VII. RESEARCH NEEDS

Few studies have reported the toxic effects of exposure to hydrazines on humans, and when these effects were reported, the extent of exposure was not determined nor were the cases followed up. No epidemiologic studies and little environmental data were found. Epidemiologic studies are needed of worker populations whose length of exposure to hydrazines approaches a normal working lifetime. These studies could determine possible chronic effects, such as blood or liver abnormalities and cancer, and possible interactions such as smoking and alcohol consumption. Environmental and medical data are needed to establish the validity of the present recommendations.

CNS effects, hemolytic changes, renal and hepatic damage, and tumorigenic effects caused by exposure to the hydrazines have been well documented, mostly in animal studies. However, there are species differences for many of these effects, and it is not apparent at this time which effects on animals most closely resemble those on humans. This problem needs clarification. In addition, toxic effects caused by inhaling phenylhydrazine and 1,2-dimethylhydrazine need to be investigated, especially as they relate to long-term exposure. Better information on questions of whether or not the hydrazines cause prenatal or perinatal changes (teratogenicity), inherited changes (germinal mutagenicity), or other effects on reproduction is needed.

The stability of the hydrazines needs to be examined with particular emphasis on the quantity and identity of impurities that occur either from

manufacture or decomposition. Possible effects of these impurities on toxicity of the hydrazines should be investigated.

Available data from animal studies support the conclusion that hydrazine and 1,2-dimethylhydrazine may be carcinogenic in humans; the exposure routes were usually sc, ip, or oral. The role of nitrosodimethylamine in tumorigenicity and the amount present in 1,1-dimethylhydrazine need to be examined. Data on the carcinogenicity of methylhydrazine and phenylhydrazine are less definitive, and more information on these compounds is needed. In many cases, only specific sites of tumor induction were examined; these studies should be extended to include other organs or systems. It is likely that these hydrazines are carcinogens when inhaled, but confirmation is desirable. A mechanism of carcinogenicity for 1,2-dimethylhydrazine has been postulated, but no similar information is available for the other hydrazines. Further studies on the metabolism of these compounds may reveal possible mechanisms and species differences relevant to tumor induction.

A gas-chromatographic method has been recommended for monitoring hydrazines except for 1,2-dimethylhydrazine. A method for 1,2-dimethylhydrazine, although it may have limited use, needs to be developed. The gas-chromatographic method itself is not as sensitive as would be desirable, and it has not been tested for its ability to measure hydrazine salts. The method needs to be tested in the field and modified to improve sensitivity. A sampling method capable of collecting both vapors and aerosols needs to be tested. In addition to the gas-chromatographic method, a specific and continuous monitoring method would be desirable to

document exposure in the workplace and to warn of overexposure. A method capable of measuring total hydrazines would also be useful, especially in situations where employees are exposed to mixtures of hydrazines.

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