this varied between tools and type of exposure. Correlations between the measurement results and tool predictions also varied with tool and exposure type. Furthermore, a wide range of exposure estimates were observed when different users were asked to apply the same tools to the same scenario conditions.

**Conclusion** Models to estimate exposure and risk are essential elements of the toolbox of occupational hygienists and risk assessors and managers. However, there is increasing evidence that performance varies between tools, type of exposure and scenario conditions. More importantly, users appear to struggle to apply the tools consistently, leading to wide ranges in estimated exposures. There is an urgent need for the development and implementation of generic quality control procedures for use of exposure tools, to reduce the large uncertainties when applying these tools, both to prevent workers from being excessively exposed and unnecessarily implementation of stringent exposure control measures.

**Discussion**

Exposure to benzene vapour by vapour recovery unit existing year. Other significant interventions were reduction in exposure to benzene vapour by vapour recovery unit (from 3.2 mg/m³ to <0.2 mg/m³) and reducing noise exposure from 96.2 dBA to 85 dBA by providing acoustic insulation, Heat stress reduction at loading point), Noise exposure reduction from 13.21 mg/m³ to 0.26 mg/m³ (substitute with direct bulker unloading instead of manual bag unloading system), catalyst replacement activity to reduce nickel exposure from 33 mg/m³ to <1 mg/m³ (local exhaust ventilation system at loading point), Noise exposure reduction from 96.2 dBA to 85 dBA by providing acoustic insulation, Heat stress reduction for workers working inside sea water pipe line by providing forced cool air ventilation system. Ergonomic improvement project of implementing vertical lifting machine at material storage location.

**Case Study**

CASHe program at Reliance proves that team work of Medical, Safety, Environment and Technical department helps to bring positive change and continual improvement in occupational health practices. This helps to steer plant management in a focused way to look into the work place hazards and take appropriate control measures.

**Method**

CASHe program has defined annual road map which comprises formation of CASHe Team, field visit, IH-OH survey, submission of project charter, monthly CASHe team meetings with progress reports, midyear project review, final survey with report submission and plant inter-site competition for evaluation. Multidisciplinary CASHe team continuously work on this road map to achieve project goals.

**Result**

In 2016 – 17, Total 302 projects out of 408 were completed (74%). To inculcate best projects like Chemical Exposure reduction from 6.44 PPM to 0 PPM (closed loop sampling system at benzene storage tank), dust exposure reduction from 13.21 mg/m³ to 0.26 mg/m³ (substitute with direct bulker unloading instead of manual bag unloading system), catalyst replacement activity to reduce nickel exposure from 33 mg/m³ to <1 mg/m³ (local exhaust ventilation system at loading point), Noise exposure reduction from 96.2 dBA to 85 dBA by providing acoustic insulation, Heat stress reduction for workers working inside sea water pipe line by providing forced cool air ventilation system. Ergonomic improvement project of implementing vertical lifting machine at material storage location.

**Discussion**

CASHe program at Reliance proves that team approach, creating awareness, positive attitude and implementation of innovative interventions are win-win prospect and makes good business sense. CASHe program is an endless journey of awareness and workplace improvements.

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**MEDICHEM SYMPOSIUM: HOW EPIDEMIOLOGY CAN INFORM NON-LINEAR DOSE-RESPONSES FOR OCCUPATIONAL CARCINOGENS**

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**Aim of special session**

Epidemiological evidence challenges the linear no-threshold default model for cancer risks. The methodological and regulatory implications are explored.

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Many chemicals are classified as known human carcinogens, based at least in part on epidemiological evidence. However, occupational epidemiological studies often lack detailed and reliable individual-level exposure information, and only may be capable of qualitatively indicating increased risk among ‘exposed’ versus ‘unexposed’ groups. Although this information might be helpful for hazard identification, it is of limited use for risk assessment. Therefore, many investigators have placed greater emphasis on obtaining measurements and deriving quantitative estimates of individual exposures over time. In addition to facilitating the identification of potentially nonlinear exposure response relationships, including exposure thresholds for risk, this information helps improve risk assessments. Evidence of nonlinear exposure-response sometimes aligns with knowledge about the agents’ route of exposure, mode of action, metabolism and elimination. Furthermore, the identification and application of sensitive biological markers of exposure can help define groups of workers with exposures that are biologically meaningfully different from those of other groups, allowing more precise characterisation of the risk function and possibly the shape of the underlying dose-response function. For many carcinogens, the exposure-response is becoming clearer, and for some it is not linear. Furthermore, where there is evidence of exposure thresholds, epidemiological data may provide direct evidence of the exposure level where risk is increased, i.e., a meaningful departure from background rates. This presentation will review the epidemiological evidence on several known occupational carcinogens that suggest nonlinear risk functions, drawing on examples such as hexavalent chromium, crystalline silica, ionising radiation, vinyl chloride and benzene. Possible mechanisms that give rise to the observed nonlinear relationships (e.g., production of carcinogenic metabolite, overwhelming clearance pathways or repair mechanisms, etc.) will be discussed, and recommendations on how the integration of evidence from different lines of inquiry holds promise for identifying nonlinear exposure-response relationships for occupational carcinogens.

Effects of crystalline silica on the respiratory tract have been demonstrated in a large number of epidemiological studies. Crystalline silica is a known occupational carcinogen with the lung as main target organ and can cause silicosis as well as chronic obstructive pulmonary disease (COPD). While these hazards are well characterised, there is an ongoing debate on the quantitative exposure-response relationships for crystalline silica and these respiratory endpoints.

Both for regulatory and preventive purposes, the demonstration of an exposure threshold which almost excludes any human health risk would be highly desirable. Another option would be the derivation of an exposure-risk relationship associating a given exposure level with a specific lifetime risk, e.g. for lung cancer. However, chronic inflammation – believed to be a threshold effect – is currently considered as the most likely mechanism relevant for both the development of silicosis and lung cancer, while it is unclear whether silica-induced lung cancer requires the presence of silicosis. This presentation will review the current epidemiological evidence for the derivation of a threshold with respect to the development of lung cancer and silicosis focusing on high-dose.