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that have been reported for other occupational cohorts exposed to predominantly chrysotile asbestos. Distributions of occupational tenure data were taken from the 1987 Current Population Survey, which provided data on the years worked by mechanics from the 1960s through most of the 1980s. Distributions of airborne chrysotile data were developed from the National Institute for Occupational Safety and Health surveys conducted from 1976 to 1987 in 22 different garage settings. A Monte Carlo analysis indicates that 3 f/cc*year represents the 95th percentile cumulative chrysotile asbestos exposure for garage mechanics in the U.S. A review of the literature shows that this upper-bound exposure is consistent with no-effect exposure thresholds that have been reported for occupational cohorts exposed primarily to chrysotile asbestos. Specifically, reported no-effect exposure thresholds for lung cancer are typically 40 f/cc-year and higher; reported exposure thresholds for mesothelioma were also higher than the 3 f/cc*year estimate for garage mechanics. It is important to note that it is still unclear whether chrysotile is a risk factor for mesothelioma and that any increased risk of mesothelioma reported in the aforementioned "chrysotile only" occupational cohorts may have been due to the presence of amphibole asbestos in the workplace.

855 EXPOSURE TO NATURALLY OCCURRING ASBESTOS DURING OFFROAD VEHICLE AND CAMPING/HIKING ACTIVITIES AT A RECREATIONAL AREA IN CALIFORNIA

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Activity-based personal monitoring was used to measure exposures to naturally occurring asbestos (NOA) during both wet and dry seasons at BLM's Clear Creek Management Area (CCMA) in San Benito County California. Multiple motorcycle, all-terrain vehicles (ATVs) and sport utility vehicles (SUV) riders (3 riders at a time) were equipped with personal monitoring equipment to measure asbestos levels as they rode over a set course at the CCMA similar to known recreational riding routes. In addition personal exposures were monitored during various simulated camping, hiking, fence mending and vehicle cleanup activities. CCMA has been long known for its naturally occurring asbestos (predominantly chrysotile deposits) and the purpose of this exposure effort was to update a similar 1992 sampling effort conducted by BLM. The current effort used an updated counting methodology, ISO 10312 Transmission Electron Microscope analytical method, and assessed exposure to both adult and children during several recreational activities. Children as young as six years old were observed riding the trails. RESULTS: Asbestos was found in all personal and ambient air samples, however personal activities greatly increased exposure. Personal exposures for some of the trailing riders exceeded 1 PCME (phase contrast microscopy equivalent) fibers/cc. The highest personal asbestos exposure was 2 PCME f/cc for a trailing ATV rider during the dry season. CONCLUSIONS: Off-road vehicle activities in areas of CCMA created very high personal exposures from NOA. Those exposures may remain high despite moist soil conditions. Lastly, when sampling heights were lowered to simulate a child riding a motorbike or an ATV the personal exposure levels were higher than the adult.

856 PERSONAL EXPOSURES TO NATURALLY-OCCURRING ASBESTOS DURING SPORTS AND PLAY ACTIVITIES IN A CALIFORNIA COMMUNITY IN THE SIERRA FOOTHILLS

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Personal exposures to naturally-occurring asbestos (NOA) were monitored during simulated sports and play activities (hiking, biking, baseball, soccer, basketball, gardening) at 3 public schools and a park in a Sierra foothill community. Sampling occurred over 11 days during the dry season in El Dorado Hills, CA, where NOA is present in areas of intense residential development. Asbestos levels in personal and ambient air samples were measured as PCME (phase contrast microscopy equivalent) fibers using the ISO 10312 analytical method. Personal asbestos exposures (n=5 for each activity) ranged 0.001 to 0.034 f/cc during simulated activities and were compared to ambient stationary samples (n=5 each day; grand mean = 0.0008 f/cc) collected concurrently nearby in the community. **Results**: Asbestos was detected in almost all personal exposure and ambient air samples. The predominant fiber type was an amphibole of the actinolite-tremolite solid solution series. Simulated sports and play activities created personal asbestos exposures that ranged 2-fold to 62-fold higher than concurrent ambient air levels in the community. The highest asbestos exposures (12-fold to 62-fold higher than concurrent ambient) occurred to participants on bare, natural dirt in a student garden and on a trail used for hiking and biking. Elevated asbestos exposures during sports activities on grass (soccer) and asphalt (basketball) ranged 3-fold to 16-fold higher than concurrent ambient levels. **Conclusions**: Sampling breathing zone air during simulated activities is a superior technique for evaluating personal asbestos exposures than is stationary air sampling. Typical sports and play activities can create significantly elevated personal asbestos exposures for children in areas where NOA is present. Since amphibole fibers persist in the body for many years and children can be expected to survive the decades-long latency period associated with asbestos-related diseases, this exposure represents a potential public health issue worthy of attention from all stakeholders.

857 RETROSPECTIVE EXPOSURE ANALYSIS OF RESIDENTIAL EXPOSURE TO PERFLUOROOCTANOIC ACID (PFOA) FROM 1951 TO 2003

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Measurable quantities of PFOA have been detected in the drinking water of five communities located near a fluoropolymer manufacturing facility in Washington, WV. The plant has been operational since 1951 and has been investigated as the possible source of PFOA found in the drinking water. A retrospective exposure analysis was conducted to estimate the potential intake of PFOA from 1951 – 2003 by persons residing in the local communities where the drinking water has been affected. Following considerable analyses, particulate deposition from facility air emissions to soil and the subsequent transfer of the chemical through the soil was determined to be the most likely source of the PFOA detected in the groundwater near the facility. A mass balance analysis was conducted to determine the historical releases of PFOA from the plant. Estimates of historical environmental concentrations were made using EPA's ISCST3 air dispersion and deposition model as well as the PRZM-3 model to estimate the PFOA concentrations in surface soil and the movement of the chemical to the groundwater. Estimates of the intake of PFOA by residents were estimated for each water district for various routes of exposure. The highest off-site environmental concentrations were predicted to occur about 1 mile away. For this 1 square mile area, during the time period 1951 -2003, the model estimated air concentration was 0.2 μg/m3, the estimated surface soil concentration was 11 μg/kg, and the estimated drinking water concentration was 3 μg/L. Comparison of measured to modeled PFOA concentrations in groundwater indicated that the models over predicted recent groundwater concentrations by factor of 3 to 5. A margin of exposure (MOE) analysis was conducted to understand potential human health risk to the local residents. The resultant MOEs ranged from approximately 9,000 to greater than one million. As such, based on current toxicity information, adverse health effects from chronic exposure to PFOA in the affected communities would not be expected.

858 NICKEL ABSORPTION FOLLOWING WATER INGESTION IN ADULTS: A PROBABILISTIC APPROACH TO ESTIMATION OF NICKEL BIOAVAILABILITY

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Estimation of health risks associated with exposures to nickel in drinking water requires accurate estimates of nickel bioavailability. Bioavailability of water soluble nickel is higher when exposure occurs in the fasted state than when exposure occurs with meals, and decreases as the time between exposure and the meal decreases. Therefore, average bioavailability of water-borne nickel would be expected to be influenced by variability in the daily temporal patterns of drinking water and meal ingestion. In the current study, we used Monte Carlo simulation and meal consumption data from NHANES III, along with experimentally-derived estimates of changes in bioavailability of nickel in subjects who consumed nickel at various times before or after meals, to derive estimates of a meal-weighted daily average bioavailability of water soluble nickel in the U.S. adult male population. The model predicted meal-weighted absolute bioavailability estimates ranged from a low of 3.4%, for people who ingest 100% of their total daily drinking water intake at meal times, to as much as 17% for people who ingest all of their water between meals. A sensitivity analysis of the meal-weighting nickel bioavailability model indicated that the estimate of the bioavailability of nickel was most sensitive to the parameter that represented the percent of exposure that occurred at meal times and the number of meals eaten per day. The model was not sensitive to the number of exposure events per day, or the intra-individual correlation in absorption fraction.

859 SURVEY OF RECREATIONAL ACTIVITIES ALONG KING COUNTY, WA SHORELINES FOR USE IN SITE-SPECIFIC RISK ASSESSMENT: EXPOSURE DISTRIBUTIONS FOR SEDIMENT AND WATER CONTACT ACTIVITIES AND FISH CONSUMPTION

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Activity pattern surveys are useful tools for reducing uncertainty when defining exposure in a risk assessment. This report presents the results of two site-specific surveys that were used to quantify recreational activity and fish consumption patterns