respiratory, cardiac, central, and peripheral nervous systems, as well as liver and kidney function. Alcohol intake should be evaluated.

SPECIAL TESTS

Expired air analysis and urinary metabolites have been used to monitor exposure.

PERSONAL PROTECTIVE METHODS

Gloves and protective clothing should be worn, and fullface mask should be used in areas of excessive vapor concentrations.

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VINYL CHLORIDE

DESCRIPTION

$CH_2=CHCl$, vinyl chloride, is a flammable gas at room temperature and is usually encountered as a cooled liquid. The colorless liquid forms a vapor which has a pleasant ethereal odor.

SYNONYMS

Chloroethylene, chloroethene, monochloroethylene.

POTENTIAL OCCUPATIONAL EXPOSURES

Vinyl chloride is used as a vinyl monomer in the manufacture of polyvinyl chloride and other resins. It is also used as a chemical intermediate and as a solvent.

A partial list of occupations in which exposure may occur includes:

Polyvinyl resin makers
Organic chemical synthesizers
Rubber makers

PERMISSIBLE EXPOSURE LIMITS

The Federal standard for exposure to vinyl chloride sets a limit of 1 ppm over an 8-hour period, and a ceiling of 5 ppm averaged over any period not exceeding 15 minutes.

ROUTES OF ENTRY

Vinyl chloride gas is absorbed by inhalation. Skin absorption has been suggested but experimental evidence is presently lacking.

HARMFUL EFFECTS

Local—

Vinyl chloride is a skin irritant, and contact with the liquid may cause frostbite upon evaporation. The eyes may be immediately and severely irritated.

Systemic—

Vinyl chloride depresses the central nervous system causing symptoms which resemble mild alcohol intoxication. Lightheadedness, some nausea, and dulling of visual and auditory responses may develop in acute exposures. Death from severe vinyl chloride exposure has been reported.

Chronic exposure of workers involved in reactor vessel entry and hand cleaning may result in the triad of acro-osteolysis, Raynaud's phenomenon, and sclerodermatus skin changes. Chronic exposure may also cause hepatic damage.

Vinyl chloride is regarded as a human carcinogen, and a causal agent of angiosarcoma of the liver. Excess cancer of the lung and the lymphatic and nervous systems has also been reported. Experimental evidence of tumor induction in a variety of organs, including liver, lung, brain, and kidney, as well as nonmalignant alterations, such as fibrosis and connective tissue deterioration, indicate the multisystem oncogenic and toxicologic effects of vinyl chloride.

MEDICAL SURVEILLANCE

Preplacement and periodic examinations should emphasize liver function and palpation. Liver scans and grey-scale ultrasonography have been useful in detecting liver tumors. Medical histories should include alcoholic intake; past hepatitis; exposure to hepatotoxic agents, drugs and chemicals; past blood transfusions; past hospitalizations. Radiographic examinations of the hands may be helpful if acroosteolysis is suspected. Long term followup of exposed persons is essential as in the case of other carcinogens.

SPECIAL TESTS

None in common use. Metabolism is being studied.

PERSONAL PROTECTIVE METHODS

Where vinyl chloride levels cannot meet the standard, workers should be required to wear respiratory protection, either air supplied respirator or, if the level does not exceed 25 ppm, a chemical cartridge or cannister type gas mask. In hazard areas, proper protective clothing to prevent skin contact with the vinyl chloride or polyvinyl chloride residue should be worn.

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DESCRIPTION

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ALIPHATIC AMINES

The aliphatic amines are derivatives of ammonia (NH_3) in which one or more hydrogen atoms are replaced by alkyl or alkanol radicals. They tend to have a characteristic fishlike ammonia odor in the free base form.

These compounds are generally prepared by alkylation of ammonia or hydrogenation of the appropriate nitrite. They are widely used in industry, particularly as chemical intermediates.

The amines are basic compounds and may form strongly alkaline solutions which can be highly irritating and cause damage on contact with eyes and skin. Skin absorption may be significant as many are capable of cutaneous sensitization. Some members of this series may have physiologic or pharmacologic effects—e.g., histamine liberation and vasodilation, but, in general, local effects predominate in industrial exposures.

Because of the strong irritant properties of aliphatic amines, eyes, skin, and respiratory tract should be protected from exposure to them.

N-BUTYLAMINE

DESCRIPTION

CH_3-CH_2-CH_2-CH_2-NH_2, n-butylamine, is a flammable colorless liquid with an ammoniacal odor.