accidental petroleum leak occurred in an underground section near a residential area. Health risk concerns to residents from petroleum vapour were raised. An environmental site assessment (ESA) done 2011 revealed a cemented layer composed of silty and sand material from 2.0 to 4.5 metres underground, acting as 'vaportard,' limiting upward vapour migration. Impacted groundwater and soil are situated below the vapor-tard, minimising vapour intrusion. As part of the remediation, ambient and indoor vapour intrusion studies have been conducted to determine exposure risks.

Methods Community ambient levels of volatile organic compounds (VOCs) and Benzene have been measured from 2011 to 2015. In 2011, vapour intrusion (VI) study was performed to assess potential indoor air impacts from subsurface vapour intrusion. Probes were installed through concrete floor slabs and sampled for vapours.

Result 99% of VOCs and 100% of Benzene ambient air readings are below the detection limit of the photoionization device. 1% of VOC readings ranged from 0.1 to 2.0 ppm. The VI study has detected 17 VOCs in indoor and vapour samples above screening levels. These VOCs in indoor air is not likely to be related to the VI pathway, and linked to background indoor and outdoor sources related to fuel products of combustion such as vehicle traffic from a major highway, asphalt paving, and cooking fuels.

Discussion Results show the 'vaportard,' layer is effective in limiting the upward migration of vapours from the underground release area. Monitored VOCs are from ambient air pollution with mobile sources as major contributor. No risk to health of residents was identified. Remediation is on-going and has achieved the Human Health Risk Assessment targets and is in the final stage of completion.

Industrial Hygiene

1296 E-WASTE RECYCLING IN CANADA – WORKERS' EXPOSURE TO METALS AND FLAME RETARDANTS

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Introduction Electronic waste (E-waste) recycling is a booming industry. E-waste contains metals and flame retardants (FRs) that are released during dismantling processes, thus exposing workers. Several of these substances are associated with adverse health effects. The goal of this study is to assess occupational exposure to metals, brominated (BFR) and organophosphosphate ester (OPE) FRs in e-waste recycling facilities.

Methods Personal air sampling was performed over 8 hour work days with 10 workers in two companies. Analyses covered a dozen metals, BFRs and OPEs, including polybromodiphenyl ethers (PBDEs). Tasks and workstations were described through observation. Metals were analysed by inductively coupled plasma mass spectrometry, and flame retardants by gas chromatography and mass spectrometry. Concentrations below the limit of detection were imputed as LOD/ $\sqrt{2}$.

Results The exposure levels for metals were below occupational exposure limits. Geometric means (GM) for air

concentration were 918 ng/m³ for copper [range: 487–2200], 346 ng/m³ for lead [121–1000], 85 ng/m³ for cadmium [60–240] and one positive sample for yttrium (970 ng/m³). The highest PBDE concentration was for BDE-209 (GM=39 ng/m³ [6–986]), and the highest OPE was tris (2-chloroethyl) phosphate (TCEP) (GM=156 ng/m³ [80–478]). Lead concentrations were correlated with BDE-153, BDE-183, BDE-209 and tris (1,3-dichloro-2-propyl) phosphate (TDCPP); Spearman's ρ of 0.70, 0.89, 0.80 and 0.71 ($p < 0.05$), respectively. TDCPP levels were also correlated with BDE-183, copper and cadmium; Spearman's ρ of 0.77, 0.84 and 0.67 ($p < 0.05$). Highest levels of BDE-153, BDE-209, TCEP, lead and yttrium were measured at the cathode ray tubes dismantling workstation.

Conclusion These results in E-waste recycling sites clearly show concomitant exposure to various metals and flame retardants, some of which predominate in certain workstations. Upcoming additional samples and their detailed task description will help identify activities and electronic items that may require more attention in e-waste management.

1717 OCCUPATIONAL HYGIENE: STANDARDS AND PRACTICES

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Aim of special session The aim of the session is to show how resources provided through the REACH and CLP Regulations and the revised EN689 standard can be used as tools for assessing and controlling exposure to hazardous substances. The session also aims to share knowledge on the use of biological monitoring for exposure assessment and on how to develop a successful partnership between the fields of industrial hygiene and occupational health. Attendees will hear from experts who have developed standards, guidance and working practices in each of these areas.

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1717a EN 689: THE NEW EUROPEAN STANDARD ON TESTING COMPLIANCE WITH OCCUPATIONAL EXPOSURE LIMIT VALUES

Raymond Y Vincent.

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(Occupational exposure limit values (OELVs) must not be exceeded over a period of time. The revision of EN 689 gives a strategy for testing compliance with OELVs by measurement of exposure by inhalation to chemical agents. The strategy describes a procedure to perform a small number of exposure measurements to demonstrate with a high degree of confidence that workers are not likely to be exposed to concentrations higher than the OELV, taking into account the variability of exposures.

It comprises three main steps concerning groups of workers having similar exposure (Similar Exposure Group-SEG).

During the first step- Basic Characterization-BC-the appraiser collects available information to allow reliable estimates of the exposure of the workers and to take the decision whether or not to perform exposure measurements. The second step, or 'Initial Assessment-IA', consists of performing at least 3 (screening test) to 6 representative exposure measurements for the workers of each SEG, in order to demonstrate by using a statistical test whether less than 5% of exposures in the SEG exceed the OELV (compliance). In a third step and based on IA results, a program of 'Periodic Reassessment-PM' determines time intervals ranging from 1 to 3 years for performing new measurements, depending of the levels of exposure. This is based on the assumption that no major changes (e.g. process, RMM, quantities and nature of chemicals) have occurred during this period.

The new EN-689 also takes into consideration simultaneous exposure to several chemicals, and workshift durations higher than 8 hours. The informative annexes give recommendations to determine for example: sampling duration, statistical distribution of exposure measurements results and treatment of representative results lower than the limit of quantification (LoQ).

The new EN 689 is a helpful tool, especially when expertise/science/evidence does not help in the decisions to protect workers exposed to chemicals.

1717b REGULATORY ADVANCES IN CONTROLLING HAZARDOUS SUBSTANCES

Bridget Ginnity.

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The REACH and CLP Regulation have given rise to a rich source of information on chemicals and introduced new mechanisms for regulatory control of hazardous chemicals. Occupational health and hygiene practitioners (OHPs) can contribute to the regulatory decision making and can use the increased information and regulatory control to promote the safe use of chemicals in the workplace.

The registration element of REACH has received most attention to date and the final registration deadline under the REACH Regulation for chemical substances manufactured or imported into Europe is imminent, 31 st May 2018. The registration process generates an immense amount of information on the hazardous properties of substances and on how they can be used safely. Some of this information is provided with safety data sheets, such as DNELs (Derived No Effect Levels) and exposure scenarios. Much more information, including toxicological data, is available on the website of ECHA, the European Chemicals Agency.

REACH and the CLP Regulation provide for the regulatory control mechanisms of authorisation, restriction and harmonised classification and labelling. These mechanisms are intended to protect workers, consumers and the environment. OHPs can engage with these processes to ensure that decisions are made with reliable, up-to-date information on what is happening in the field. By knowing the regulatory status of chemicals used on site, OHPs can ensure regulatory compliance and promote the safe use of chemicals in their company.

1717c BIOLOGICAL MONITORING AND THE USE OF GUIDANCE VALUES IN ASSESSING OCCUPATIONAL EXPOSURES

Kate Jones.

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Biological monitoring is a useful tool for assessing systemic exposure, particularly for substances absorbed through the skin or where control of exposure relies on respiratory protection. Many organisations propose health-based guidance values (BMGVs) but recognise that there are no 'bright lines' between safe and unsafe levels and avoid the word 'limits'. Where a health-based BMGV is not possible, a non-occupational exposed background or reference value may be proposed. Exceeding such a reference value then indicates the likelihood of occupational exposure and possibly the need to review workplace controls. Great Britain (GB) has an alternative approach based on the 90th percentile value of biological monitoring data from workplaces following good occupational hygiene practice. It is not health-based and exceeding it simply indicates a need to review, and possibly improve controls.

This presentation will give an overview of biological monitoring, its role in occupational exposure assessment and the derivation and use of guidance values in interpreting results and determining future action.

1717d OCCUPATIONAL HEALTH & INDUSTRIAL HYGIENE PARTNERSHIP AT CORPORATE & SITE LEVEL

Michel Vangeel.

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A close partnership, collaboration and communication between Occupational Health and Industrial Hygiene is key. The outcome of the IH risk assessment should form the bases of the medical surveillance program. Work related health complaints reported at Occupational Health should be investigated by the IH department. Close communication at different levels is mandatory. In the first part of the presentation, the structure and partnership at Johnson and Johnson Corporate Level will be shared. In the second part, examples of collaboration at a J and J site (Janssen Campus Belgium) will be highlighted. Strong collaboration creates benefits on Corporate, Site, Departmental and Personal level.

927 AUDIT OF A FUEL DISTRIBUTOR COMPANY TANK TRUCK LOADING OPERATIONS IN THE STATE OF RIO GRANDE DO SUL/BRAZIL

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Introduction This case study presents the result of labour inspection intervention in one of the largest distribution terminal of petroleum-derived fuels in Brazil. The inspection