particular organ that shows the largest amount of damage is the one that is chosen for estimating the effect

Lead, when taken into the body, may be deposited in the bones When the intake of lead stops, the stored portion is excreted until it is virtually eliminated from the system In chronic poisoning, the excretion rate usually rises until it balances the absorption rate

In the case of lead poisoning, biochemical tests performed on the body fluids would indicate the amount that is being circulated in the blood, excreted in the urine, or stored in the bones if an autopsy was made

An important difference between inhalation as route of entry and ingestion or skin absorption is that through inhalation the material enters the arterial blood directly, whereas with ingestion or skin absorption the material enters the venous blood and is carried through the right portion of the heart where it is then diluted by the entire venous system and passed through the lungs and then pumped by the left portions of the heart to the brain and other organs

Reactive gases and vapors are altered within the body and are eliminated to a large extent in forms other than those in which they are absorbed The toxicological action may be exerted either by the substance in its original form or by its detoxification products

Nonreactive gases and vapors are not altered to any appreciable extent in the body and are eliminated in the same chemical form in which they are absorbed The aliphatic hydrocarbons, such as propane and heptane, are examples of that type

Mode of action

Industrial poisoning may be classified as one of three types acute, subacute, or chronic The classification is based on the rate of intake of harmful materials, rate of onset of symptoms, and the duration of symptoms

Acute poisoning, typically, is characterized by rapid absorption of the offending material and the exposure is sudden and severe For example, inhaling high levels of carbon monoxide or swallowing a large quantity of cyanide compound will produce acute poisoning The death or survival of a victim through the critical period occurs suddenly Generally, acute poisoning results from a single dose