

Long-Term Exposure, Health Risk, and Loss of Quality-Adjusted Life Expectancy Assessments for Vinyl Chloride Monomer Workers

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Abstract : The vinyl chloride monomer (VCM) has been classified as group 1 (human) carcinogen by the IARC. Workers exposed to VCM are known associated with the development of the liver cancer and hence might cause economical and health losses. Particularly, for those work for the petrochemical industry have been seriously concerned in the environmental and occupational health field. Considering assessing workers' health risks and their resultant economical and health losses requires the establishment of long-term VCM exposure data for any similar exposure group (SEG) of interest, the development of suitable technologies has become an urgent and important issue. In the present study, VCM exposures for petrochemical industry workers were determined firstly based on the database of the 'Workplace Environmental Monitoring Information Systems (WEMIS)' provided by Taiwan OSHA. Considering the existence of miss data, the reconstruction of historical exposure techniques were then used for completing the long-term exposure data for SEGs with routine operations. For SEGs with non-routine operations, exposure modeling techniques, together with their time/activity records, were adopted for determining their long-term exposure concentrations. The Bayesian decision analysis (BDA) was adopted for conducting exposure and health risk assessments for any given SEG in the petrochemical industry. The resultant excessive cancer risk was then used to determine the corresponding loss of quality-adjusted life expectancy (QALE). Results show that low average concentrations can be found for SEGs with routine operations (e.g., VCM rectification 0.0973 ppm, polymerization 0.306 ppm, reaction tank 0.33 ppm, VCM recovery 1.4 ppm, control room 0.14 ppm, VCM storage tanks 0.095 ppm and wastewater treatment 0.390 ppm), and the above values were much lower than that of the permissible exposure limit (PEL; 3 ppm) of VCM promulgated in Taiwan. For non-routine workers, though their high exposure concentrations, their low exposure time and frequencies result in low corresponding health risks. Through the consideration of exposure assessment results, health risk assessment results, and QALE results simultaneously, it is concluded that the proposed method was useful for prioritizing SEGs for conducting exposure abatement measurements. Particularly, the obtained QALE results further indicate the importance of reducing workers' VCM exposures, though their exposures were low as in comparison with the PEL and the acceptable health risk.

Keywords : exposure assessment, health risk assessment, petrochemical industry, quality-adjusted life years, vinyl chloride monomer

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