JP-8 is the major fuel used by the U.S. Air Force and the North Atlantic Treaty Organization and it has been recognized as a major source of chemical exposure among fuel-cell maintenance workers. Inhalation is believed to be the primary route of JP-8 exposure but dermal exposure is common and unavoidable since workers wear cotton overalls during work to avoid the formation of static electricity. Furthermore, the low vapor pressure and slower rate of evaporation of JP-8 compared to its predecessor JP-4 provides an opportunity for increased dermal exposure. To our knowledge, dermal exposure assessment has not yet been performed on JP-8 exposed workers. The goal of this study was to use a non-invasive tape-stripping technique coupled with GC/MS method to assess dermal exposure to JP-8 on U.S. Air Force fuel-cell maintenance workers and to investigate the importance of dermal exposure route to total body burden. Subjects (n = 124) were volunteers from active duty Air Force personnel who routinely worked with or were exposed to JP-8. Demographic, medical history including skin condition, job and work task, environmental, and use of protective equipment-related information was collected using questionnaires. Our results showed that measured dermal exposure to naphthalene (as the marker to JP-8 exposure) was significantly correlated to breath and urine naphthalene and naphthalene metabolite concentrations. Multiple linear regression models showed that breath naphthalene and urinary 2-naphthol concentrations, time duration of JP-8 exposure, and skin irritation were significant factors to explain dermal exposure to naphthalene. We concluded that dermal exposure is an important route for JP-8 exposure and it has a great contribution to total body burden in this exposed population.

261.

OCCUPATIONAL EXPOSURE TO N-METHYL PYRROLIDONE DURING GRAFFITI AND PAINT REMOVAL.
J. Cocker, P. Akrill, D. Bagon, M. Roff, N. Warren, Health & Safety Laboratory, Sheffield, United Kingdom.

This study is part of the EU project RISKOFDERM and looked at exposure to N-methyl pyrrolidone (NMP) during graffiti removal and dipping for paint stripping or degreasing.

Potential dermal exposure was assessed with 11 patches outside and 1 inside normal workwear (OECD). Cotton gloves over the protective gloves were used to assess hand exposure. Patches and gloves were extracted in methanol and analysed by GC-MS. Air sampling used pumped Tenax sorption tubes and were analysed by automated thermal desorption with capillary GC-FID detection.

Workers were asked to give urine samples before and after work, and again the next morning. Urine was analysed for 5-hydroxy-N-methyl pyrrolidone (5-HNMP) by GC-MS. Forty-one (23 graffiti, 18 dipping) sets of pads and air samples were taken and 28 workers provided 81 urine samples.

Airborne NMP concentrations were low; graffiti removal 0.01–30 mg.m-3; dipping 0.01–6 mg.m-3. Potential dermal exposure to the body was low for all tasks, but hand exposure was significant for wiping (14–550 µg.cm-2.min-1) and dipping (0.001–250 µg.cm-2.min-1). All graffiti removal workers had detectable levels of 5-HNMP in their urine. Post-shift results ranged from 0.7 mmol.mol-1 to 27 mmol.mol-1 (mean = 6). For semi-automated dipping only 3 out of 10 workers had detectable levels of 5-HNMP in their urine. In contrast, all four workers performing manual dipping had detectable levels of 5-HNMP in their urine (range 0.72 to 47.4, GM 3.76 mmol.mol-1).

PBPK modelling showed that inhalation exposures cannot account for the urinary 5-HNMP in some groups of workers. Dermal exposure of the hands is the most significant route of exposure to NMP during graffiti removal and dipping activities. Careful selection and use of gloves is important to control exposure. Biological monitoring is useful in assessing overall exposure and the effectiveness of controls.

262.

APPLICATION OF DATA FROM ANIMAL TOXICITY TESTING AND ALTERNATIVE METHODS IN ASSIGNMENT OF SKIN NOTATIONS.
C. Chen, H. Ahlers, M. Boeniger, NIOSH, Cincinnati, OH.

Skin notations (SNs) are the primary mechanism to warn of potential health hazards from skin exposures at the workplace. In theory, the SN is established based on the potential contribution of a chemical substance to causing systemic toxicity by way of dermal absorption. However, the SN assignment has not always strictly followed this principle, and inconsistent criteria have been used in the process, partly due to the limited availability of data reporting skin exposures and consequent health effects. To reduce the misuse and enhance clarity, SNs need to be assigned following standardized criteria using scientifically reliable information. Based on the prevailing methods of evaluating health effects resulting from skin exposure and the abundance of pertinent data, we designed a strategy to improve SNs by accommodating both the conventional concept of the skin as a route of absorption contributing to systemic toxicity and the concern of the skin itself being a target organ. In this design, SNs are structured into three distinct classes for use independently or in conjunction to indicate: (1) hazards of systemic toxicity due to dermal absorption; (2) hazards of direct effect(s) on skin including primary irritation, corrosion, and compromised skin barrier integrity; and (3) hazards of allergic contact dermatitis in exposed workers or sensitization of mucous membranes due to skin exposure. For a chemical to receive one of these labels, the evaluation for assignment must consider data demonstrating the presence of adverse effect(s) from skin exposure, including reports of clinical/field observations, results of animal studies following scientifically validated protocols, and data from alternative methods such as in vitro bioassays and estimation algorithms based on quantitative structure-activity relationships. This presentation will introduce the transformation of these methods into operational criteria for application in the SN assignment.

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CONTENDING WITH SARS IN BRITISH COLUMBIA: AN OCCUPATIONAL HYGIENE PERSPECTIVE.
C. Hon, A. Yassi, OHSAH, Vancouver, BC, Canada.

Severe Acute Respiratory Syndrome (SARS) is a novel disease that garnered international attention in early 2003. Although Vancouver only had a handful of probable SARS cases, the level of fear and anxiety surrounding SARS in Vancouver cannot be understated. When it became apparent that symptomatic patients could transmit the virus to health care workers, there was considerable concern and a call for the immediate implementation of protective measures. This case study describes the occupational hygiene principles applied in the province to help minimize the transmission of this disease to health care workers. Some of the problems were:

- Constant new developments regarding the disease
- Considerable fear and anxiety because SARS was a novel disease
- Media 'hype' created paranoia among community as well as health care workers
- Health care workers are bound to protect health of patients
- Infection control practitioners generally took the lead
- Health care workers not accustomed to wearing respiratory protection
- Lack of resources

A pragmatic way of tackling this emerging issue was a collaborative science-based approach. This consisted of the establishment of a Provincial SARS Science Committee with representatives from a variety of disciplines including occupational hygiene. The committee developed "Guidelines for the Acute Management of the Patient with SARS in the Hospital Setting." The Guidelines included a risk assessment table which outlined the various levels of risk and the corresponding protective equipment to be used. An educational working group was spun off from the provincial committee. The purpose of this working group was to develop a train-the-trainer session, which would teach participants about

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