that were derived from the literature and were not reflected by the endpoints within the in vitro neurotoxicity test battery.

1860 COMPARISON OF ESTIMATED INDOOR AIR CHEMICAL CONCENTRATION RESULTS FROM FATE AND TRANSPORT MODELING VERSUS SURFACE FLUX MEASUREMENTS.

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Exposures to chemicals can result from both direct (dermal or ingestion) or indirect (vapors from chemicals in groundwater) contact. Estimation of exposure concentrations for use in health risk assessments requires calculated or actual measurements. To estimate indoor air concentrations of chemicals due to vapors migrating upwards from chemicals in groundwater, one can use environmental fate and transport modeling or perform surface flux measurements. Environmental fate and transport modeling makes use of chemical- specific and site-specific data as well as default parameters to estimate first a vapor flux (using a vapor flux model) and then an indoor air concentration (using a box model). Surface flux measurements are directly used in a box model to estimate indoor air concentrations. In this assessment, we compared the results of using default parameters and chemical-specific parameters in a vapor flux model with the results of using surface flux measurements to estimate indoor air concentrations. At the site used for this case study, tetrachloroethylene was present in groundwater located 15 feet below ground surface. The Farmer et al. model was used to estimate flux at a point above contaminated groundwater. Surface flux measurements were taken at a point above which the groundwater concentration was measured. The modeled flux was 2 orders of magnitude less than the actual flux. This resulted in a 2 order of magnitude difference in estimated indoor air concentration and, subsequently, cancer risk. Uncertainties in the modeled flux include use of default parameters for total porosity and air-filled porosity. The results of this assessment demonstrate the importance of validation of models as well as the importance of use of more site-specific parameters in models.

1861 A HUMAN HEALTH AND ECOLOGICAL ASSESSMENT OF VOLATILE COMPONENTS OF PM10 EMISSIONS.

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Approval for the construction of a fiberglass manufacturing facility under the California Environmental Quality Act required an environmental impact report concerning human health and ecological effects of likely constituents of stack PM10 emissions. Specifically, PM10 components consisted of phenol, formaldehyde and various methylol phenols (MPs) compounds. There are currently no air standards for MPs or cured phenol-formaldehyde resins. An assessment of the hazard characteristics was developed for the following compounds: 2-MP, 4-MP, 2,6-diMP, 2,4,6-triMP, and cured phenol-formaldehyde resins. A threshold air concentration for mono- and diMP, based on potential dermal sensitization (assessed as the most sensitive endpoint), was estimated to be 3100 $\mu g/m^3$ of air. Modeled air concentrations of PM10 indicated likely levels of these compounds would not exceed 16 $\mu g/m^3$. We predicted the likely PM10 emissions would not represent a threat to human health. Information on the aquatic toxicity of MP compounds is extremely limited. A no-effect level for aquatic organisms was based on toxicological information generated from mono-substituted MPs. A no-effect level of 5 mg/l was derived for MP indicating the relatively low potency of this chemical. Modeled air concentrations were not predicted to yield a water concentration in excess of this threshold. Thus, the modeled air concentrations do not represent a threat to aquatic organisms. Based on this analysis, concentrations of these compounds released as constituents of PM10 from this planned facility are not expected to pose a significant threat to human health or the environment.

1863 CHARACTERIZATION OF AROMATIC CANDLE EMISSIONS AND ITS SIMILARITY TO DIESEL ENGINE EXHAUST.

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At least fifty documented incidences of severe soot deposition in Florida residences, believed to be caused by aromatic candle emissions, have occurred since 1996. Concerns of occupant exposures and potential health impacts were raised. Submicron particulate has been recognized as carcinogenic in health assessments of diesel emissions. The estimated clearance time for these insoluble carbon particles from the human respiratory system is up to 1 year, providing adequate time for desorption of adsorbed organic compounds. Aromatic candle emissions resemble those of diesel engine exhaust in particle size and organic compounds, while their use in confined spaces may constitute a significant occupant exposure. An assessment of the emissions from aromatic candle usage was performed using a 45 liter stainless steel chamber with high air exchange rates to reduce losses to chamber surfaces. Exhaust was collected for analysis of particulate matter and gaseous emissions. Particulate and gaseous phase emission rates were calculated. To determine the quantity, and identification, of adsorbed compounds GC/MS and GC/FID analyses were performed. Initial characterization and quantification of particulate matter (PM) emissions revealed emission of particles ranging from 0.06 to 0.1 µm, determined by scanning electron microscopy (SEM), at rates up to 3.5 mg/min. Gas phase emissions contained compounds including benzene, 2-butanone, chloroform, carbon tetrachloride, xylenes, and other volatile and semivolatile compounds. This study determined that certain candles produce particulate and gaseous emissions similar to those of diesel engine exhaust, and when used indoors, can result in occupant exposures that may pose a significant risk. (Supported in part by NIOSH Grant T42/CCT412874.)

1864 HIERARCHICAL APPROACH TO PHYSIOLOGICALLY BASED PHARMACOKINETIC MODELS.

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Historically, many physiologically based pharmacokinetic (PBPK) models have been analyzed through commercial simulation and optimization software such as SimuSolv®. During the optimization process, model parameters are adjusted to maximize the value of the objective function, the log likelihood function (LLF). Optimization of these PBPK models is usually based on repeated measurement data from multiple individuals. Under the normality assumption, the optimization method implemented in SimuSolv® is correct for data from a single individual when statistical inference is focused solely on that individual. When data from multiple individuals are pooled, however, a problem arises in using SimuSolv®. Used to derive the LLF, the error model in SimuSolv® is not appropriate because it confounds two sources of variation: intraindividual variability, which is variation among measurements within a given individual, and interindividual variability, which is random variation among individuals. If sources of variation are not taken into proper account, misleading estimates of the parameters and uncertainty in those estimates may result. These two variation components can be taken into appropriate account in a statistical hierarchical or staged model. We used the PBPK models for tert-amyl methyl ether (TAME) and tert-amyl alcohol (TAA) to contrast inference based on the incorrect error model implemented in SimuSolv® and inference based on a hierarchical model. To fit a hierarchical model, maximization of a more complex objective function than that found in SimuSolv® is required. SAS® software is very efficient in implementing hierarchical model fitting for PBPK models. With a hierarchical approach to current PBPK models, the model that most accurately accounts for variation can be developed, which will allow a more precise extrapolation to humans.

1865 ROUTE-TO-ROUTE EXTRAPOLATION WITH A PHYSIOLOGICALLY-BASED PHARMACOKINETIC (PBPK) MODEL FOR CUMENE.

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EPA's inhalation Reference Concentration (RfC) and oral Reference Dose (RfD) for cumene are both based on renal effects observed in separate studies where exposures were by the respective route. As some pharmacokinetic data are available, cumene toxicity could thus be examined for dosimetric route-to-route relationships. A PBPK model was developed in which the chemical-specific partition coefficients and metabolic parameters were estimated from structurally-related chemicals. The resulting model was used to convert the inhalation concentrations of the RfC study to equivalent oral doses based on the predicted area under the concentration curve for cumene metabolites in the blood. Estimates from this dose conversion, in mg/kg-day, are 78 (from 100 ppm inhalation), 408 (from 496 ppm inhalation) and 955

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