

ORGANICS AND SOLVENTS HEALTH HAZARDS

In discussing health hazards of Organics and Solvents, it must be recognized that in general, much of what is written in standard medical texts is generally accepted, although some of this information may be incorrect. Many of you who work directly with these compounds have more experience than I, personally, but I will try to give a general rundown on these compounds which we either make here or use as raw materials.

I have divided the compounds into two groups -- the chlorinated hydrocarbons and others.

The chlorinated hydrocarbons. The pathological changes occurring as a result of poisoning by these compounds are very similar, but varying to some extent in degree. There is more information available to me on carbon tetrachloride, so this compound's pathological changes are what I will give you. This compound causes severe liver damage. The normal liver lobule is affected at its central portion by a condition we call necrosis, (death of cells by dissolution) and spreads toward the periphery. This reaches its maximum in about two weeks and regeneration then begins. Regeneration proceeds from the undamaged cells at the periphery of the lobule towards the center. One is less likely to find either fibrosis or cirrhosis from carbon tetrachloride than is to be found from a viral or nonchemical agents. Death may occur from massive liver destruction, however, as acute yellow atrophy. About the time the liver starts to regenerate one becomes disturbed by failing kidneys which proceeds to get worse as the liver gets better. A fatty degeneration of the proximal convoluted tubules occurs leading to decreased urinary output, oliguria, and retention of urinary waste, uremia.

The symptoms of toxicity of the chlorinated hydrocarbons are similar and may be grouped as:

1. Effects of the central nervous system to include such signs and symptoms as headaches, dizziness, confusion, weakness, tremors and incoordination, somnolence, loss of consciousness, depression of respiration and circulation and finally death. Other nervous problems not necessarily related to the central nervous system include peripheral neuritis (paralysis of a muscle, or group of muscles) and their addicting effects similar to glue sniffing.
2. Liver and kidney damage with nausea, vomiting, loss of appetite, at times gastro-intestinal hemorrhage, jaundice, abdominal pain or cramping, and death, either due to liver failure or kidney failure.
3. The respiratory tract usually is affected only by high concentration causing a local irritation. Most of these compounds are not unpleasant in odor and only a high concentration cause sore throat, cough, and bronchitis.
4. Contact with skin. All of the chlorinated hydrocarbons cause a defatting effect on the skin which causes a chapping, which in turn leads to easily contracted secondary infection. Contact with the eyes either in solution, or vapor, causes a marked irritation and tearing.

THERE ARE FOUR MAIN FACTORS PREDISPOSING TO SUSCEPTIBILITY OF INDIVIDUALS TO THESE COMPOUNDS:

- (1). ALCOHOLISM
- (2). OBESITY
- (3). PREVIOUS EXPOSURE TO HYDROCARBONS
- (4). ? A LACK OF DIETARY CALCIUM

Individuals with any of the above problems should not be placed in positions where exposure to these compounds is possible.

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The information which I have on these individual compounds has been compiled from various sources and I have had no previous experience with many of these.

1. Carbon tetrachloride -- The recommended safety limit is 25 ppm for 8 hours which is below the odor level, if the average for an 8 hour period is not over 10 ppm. The symptoms of exposure include those of the central nervous system, namely; dizziness, headache, faintness, confusion, convulsions, eye irritation, abdominal pain, nausea, liver enlargement, heart muscle damage, leading to congestive heart failure with pulmonary edema or cardiac arrhythmia. Kidney damage leading to oliguria in from 8 hours to 10 days, and uremia. Alcohol ingestion, either before or after exposure, markedly aggravates the condition. Chronic exposure rarely produces any disease.
2. Dichloroethane (EDC) -- 100 ppm for an 8 hour period is the safe level. Overexposure causes respiratory irritation, nausea, vomiting, dizziness, epigastric cramps -- death is rare. By ingestion death can occur from kidney or liver injury. On the skin it removes the skin oils leaving the skin dry, chapped, susceptible to secondary infection.
3. 1-1-1 Trichloroethane (Methylchloroform) -- 500 ppm over an 8 hour period is the safe level. Overexposure leads to depression of the central nervous system, dizziness, incoordination, finally leading to respiratory failure. There are no known human deaths.
4. Tetrachloroethane -- 10 ppm for an 8 hour period is the safe level. It is four times as toxic as chloroform. It is extremely toxic to the liver and may also damage the kidney. It also affects the central nervous system by causing dizziness, nervous tremors, convulsions. It may also cause peripheral neuritis. It also causes gastro-intestinal upset and abdominal pain.

5. Pentachloroethane -- Similar to tetrachloroethylene but less volatile. No toxic effects in man have been reported. It may act as narcotic (central nervous system), or metabolic poisoning in animals.
6. Trichloroethane -- Recommended exposure concentration has recently been reduced from 200 ppm per 8 hours to 100 ppm for an 8 hour period by Dr. Irish of Dow Chemical Company. This is an anesthetic (trilene) and in certain employees causes a craving and is habit forming. In high concentrations it causes irritation of the nose and throat, dizziness, nausea, and vomiting, rapid respiration, anesthesia, and collapse. Chronic effects include headache, nausea, vomiting, confusion, local paralysis, cardiac irregularity. Contact on the skin causes damage from defatting.
7. Tetrachloroethylene (Perchloroethylene) -- Similar reduction in concentration (from 200 ppm to 100 ppm for 8 hours) as stated above by Dr. Irish is recommended. This compound is used for the treatment of hookworm in man and animals. It is possibly the least harmful. Vapors cause headache, faintness, excessive salivation, tearing, respiratory irritation, possibly some liver and kidney damage. Skin contact also causes chapping.
8. Mono-chlorobenzene -- Much safer to use than benzene. This compound causes headache, sleepiness, fainting, respiratory difficulty.
9. Dichlorobenzene -- Occurs in two forms, ortho and para. Paradichlorobenzene vapors give symptoms of headache, dizziness and excitability. Prolonged exposure causes liver damage and cirrhosis.

Non-chlorine compounds

1. Benzene -- Other non-chlorine compounds discussed include benzene. The recommended concentration is 25 ppm for an 8 hour period, although 3,000 ppm for 8 hours may be tolerated for 30 minutes. Symptoms of

1. Benzene - Continued

acute poisoning by the vapors include irritation to the eyes, the respiratory tract, exhalation, headache, nausea and vomiting, weakness, cynosis, feeble pulse, unconsciousness and convulsions. The chronic effects vary depending on the individual susceptibility as well as the intensity and duration of the exposure. The chief problem regarding chronic benzene poisoning is a condition called aplastic anemia which is an ultimately fatal disease due to the fact that bone marrow has been so damaged that it is unable to produce formed elements of the blood -- that is red blood cells, white blood cells and platelets. Transfusions help for awhile only. Women, particularly young or pregnant women, or those having chronic ailments, or a Vitamin C deficiency, are most severely poisoned by less severe concentrations or durations.

2. Phenol (Carbolic acid) -- Upon direct contact on the skin or on the mucous membrane this compound acts as tissue coagulant, causing first, prickling and burning sensation, rapid change to numbness due to death of the nerve ending. The area first becomes white, then changes to red, then to brown and finally sloughs. Poisoning by the vapors of phenol causes symptoms of headache, dizziness, tinnitus, excitement, twitching, convulsions and coma. Later pneumonia develops. Blood pressure drops, pulse becomes rapid.

3. IPCF (Isopropyl chloroformate) -- Acts primarily as an irritant to the respiratory tract and the skin causing first and second degree burns of the skin when spilled; cough, tearing, possibly bronchitis when the vapors are inhaled.

In exposure to any of the above discussed compounds, once symptoms of toxicity are suspected, immediate removal from the area is imperative. Whether or not medical or hospital care is necessary will depend on the severity of the symptoms and the recommendation of the plant or personal physician. In general, repeated exposures

are not cumulative.

"Former Hepatitis Patients Working in Organic Plants" has not been presented to me as a problem. It is my feeling, however, that if a known case of hepatitis has completely recovered, as is best determined by physical examination and sensitive screening laboratory tests, he may return to work, or he may go to work in an organic plant with permission of his own private physician one year after both physical and laboratory work are normal. I realize that this is arbitrary, but the liver is a large, complicated organ. The tests we have are gross at best, therefore, I feel that a delay of one year is not unreasonable. We might recommend here that on preemployment history a question concerning "Hepatitis? Jaundice? Liver diseases?" might be included.

Changes in the Lake Charles plant physical schedule include only additional laboratory work of complete blood count; blood, urine, nitrogen; SGPT (serum Glutamic Pyruvic transaminase). At this plant, however, we routinely do a complete physical examination including a chest X-ray, urinalysis, vitalometry annually. The only abnormality we have found in any organic plant worker has been an elevated transaminase, which was rechecked and then liver damage ruled out by a BSP (Bromsulphon-pthalein) test. Apparently other plants of Columbia-Southern check their employees physically and laboratory-wise every two weeks to six months. As yet, we have seen no indication that this is necessary or advisable.