In a recent bridge replacement project there were seven state and federal agencies each performing a different risk analysis. These agencies employed a variety of methodologies to protect workers, endangered species, the water supply, the ambient air quality and the public. In addition to regulatory constraints, there were contractual constraints among the different parties performing the work. Left unchecked the current system would have resulted in (1) the asbestos abatement preventing completion of the bridge before winter forcing local residents, school buses, and emergency vehicles to drive 30 miles on snow and ice covered roads, and (2) burying 1800 tons of steel in a landfill because it was coated with asbestos containing paint that was identified only after the contract to perform the work had been signed.

Asbestos levels are regulated to prevent a 1:1,000,000 chance of mesothelioma. The chance of dying in a fatal automobile accident is about 1:100. The principal risk in this scenario appears to be from increasing the chances of a fatal auto accident by increasing the driving distance on snow and ice covered roads. While there is no great risk in burying steel, it does squander resources and violates the principles of sustainable development and industrial ecology.

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EVALUATION OF THE ADEQUACY OF THE MIXTURE FORMULA (EM) IN PREVENTING OVEREXPOSURE TO SOME NEUROTOXIC GASOLINE COMPONENTS. J. Dennison, M. Andersen, R. Yang, Colorado State University, Fort Collins, CO.

Evaluating exposures to more than one chemical that exert similar toxic actions by using the "Mixture Formula" is recommended by ACGIH and required by OSHA. The Mixture Formula essentially assumes that exposures exhibit linear pharmacokinetic (PK) and pharmacodynamic dose response relationships and that the effects are additive in nature, i.e., no interactions occur between chemicals. To explore the hypothesis that the additivity assumption for PKs is valid, we used physiologically-based PK modeling to assess potential interactions for a series of chemicals with relatively simple dose metrics, the alkyl benzenes. The PBPK model was first used to calculate the target tissue dose for single chemicals, based on the premise that their TLVs were adequately protective. A PK-Em was then developed from the sum of ratios of the tissue dose of each chemical during co-exposures to the dose for single exposure for each chemical. The PK-Em was estimated for a variety of mixture exposures that would be allowable under the standard Em equation. The PK-Ems indicated that for two chemicals that act as clear CNS depressants, the Mixture Formula works reasonably well. However, when interacting solvents such as MTBE are excluded from the Em because they are not expected to cause CNS depression, the PK-Em suggests that an overexposure can occur. Moreover, if chemicals can make a secondary contribution to toxicity, even greater over-exposures can occur. This study provides preliminary evidence that the Mixture Formula approach may need further examination. This study was supported in part by a Cooperative Agreement from ATSDR (UGI/ATU 881475).

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WASTEWATER POLLUTANT DISPERSION, MODELING, CALCULATIONS AND MAPS, THREE WEST VIRGINIA FACILITY DISCHARGES TO OHIO RIVER, 1997. D. Whaley, G. Srinivasan, West Virginia University, Morgantown, WV.

The upper Ohio River, in Pennsylvania, Ohio and West Virginia, has many sites of permitted industrial wastewater discharges, and some municipal supply water intakes. Our purpose was to model and map process wastewater contaminant dispersion from three West Virginia manufacturing facilities whose discharges were hazardous and large, as determined by ranking using the Purdue chemical hazard weighting score and mass releases from Toxic Release Inventory reports for 1997. Maps were created using geographic information systems (GIS), and the modeling used Water Characterization and Modeling System (WCMS), a modification of GIS developed at West Virginia University Division of Resource Management. Modeling of one facility showed downstream ambient levels insignificant, compared to U.S. drinking water standards, but did show substantial loading for total suspended solids and phosphate, downstream only. However, the upper Ohio River functions as a series of constrained pools between locks and dams, with inconsistent flows determined by their operators, the U.S. Army Corps of Engineers. Also, the upper Ohio River driving gravitational flow gradient is so slight that the resolution of the digitalized terrain data from the U.S. Geological Survey, used by WCMS, sees the valley as flat. Therefore, modeling showed dispersion both upstream and downstream within constraint pools for the other two of these three facilities, suggesting community exposure to accumulated hazardous discharges. We conducted independent mass balance calculations of ambient contaminant concentrations for these two facilities, showing essentially the same result, low concentration exposures upstream and downstream — contributions from these facilities. We mapped West Virginia municipal supply water intakes, showing that only a few intakes were potentially impacted, upstream and downstream along the Ohio River. This work is foundation for studies of discharge dispersion and municipal intakes along the Pennsylvania and Ohio shores, to estimate the total cumulative ambient pollution, for comparison with limited monitoring data.

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DEVELOPMENT AND APPLICATION OF AN OCCUPATIONAL ACCIDENTS ANALYSIS METHOD. A. Miguel, Universidade do Minho, Guimarães, Portugal; G. Perestrelo, J. Machado, SMGP - Consultores, Lda., Porto, Portugal.

The authors develop a method for the quantification of accident risk in 3 industrial companies of different sectors of activity, based on frequency and severity rating. Risk categories correspond to different accident types, according to ILO classification. An inquiry involving the workers of the industrial companies was conducted aiming at comparing the risk assessment with the workers' subjective judgment, based on their risk perception. The obtained results show that there are no significative differences between the objective risk assessment and the workers' subjective judgment.

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USE OF A DIFFERENTIAL PRESSURE-BASED DETECTOR TUBE TO MEASURE RESPIRABLE COAL DUST. J. Volkwein, R. Vinson, S. Vanderslice, S. Page, NIOSH, Pittsburgh, PA.

The National Institute for Occupational Safety and Health has evaluated a new version of a dust sampler at the Pittsburgh Research Laboratory. This device uses an inexpensive plastic disposable detector tube to provide an immediate indication of cumulative dust exposure. A low flow rate pump draws a dust sample through a foam section and onto a treated glass fiber filter. The respirable fraction of dust is classified using the section of porous foam. The increasing pressure differential across the glass fiber filter created by dust mass accumulation is measured and correlated with respirable mass. Triplicate differential pressure measurements are compared to triplicate measurements of respirable dust mass collected using the U.S. Coal Mine Dust Personal Sampling Unit. In this unit, a Dorr-Oliver cyclone classifies the respirable fraction with subsequent filter mass measurement. Results show that the differential pressure of specific filtration media can be an effective surrogate for respirable mass. Data show that there is a dependence on coal type, an effect of relative humidity, and an effect of altitude change. These dependencies are broadly within ±50% of the average response for all factors. There also appear to be two distinct coal type responses, perhaps related to coal rank. For specific coals the regression coefficients are better than 0.9. For general use the detector tube can be used to estimate respirable dust levels using laboratory generated calibration curves. However, calibration to a specific coal type improves accuracy to ±25% of the gravimetrically determined mass.

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A LABORATORY COMPARISON OF THE DIFFERENTIAL PRESSURE-BASED DUST DOSIMETER WITH THE PERSONAL GRAVIMETRIC RESPIRABLE DUST SAMPLER ON COAL DUST. V. Marple, P. Luna, B. Olson, University of Minnesota, Minneapolis, MN; J. Volkwein, NIOSH, Pittsburgh, PA; R. Ramami, J. Mutmansky, H. He, Pennsylvania State University, University Park, PA.

The approved gravimetric respirable dust sampler (GRD), used to measure the amount of respirable dust to which a miner has been exposed, can only provide data on the miner's exposure days after the sample has been taken. It is more desirable to have an instrument that can provide real time personal respirable dust exposure level data so that the miner can take corrective action. This need has led to the development of a respirable dust dosimeter (RDD) by the National Institute for Occupational Safety and Health. The RDD pulls air through a tube where a foam plug removes the large non-respirable particles and the respirable fraction of the dust is collected on a filter. A pressure transducer continuously monitors the pressure drop across the filter and displays the data in real time. This paper describes the results of a laboratory comparison between the RDD and the GRD. Dust from three coal seams, Pocohonatas, Pittsburgh and Kittaning, were used in the comparison and twelve RDD pressure drop/GRD respirable

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ABSTRACTS