assessment is used to estimate the likelihood and severity of an oxygen deficiency event. Together, the liklihood and severity determine the required level of engineering and operational control as well as personal protective equipment. The hazard assessment methodology, with emphasis on determination of the source terms, is presented. Source terms for input into the risk function come from a systems analysis such as fault tree, release rates from chemical process safety applications, and oxygen deficiency estimates from a two compartment ventilation model adjusted for the characteristic behavior of liquid helium releases. A risk function termed the oxygen deficiency hazard rate (ODH), which has been in use in other accelerators, combines time to incapacitation at a given oxygen level with a system failure rate. The ODH rate triggers an ODH categorization of 0 to 4, with 4 requiring the most stringent control.

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ASSESSMENT OF STATE AIR TOXICS REGULATIONS: A CASE STUDY. C. Feigley, H. Pastides, C. Prince, University of South Carolina, Columbia, SC; D. Jollow, Medical University of South Carolina, Columbia, SC.

A Workgroup was formed to recommend science-based methods for determining which air pollutants should be regulated under South Carolina Air Toxics standard (Regulation 62.5, Standard 8) and for specifying appropriate ambient concentration limits (ACLs) for protecting public health. These methods were to make efficient use of existing data sources and guideline levels, recognizing that State agency resources are limited. Initially, state air toxics regulations, policies, and approaches throughout the United States were surveyed and analyzed. States with their own air toxics regulations were found to have higher population, a greater portion of the population less than 5 years old, higher gross state product, higher per capita income, higher ambient concentrations of air toxics; they were more likely to have fishing and tourism as important industries. The Workgroup concluded that the SC Standard is essential for controlling air toxics for protection of public health because it complements federal standards. Recommendations included listing/delisting criteria based on weight-of-evidence cancer classifications and noncancer exposure limits developed by national and international organizations, and a tiered protocol for setting ACLs based on carefully developed exposure guideline levels. The Workgroup observed that developing ACLs to control cancer risk requires that the State specify an acceptable risk level. Also, although ACLs may be set to protect people within the normal range of susceptibility, ACLs protecting hypersusceptible persons now are not scientifically feasible.

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OCCUPATIONAL EXPOSURE LIMITS FOR FREONS IN POLAND. K. Konieczko, The Nofer Institute of Occupational Medicine, £ódŸ, Poland; S. Czerczak, The Nofer Institute of Occupational Medicine, £ódŸ, Poland.

Cardiotoxicity is thought to be the most essential effect of exposure to trichlorofluromethane (CFC-11), dichlorodifluoromethane (CFC-12), and 1,2-dichloro-1,1,2,2-tetrafluoromethane (CFC-114). In a study involving ten volunteers exposed by inhalation to freon 11, freon 12, freon 114, no clear-cut pathological changes in ECG were found, although most subjects developed heart rate variability exceeding that noted before exposure. In a few cases T wave inversion, and in one case atrioventricular block, were observed. The time of exposure was 15, 45 or 60 seconds. The concentration of propellants in the air ranged from 16 to 150 g/m3.

In exposure to chlorodifluoromethane (CFC-22), the major effect of the short-term exposure is cardiotoxicity (NOAEL - 87.5 g/m3). In a long-term experimental study, systemic toxicity was observed. The rats exhibited a statistically significant increase in the kidney, adrenal and pituitary weights. NOAEL of 35,400 mg/m3 for systemic effects was determined.

Dichlorofluoromethane (CFC-21) produces mainly hepatotoxic effect. The Polish proposal of occupational exposure limit was based on a 90-day animal study. NOAEL of 213.8 mg/m3 for hepatotoxicity was established.

Dibromodifluromethane (freon 12B2) is an imitant, hepatotoxic and neurotoxic agent. The no-effect level of 3,000 mg/m3 in animals exposed for up to 7 months was determined.

Based on literature data, the occupational exposure limits for freons in Poland were proposed.

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TOXICOLOGY, RISK ASSESSMENT AND THE INDUSTRIAL HYGIENIST. G. Briggs, Geo Centers, Inc., Naval Health Research Center Detachment (Toxicology), Wright-Patterson AFB, OH; K. Still, Naval Health Research Center Detachment (Toxicology), Wright-Patterson AFB, OH.

Risk assessment is an interdisciplinary method of quantifying health risks associated with exposure to environmental and occupational toxicants. Industrial hygienists, toxicologists and epidemiologists provide most of the vital information used in risk assessments of chemicals of interest to the U.S. Navy. These data are used to characterize the toxicology of potential hazards, perform human health hazard evaluations, and to formulate appropriate exposure limits for Navy operations. The roles of industrial hygienists and risk assessors will be discussed and evaluated for developing critical data for hazard identification, dose response evaluation, exposure assessment and risk characterization. This information is vital to effective risk management decision making. Examples of how our interdisciplinary team works together within the Navy to perform risk assessments are presented. The integration of processes used by toxicologists and industrial hygienists in establishing appropriate risk management policies to help ensure readiness of sailors in completing the military mission will be discussed. The presentation will focus on problem solving, determining the nature and magnitude of the problem, and determining what decisions are needed to prevent health risks and, in establishing the criteria for ensuring that readiness of sailors is maintained.

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EVALUATION OF REPRODUCTIVE TOXICITY FROM EXPOSURE OF MALE RATS TO JET PROPULSION FUEL JP-8 VAPOR. W. Price, G. Briggs, Geo Centers, Inc., Naval Health Research Center Detachment (Toxicology), Wright-Patterson AFB, OH; K. Still, Naval Health Research Center Detachment (Toxicology), Wright-Patterson AFB, OH; K. Grasman, Wright State University, Fairborn, OH.

Each year several hundreds of thousands of U.S. Air Force, U.S. Army, and U.S. Navy & Marines personnel are exposed acutely or chronically to JP-8 vapor. Although the U.S. Navy & Marines have traditionally used JP-5 fuel for powering of aircraft and land vehicles, there is an ongoing transition to predominant use of JP-8. These exposures occur directly during workplace and combat deployment, but often occur indirectly to personnel simply assigned near fuel-handling sites. Typically, these exposures occur with no respiratory protection. While there is substantial evidence that acute or chronic exposure to other jet fuel vapor or aerosol may induce significant deficits in humans, there has been little relevant published research on the effects of acute or repeated exposure to JP-8 vapor. The Hamilton Thorne sperm analyzer was used to evaluate sperm damage produced by inhalation exposure to JP-8 in laboratory rats. Groups of male rats were exposed to room air or to jet fuel vapor at 1000 mg/m3, 500 mg/m3 or 250 mg/m3 for 6 hours per day, 7 days a week for 90 consecutive days to determine if exposure resulted in damage to the reproductive system. The inhalation exposure system consisted of a vapor generator, a 670 L whole body inhalation air control exposure chamber, three exposure chambers identical to the control chamber and an IR-vapor concentration analyzer. The vapor exposure chambers were filled with JP-8 vapor on a continuous basis and the control chamber was filled with HEPA filtered room air at a rate of 72 L/min. After exposure, rat semen was analyzed using the Hamilton Thorne sperm analyzer computer assisted semen analysis (CASA) for sperm count, concentration, motility and morphology. Sperm quality parameters were evaluated (sperm concentration, motility, and morphology) to provide evidence of sperm damage.

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GLUTARALDEHYDE: A NEW STRATEGY FOR UPDATING RECOMMENDED EXPOSURE LIMITS. K. MacMahon, J. Wess, C. Forrester, M. Haring Sweeney, NIOSH, Cincinnati, OH.

The Occupational Safety and Health Act of 1970 authorizes the National Institute for Occupational Safety and Health (NIOSH) to develop criteria, including recommended exposure limits (RELs), for preventing disease and hazardous conditions in the workplace. A REL is an occupational exposure limit recommended by NIOSH as being protective of worker health and safety over a working lifetime. NIOSH determined that an updated REL was indicated for glutaraldehyde as significant adverse health effects including contact dermatitis and asthma have been reported to occur in workers exposed below the current glutaraldehyde REL of 0.2 ppm (0.8 mg/m3) as a ceiling limit. A new process has been implemented in the development of an updated REL for glutaraldehyde in which NIOSH's comprehensive toxicology and epidemiology literature evaluation is based on recent reviews published by other standard-setting groups. The Health and Safety Executive of the United Kingdom and the Nordic Expert Group in conjunction with the Dutch Expert Committee for Occupational Standards summarized the available occupational health literature on glutaraldehyde in 1997 and 1995, respectively. NIOSH has used these documents as the basis for its criteria document on glutaraldehyde. NIOSH has also reviewed the literature available since 1997 and evaluated current exposure data in order to develop a new REL and criteria

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ABSTRACTS