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exposures to TEB used as a wood preservative based on these NOELs and a margin of exposure (MOE) approach. Using reasonable maximum exposure (RME) assumptions, MOEs for residential exposures to TEB ranged from 1.1×10^4 for a child (from dermal contact with soil) to 2.4×10^7 for an adult handler (from incidental ingestion of dislodgeable residue). **Conclusion:** No appreciable risk of adverse health effects from exposures to TEB in CA-B-treated wood are expected based on the sufficiently large MOEs calculated for the exposure scenarios in our HHRA.

750 PROBABILISTIC CANCER RISK ASSESSMENT OF WORKERS EXPOSED TO CREOSOTE DURING PRESSURE TREATMENT OF WOOD.

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Creosote is a complex coal tar-derived mixture consisting of polynuclear aromatic hydrocarbons (PAHs) used as a preservative in pressure-treated commercial wood products. A cancer risk assessment was conducted for occupational exposure associated with pressure-treatment of wood. For exposure assessment, a recent exposure study in creosote workers served as the primary source of information and dose estimation. In the exposure study, measurements with personal air samplers and passive, whole-body dosimeters were made for 108 dermal and 88 inhalation work shifts job activities involving creosote exposure. Total dermal doses ranged from 0.0141 to 49.6 mg/kg, and were lognormal in distribution. No carcinogenic PAHs were identified in air samples and CTPV's were detected in only one of 88 samples ($<0.1 \text{ mg/m}^3$). For the toxicity assessment, cancer potency was estimated based on a study of coal tar mixtures in mice exposed orally for two years. In this study, dose-related increases in hepatocellular adenomas and carcinomas, alveolar and bronchial adenomas and carcinomas, forestomach papillomas and carcinomas, small intestine adenocarcinomas, and other tissue tumors were reported. For dose-response relationships, the tissue sites were grouped into two categories: (1) point-of-contact tumors, consisting of forestomach and small intestines; and (2) systemic tumors, consisting of all other tissue sites. Monte Carlo methods were used to characterize the variability and uncertainty associated with exposure and dose-response components. The estimates of cancer risk generally fall within the range of USEPA acceptable risk levels (5×10^{-6} to 1×10^{-4}). It is concluded that over the course of a working lifetime, wood treating workers exposed to creosote will experience no more than one additional cancer per 10,000 workers. In a population of about 600 to 3700 workers, the number actually involved in pressure treatment of wood, less than one new cancer case could be expected to occur as a result of occupational creosote exposure.

751 GEOSPATIAL ANALYSIS OF THE EFFECTIVENESS OF THE RESIDENTIAL DUST CLEANUP PROGRAM IN LOWER MANHATTAN FOLLOWING THE ATTACK ON THE WORLD TRADE CENTER.

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In response to the concerns of the residents of Lower Manhattan regarding the potential presence of residual contamination from the collapse of the World Trade Center (WTC) buildings, the USEPA (EPA) and its federal, state and city partners developed a comprehensive plan to ensure that residences potentially affected by the collapse of the WTC had been properly cleaned. Upon the request of residents located in Lower Manhattan (south of Canal Street), USEPA and its partners arranged for the cleanup of residential units, using certified contractors, with follow-up testing for air-borne asbestos and total fibers. In a subset of residences, data on metals loading in settled dust ($\text{ug} / \text{sq. ft.}$ of sampled surface area) were collected prior to and following cleanup. As part of the assessment of the effectiveness of the cleanup effort, we analyzed the data, using methods from point pattern analysis, to determine if the post-cleanup data exhibited any spatial pattern that might support the hypothesis that exceedance of health-based benchmarks were attributable to residual contamination from the collapse of the WTC buildings. We tested the hypothesis using Monte Carlo-type statistical tests that are appropriate for data that were not collected using random sampling methods (cleanups and sampling were performed at the request of residents of Lower Manhattan); the tests consider the geographic location of the sampled buildings and the number of samples collected from each building. The point pattern analysis was performed using GeoSEM: GIS software that was developed by SRC for the application of spatial statistics in human and ecological risk assessment. The results of our analysis do not support the hypothesis that post-cleanup exceedance of the health-based benchmarks are related to the collapse of the WTC buildings.

752 REENTRY CRITERIA FOR DIOXIN AND DIOXIN-LIKE COMPOUNDS FOR BUILDING SURFACES.

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Building reentry criteria for dioxin TEQ, as measured by surface wipes, have varied greatly over the past 15 years, from as low as 1 ng/m^2 to as high as 125 ng/m^2 . While these values have all been derived from either the cancer slope factor (CSF) or relatively high no observable adverse effect levels, they are highly variable, inconsistent in their use of exposure parameters, and lacking complete transparency in the calculations. Recently, the World Trade Center Indoor Air Taskforce calculated a reentry criterion of 2 ng TEQ/m^2 for a residential exposure. This number was based on the EPA's draft CSF of $1 \times 10^6 \text{ (mg/kg-day)}^{-1}$, various exposure parameters, dermal absorption values, and a cancer risk criterion of 1×10^{-4} . An indoor 'degradation' parameter was also included in the calculations. However, a single criterion based on a single set of assumptions cannot, and should not, be universally applied. Reentry criteria that consider a wider range of exposure scenarios, exposure pathways, bioavailability, and behavioral parameters would be very useful to risk managers who may have to address multiple diverse situations in the coming years. This paper describes our recommended reentry building surface criteria for four exposure scenarios: 1) adult occupational, 2) adult residential, 3) childhood 'occupational' (i.e., school), and 4) childhood residential. Using a cancer risk criterion of 1×10^{-5} , USEPA's current CSF of $1.56 \times 10^5 \text{ (mg/kg-day)}^{-1}$, and updated exposure and bioavailability parameters, we calculated reentry criteria of approximately 100, 50, 10, and 5 ng TEQ/m^2 for the four scenarios, respectively. These criteria result in dose levels of approximately 0.001-0.02 pg TEQ/kg-day and thus could plausibly produce daily intakes in the vicinity of 1/100 to 1/1000 of the 70 pg/kg-month level (based on non-cancer endpoints) considered acceptable by the joint FAO/WHO committee. Therefore, they should be protective for both cancer and non-cancer effects.

753 MALIGNANT TRANSFORMATION OF HUMAN UROTHELIAL CELLS BY ARSENITE AND CADMIUM.

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Cadmium and arsenite are human carcinogens and exposure to either of them has been associated with the development of bladder cancer. Neither cadmium or arsenite has been shown to elicit the malignant transformation of human urothelial cells under *in vitro* conditions, although such a model would be of value in elucidating the mechanism of carcinogenesis of both compounds. This laboratory has characterized an immortalized cell culture model of human urothelial cells (UROtsa) that does not form colonies in soft agar or produce tumor growth in nude mice. The goal of the present study was to determine if exposure of UROtsa cells to cadmium or arsenite would result in malignant transformation. UROtsa cells were grown on both serum-free and serum-containing growth medium to confluency and then exposed to cadmium and arsenite concentrations that produced greater than 90% cell death over a 30 to 60 day period. Surviving cells were allowed to grow back to confluency in the continued presence of cadmium or arsenite. At passage 4, 8, 12 and 16, the cultures were tested for their ability to form colonies in soft agar. At passage 4 and 8 no colonies were formed, at passage 12 a few colonies were formed, and at passage 16 a large number of colonies were formed in the soft agar assay. Cells at passage 16 from each treatment group were injected into nude mice and all 4 groups formed tumors. Control UROtsa cells of equal passage failed to form colonies in soft agar and did not form tumors in nude mice. Histological examination of the tumors demonstrated characteristics expected of transitional cell carcinoma of the bladder. Tumors produced from cells grown in serum tended to have features associated with high grade tumors while those from serum-free cells had features associated with low grade tumors. These studies show that both cadmium and arsenite can cause malignant transformation of human urothelial cells.

754 ARSENIC TOXICITY IN HUMAN KERATINOCYTES.

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Arsenic, a human carcinogen and drinking water contaminant, is encountered in the environment in the trivalent (AsIII) and pentavalent (AsV) oxidation states. AsV, the most prevalent form, usually appears much less toxic with its potency being enhanced by reduction to AsIII. To understand the importance of reduction in elucidating arsenic mechanisms we evaluated the responsiveness of human keratinocyte cultures to different oxidation states using Northern and quantitative PCR analysis of heme oxygenase-1 induction. We found AsV to be as efficacious as AsIII; however a longer time was required for AsV to reach maximal effect. These observations were correlated with ICP-MS measurements of cellular uptake and conversion rates. In parallel experiments, we found pentavalent antimony (SbV) to