Oral Session 13 – Risk Assessment

O13-1 AN EXPLORATORY RISK ASSESSMENT FOR METALWORKING FLUIDS (MWFS)

Robert Park*. *CDC/National Institute for Occupational Safety and Health, Cincinnati, USA*

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MWF mixtures vary across manufacturing process, facilities, enterprises and over time. The routes of exposure are dermal in liquid phase, and inhalation as dusts, mists and vapours. The challenge is to generalise from specific worker populations observed over many decades and from animal studies limited to few priority components. Cancer risks have been observed in both hazard identification and exposure-response studies. Respiratory disorders and performance deficits are other health effects of MWFs appearing as increased morbidity and mortality or reduced pulmonary function, as well as immune-mediated disorders: adult-onset asthma and hypersensitivity pneumonitis (HP). Dermatitis has been a constant associate of MWFs for more than two centuries. The goal here was to explore the development of a generic summary of MWF effects to determine exposure levels conferring an acceptable low level of risk in most metalworking environments. Only total gravimetric measures of airborne dusts or mists were considered, usually with restriction to the respirable fraction. Aggregate cancer excess risk was estimated from the few studies with adequate retrospective exposure assessments and work history. Lifetime risk was calculated. Annual proportional loss of respiratory capacity was evaluated, using a benchmark dose procedure. Incidence of asthma and hypersensitivity pneumonitis (HP) was examined as were aggregate symptoms focusing largely on respiratory complaints. For MWF exposure to 0.1 mg/m^3 over 45 yr, the lifetime risk of attributable cancer was about 3.5% and attributable respiratory impairment would occur in 4.5% of workers. Lifetime risk of asthma or HP (under outbreak conditions) was 80% at 0.1 mg/m^3. After 45 yr at 0.1 mg/m^3 MWF, excess prevalence of primarily respiratory symptoms would be 9 percent based on published studies, and 20 percent from NIOSH investigations.

O13-2 IS THERE AN INCREASED RISK OF LUNG CANCER AMONG THE CHINESE SILICA COHORT? – SOME METHODOLOGICAL UNCERTAINTIES

Yi Sun*, Frank Bochmann. *Institute for Occupational Safety and Health of German Social Accident Insurance (IFA), Sankt Augusitn, Germany*

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The Chinese silica cohort is one of the largest silica cohort with a sample size of about 74,000 employees from 29 Chinese metal mines and pottery factories. Early analysis reveal some uncertainties in the quantification of the association between silica dust exposure and lung cancer deaths due to occupational confounders such as polycyclic aromatic hydrocarbons (potteries and Iron-copper mines), arsenic (tin mines) and radon daughter (iron-copper mines).

In a recent published exposure-response-estimation of this cohort, the authors excluded 54% cohort participants with either low data quality or heavy occupational confounders, and demonstrated a clear exposure-response relationship between silica dust exposure and lung cancer deaths. However, this study finding ist still questioned by some of the scientific communities, since some residual confounders do still exist in a part of the facilities (such as radon daughter in iron mine and polycyclic aromatic hydrocarbons in pottery factories) and may still bias the study results.

In order to evaluate the possible methodological uncertainties in the recent published exposure-response estimation, we repeated the previous analysis by using the sub-cohort of Chinese tungsten miners which are free from any occupational carcinogenic confounders.

This study cohort includes 19007 workers in six tungsten mines with a follow-up period from January 1, 1960 to December 31, 2003. Cumulative silica dust exposure was estimated by linking the work history to the job-exposure matrix. Time-dependent cox proportional hazards model was used for exposure-response analysis.

This present reanalysis does not provide a clear exposure-response relationship between silica dust exposure and lung cancer deaths. Up to date, the Chinese silica cohort still fails to provide a clear evidence to show that exposure to silica causes lung cancer in the absence of occupational confounding factors.

O13-3 RISK ASSESSMENT: CONVENTIONAL DIESEL EXHAUST AND LUNG CANCER

Robert Park*. *CDC/National Institute for Occupational Safety and Health, Cincinnati, USA*

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Studies in railroad workers, truck drivers, and miners reveal diesel exhaust to be carcinogenic. Although technology has evolved, a large capacity in the U.S and globally still comprises traditional diesel engine design in transportation, mining, construction and farming. The Diesel Exhaust in Miners Study (DEMS) with an extensive exposure assessment investigated 200 lung cancer deaths in non-coal and non-metal miners. A DEMS dataset was used to calculate the excess lifetime risk for airborne concentrations of respirable elemental carbon (REC). A healthy worker survivor effect and possible confounding by non-diesel power generation and other mining exposures (e.g., explosives) were investigated along with dose-rate effects using Poisson regression methods with high-resolution classification. Lung cancer mortality declined with employment duration and more so when REC and non diesel exposure effects were also estimated, revealing a strong survivor bias. Attenuation of the REC effect was also observed with increasing (lagged) cumulative REC exposure. In underground miners, the excess relative rate of lung cancer mortality was 0.67 ($p < 0.0001$) for a 10 year exposure to 200 µg/m^3 REC, a typical underground exposure. At occupational REC exposures of 200, 10 and 1 µg/m^3 the excess lifetime risks, respectively, were 119, 43 and 8.7 per thousand. The estimated lifetime risk was greater than some previous estimates not accounting for heathy worker survival bias. This bias was addressed using employment duration and mine above/below ground status. A model-fitted function of cumulative exposure accommodated attenuation of exposure effect. The estimated excess lifetime risks of lung cancer at old diesel REC exposure levels common in occupational groups in the past exceed 5%.

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Robert Park

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