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Workplace exposure to airborne particles in the plastics recycling and manufacturing industry

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Airborne microplastics represent an emerging health concern and there is significant interest in mapping their prevalence in indoor and outdoor environments. Surprisingly little attention has been given to plastics exposures in factories themselves. The object of this study is to survey the levels and characteristics of particulate matter (PM) in a plastics manufacturing company where part of the raw materials are recycled plastics. In this presentation, we report on our findings from two measurement campaigns. We measured particle number concentrations and size distributions associated with emissions from extruding machines, rolling machines, mixing stations, crushing machines, and thermoforming machines. We used gravimetric methods to quantify total and respirable dust; scanning electron microscopy to characterize particle morphology and chemical composition; and a small rotating drum to measure the dustiness for a collection of the frequently used raw materials, mainly different variations of polyethylene terephthalate (PET). We found that the dustiness for the materials studied were all low, less than about 6 mg/kg, and dominated by micron-size particles. In the factory, the average total particle number concentrations measured ranged from about 4,000 to 100,000 cm^{-3}, with the highest numbers near the rolling and extruding machines. The fraction of courser µm-size particles was low, but important when handling recycled materials and at feeders. Respirable dust concentrations were generally very low (7 to 13 $\mu g/m^3$) and total dust concentrations were similar. This was consistent with our observation that most particles were in the fine (<300 nm) and ultrafine size range (<100 nm). Microscopy indicated that a fraction of the collected particles was composed of synthetic polymer. We conclude that exposure to airborne fine and ultrafine plastic particles may be a matter of concern for those working in close proximity to some of the common plastics processing machines.