Mass concentration of indoor PM^{10} in a WEEE dismantling treatment plant, Greece

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The disposal of WEEE has caused serious environmental problems, especially in developing countries(Song and Li, 2014).Toxic emissions from WEEE informal recycling activities in developing countries have been studied, but so far no systemic reviews have been performed(Song and Li, 2014).Previous investigations on WEEE treatment environmental impacts showed persistent organic pollutants (POPs), heavy metals and PM emissions in air, soil, sediment and freshwater around the WEEE recycling sites in developing countries.

On the other hand, studies related to PM emissions from WEEE recycling activities in developed countries are rare and fragmented(Sepúlveda et al., 2010).Recycling consists of the following major steps: disassembly, upgrading and refining. Disassembly is usually done manually and, at this stage, certain components (cases, external cables, CRTs, PCBs, batteries etc.) are separated(Tsydenova and Bengtsson, 2011).Dismantling activities release coarse and fine particles loaded with heavy metals and flame retardants into the atmosphere(Sepúlveda et al., 2010). The current study attempts to determine the environmental impacts that result from WEEE manual dismantling activities, by estimating the concentration of PM_{10} emissions in the indoor air of a WEEE dismantling plant.

The PM^{10} mass concentrations were measured in the main area of aWEEE dismantling treatment plant, inGreece. The activities which took place in the main area of the dismantling plant was the disassembly of TV monitors with cathode ray tubes technology, other TV monitors, PCs monitors, dvd players, cell phones, kitchens, washing machines, refrigerators, photo copiers and other small size equipment. The 24-h mean PM^{10} concentration was 259.55 ± 49.5 $\mu g/m^3$.The highest mean 8-h PM^{10} concentration during working hours was 666.66μg/m3and the lowest194.61 $\mu g/m^3$, while in the offices for the administrative staff of the plant thehighest and lowest mean 8-h PM^{10} concentration was 62.46 $\mu g/m^3$ and 14.48$\mu g/m^3$ respectively. In the ambient air around the plant, the respective highest and lowest mean 8-h PM^{10} concentration was 68.86 $\mu g/m^3$ and 5 $\mu g/m^3$.

The results indicate that the PM^{10} mass concentration in the indoor air of the WEEE treatment was significant. While there is no institutionalized upper limits for the PM^{10} mass concentration for the indoor air of different environments, there is a great deal of recommendations from different institutions, organizations and local authorities regarding PM^{10} mass concentration in indoor air. The 24-h mean PM^{10} concentration was 5 times higher than the annual upper limit of the 50 $\mu g/m^3 PM^{10}$ concentration for the ambient air. Also, the 24-h mean PM^{10} concentration was 5 times higher than the recommended from the American Institution ARB/EPA California and the World Health Organization (WHO) in Europe annual upper limit of 50$\mu g/m^3$ for the indoor air in other environments except factories. It was also shown that the diurnal variation of PM^{10}concentration is influenced mostly from a) the kind of the activities is taking place inside the WEEE treatment plant, b) the age of the equipment that WEEE derives from (the older the equipment, the higher the PM^{10} released) c) the motion of the forklift and d) people's movement.

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