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Assessment of Airborne Low-Level Phosgene Exposures in Chemical Industries and Health Effects

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Abstract

Introduction: Phosgene is a highly reactive chemical widely used to manufacture isocyanates, diisocyanates, chloroformates and carbamyl chlorides. The employees are exposed to low level phosgene exposures during its manufacture, transportation and usage in process industries. Acute phosgene exposure primarily causes pulmonary edema and may result in death. A cross-sectional study has been conducted to evaluate low-level personal exposures and respiratory effects in two chemical process industries

Material and Methods: Phosgene, carbon monoxide and chlorine concentrations were measured using pre-calibrated real-time gas detectors at different process plants during shift work duration. The health study covered 288 workers including study and control group of workers at two chemical industries located at Halol & Valsad in Gujarat, India. The health study included complete clinical examination, PFT and chest radiography of each subject using 300mA equipment. The pulmonary functions of the subjects were evaluated using Spirovit SP- 10 (M/s Schiller AG, Switzerland). The time weighted average concentrations and measured values of phosgene, carbon monoxide and chlorine in two industries have not exceeded the permissible exposure limit as per Indian Factories Act 1948.

Results: The chest radiograph of 18(6.3%) subjects showed finding suggestive of old healed pulmonary tuberculosis while remaining was normal in Industry-1 & 2. The spirometry revealed that 15.5% and 0.5% 7(6.5%) and 2(1.9%) had restrictive and obstructive type of pulmonary function impairment in industry-1 and 2, respectively.

Conclusion: There is a necessity of phosgene scrubbing systems to neutralize accidental phosgene leak in industries as Phosgene is highly toxic to industrial workers may lead to sudden death. The industries were suggested to use real-time gas detectors to measure time weighted average exposures at all work areas and periodic medical examinations with PFT and chest radiography.