409 EVALUATION OF PROPOSED THRESHOLD DOSES FOR CHRYSOTILE EXPOSURE AND RESPIRATORY DISEASE.

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Some researchers have suggested that a cumulative chrysotile exposure of approximately 25 f/cc*year is a minimum threshold dose for increased risk of lung cancer and asbestosis. However, to our knowledge, the scientific merits of this suggested threshold have not been tested via a comparison to occupational doses derived from individual exposure data. Brake mechanics provide a unique opportunity to conduct such an analysis, because 1) they are exposed to the chrysotile form of asbestos only, 2) there is a substantial amount of published industrial hygiene data characterizing asbestos exposures in brake servicing facilities, and 3) numerous epidemiology studies have consistently demonstrated that brake mechanics are not at an increased risk of developing asbestos-related respiratory diseases. In this analysis, we developed distributions of occupational tenure data for automobile mechanics and 8-hour TWA concentration data from long-term personal samples collected by NIOSH in brake service garages in the US (more than 80 samples were collected during the years 1976 through 1987 at 22 brake repair facilities). A Monte Carlo analysis was used to derive an upper bound (95th percentile) cumulative asbestos exposure of approximately 3 f/cc*year for brake mechanics in the US This upper bound is below the 25 f/cc*year threshold and, therefore, our exposure analysis is consistent with the negative epidemiology data for lung cancer and asbestosis in auto mechanics. Although a chrysotile threshold dose has not been suggested for mesothelioma (indeed there is considerable debate in the scientific community as to whether chrysotile asbestos is a causative factor in mesothelioma), numerous studies have consistently concluded that brake mechanics are not at an increased risk of developing mesothelioma and therefore the upper bound cumulative exposure estimate of 3 f/cc*year for brake mechanics could serve as a preliminary estimate of a minimum threshold chrysotile dose for mesothelioma.

410 CHRYSOTILE ASBESTOS EXPOSURE ASSOCIATED WITH REMOVAL OF AUTOMOBILE EXHAUST SYSTEMS (CIRCA 1946-1970).

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For decades, asbestos-containing gaskets were used in almost every mechanical application. A gasket is a sealing device which frequently must be resistant to extreme temperatures and pressures. Prior to the mid-1970s, some automobile exhaust systems contained asbestos gaskets either at flanges along the exhaust pipes or at the exhaust manifolds of the engine. Additionally, a limited number of automobile mufflers briefly contained asbestos paper inside the muffler. Recent claims have suggested that there might be appreciable health risks associated with asbestos exposure during the repair of automobile exhaust systems. A simulation study was conducted to characterize personal and bystander exposures to asbestos during the removal of automobile exhaust systems (circa 1946-1970) containing asbestos gaskets. Personal lapel, area bystander, and area background samples were collected for about one hour during the repair work. Sixteen pre-1974 vehicles with old or original exhaust systems were studied. Air samples were analyzed by NIOSH PCM and TEM methods and bulk samples were analyzed by PLM and XRD. Results showed eighteen of thirty air samples collected on the lapel of the worker showed PCM results below the limit of detection (0.003-0.13 f/cc). TEM analysis indicated that only two lapel samples showed asbestos in which concentrations were 0.02 f/cc for chrysotile. Thirty-three of fifty-one area bystander samples were below the limit of detection (0.004-0.093 f/cc for PCM) and TEM analysis indicated that six bystander samples showed asbestos in which the highest concentration was 0.02 f/cc for chrysotile. Under a worst-case scenario where a mechanic might repeatedly conduct exhaust work over an eight-hour workday, these results indicate that exposure to asbestos from work with automobile exhaust systems containing asbestos gaskets was substantially below 0.1 f/cc, the current PEL for chrysotile asbestos.

411 EXPOSURE RECONSTRUCTION OF HISTORICAL AIRBORNE BENZENE CONCENTRATIONS: CASE STUDY OF A DECK CREWMAN ON BOARD CRUDE OIL AND CHEMICAL TANKERS.

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High benzene exposures on board tankers transporting cargo containing benzene have been reported. Several factors influence the degree of benzene exposure under this occupational setting including the type of loading/unloading tasks performed and the ventilation systems present. A reconstruction of historical airborne benzene exposures associated with deck work on board two tankers was conducted (one crude oil and one chemical). Work history of a shipmate was used as a basis for this case study. Parameters considered in the exposure model, included quantity of benzene-containing cargo, time involved with specific tasks (loading/unloading, manual gauging, transport, tank cleaning), voyage information including transit time at sea, and general conditions on board the tankers. Exposure estimates for specific operations believed to be comparable to the cargo and conditions on board these tankers were identified from the scientific literature. Monte Carlo methods were then used to characterize the plausible range of airborne benzene exposures a deck crewman might have historically experienced on board these tankers. Based on the specific work history of this case study, exposure model results showed that cumulative benzene exposures to a deck crewman on board tankers transporting crude oil and chemical cargo with less than five percent benzene were relatively low (less than one ppm-year). Tank cleaning operations provided the opportunity for the highest potential benzene exposures and appeared to drive the exposure estimates. Under the assumptions used in this case study, a worker exposed for a forty-year working lifetime would have a cumulative exposure to benzene well below levels shown to be associated with an increased risk of disease. These findings suggest that benzene exposure under the conditions modeled in this assessment do not pose a health risk to deck crewmen.

412 DIESEL-RELATED BENZENE EXPOSURES DURING REFUELING OPERATIONS AT TWO GROCERY DISTRIBUTION CENTERS.

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Airborne benzene exposures were assessed during diesel refueling of tractor trailer trucks and generator fuel tanks for refrigerated trailers used for food transportation. Fuel was dispensed from a fuel truck tank by a nozzle with no vapor recovery system. Benzene samples included near-source levels before refueling, approximate 1-min breathing zone levels while refueling, integrated breathing zone levels for an industrial hygienist shadowing a refueler, background air levels, and diesel fuel concentrations. Summa canisters were analyzed by EPA-TO-15 and passive dosimeter badges by NIOSH 4500. Airborne benzene levels above the tank openings immediately after cap removal averaged 16.0 + 7.9 ppb (mean + S.E., n = 3) for tractor tanks and 4.3 + 1.1 ppb (n = 6) for generator tanks. Breathing zone levels obtained for about 1 min while the refueler was dispensing fuel averaged 38.7 + 19.7 ppb (n = 3) for tractor tanks and 11.8 + 7.1 ppb (n = 6) for generator tanks. Integrated breathing zone levels for the industrial hygienist shadowing the refueler averaged 8.8 + 5.3 ppb (n=2) while refueling tractor and generator tanks. Yard area samples including locations downwind from the entrance where diesel trucks entered the facility averaged 2.0 + 0.04 ppb (n = 7). Benzene concentration in the diesel fuel averaged 0.0034 + 0.0010 wt.‰ (n=3). These data suggest that airborne benzene exposures during diesel refueling are lower than levels associated with gasoline. Benzene levels in the yard with diesel traffic were similar to regional historical averages and suggest that diesel exhaust is not a significant source of benzene exposure to yard workers. Average workday exposure levels to refuelers of tractor trucks in open areas could be higher if diesel refueling operations involved more vehicles, but it seems unlikely that benzene exposure would exceed the OSHA Permissible Exposure Limit of 1.0 ppm (8-hour time-weighted average).

413 OCCUPATIONAL PESTICIDE EXPOSURE DURING SEED CORN PRODUCTION IN MICHIGAN.

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A dermal exposure and work activity assessment was conducted to determine if the EPA's occupational risk assessment methodologies adequately protect workers from pesticide exposure in seed corn production. Seed corn is a crop that requires significant amount of hand labor, often conducted by sensitive subpopulations such as adolescents and migrant workers. A variety of practices such as rogueing (removing genetically undesirable plants) and detasseling are unique to this crop and can be considered high-risk from previously applied pesticides. Therefore, the purpose of the study was to determine: 1) dislodgeable foliar residues, 2) dermal exposures, and 3) a generic transfer coefficient for risk assessments on tall/row crops for Tilt® (propiconazole) and Warrior® (λ-cyhalothrin). A 152-acre field used for seed corn production was sprayed with Tilt® (4 ounces/acre) and Warrior® (3 ounces/acres). Leaf samples were taken at Days 0 through 7 after application for dislodgeable foliar residue pesticide analysis. The residue dissipation curves displayed typical first order decay; the R-squared was 0.84 and 0.86 for Warrior® and Tilt®, respectively. On day 2, the field was reentered by 15 volunteers wearing inner/outer whole body