

# Sorting of household plastic packaging : new instructions are associated with changes in exposure to bioaerosols in materials recovery facilities

O. Schlosser<sup>1</sup>, I.Z. Déportes<sup>2</sup>, B. Facon<sup>3</sup> and E. Fromont<sup>4</sup>

<sup>1</sup>SUEZ, CIRSEE, 38 rue du Président Wilson, 78230 Le Pecq, France

<sup>2</sup>ADEME, BP 90406, 49004, Angers Cedex 01, France

<sup>3</sup>CRAMIF, Laboratoire des Biocontaminants, 17-19 avenue de Flandre, 75954 Paris Cedex 19, France

<sup>4</sup>Eco-Emballages, 50 boulevard Haussmann, 75009, Paris, France

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Presenting author email: olivier.schlosser@suez-env.com

European and French regulations state that prevention and recycling are priorities for waste management. In France, the model of extended producer responsibility for household packaging was introduced in 1992, and one of the targets set was for 75% of household packaging to be recycled. This packaging is made of various materials including glass, steel, aluminium, paper, cardboard and plastic. Since 2012, a trial has been taking place for the extension of sorting instructions to all plastic packaging disposed of by households (Eco-Emballages, 2014). Thirty-four of the 240 materials recovery facilities (MRFs) currently in operation in France have been involved in this trial, corresponding to 51 communities and 3.7 million inhabitants.

The residual organic matter in pots and trays and on some films encourages the growth of micro-organisms in this plastic packaging and the contamination of cellulosic substrates such as paper and cardboard, which provide favourable conditions for growth (Tolvanen, 2004; Park et al., 2011). The aim of this study was to assess how extending the sorting instructions for plastic packaging would affect the exposure of workers working at MRF to dust, endotoxins, fungi and bacteria, taking into consideration other factors that could have an influence on this exposure. Personal sampling was carried out at four MRFs during six sampling campaigns at each facility, both in sorting rooms and when the workers were involved in mobile tasks away from the rooms.

Bioaerosols were collected by filtration in sealed cassettes in accordance with the protocols described by the French occupational health and safety institute (INRS). The samples were taken over a whole working day to ensure that they would be representative of exposure.

Sample analyses were based on culture-based methods for bacteria and fungi, and on limulus amebocyte lysate kinetic chromogenic method for endotoxins. Protocols used have been developed by the INRS. Multivariate analysis was performed using a mixed-effect linear model for both series of sample data: those related to the sorting rooms and those related to the mobile tasks at the MRFs.

Overall, before the extension of the sorting guidelines, the geometric mean of personal exposure levels in sorting rooms was 0.3 mg/m<sup>3</sup> for dust, 27.7 EU/m<sup>3</sup> for endotoxins, 13000 CFU/m<sup>3</sup> for fungi and 1800 CFU/m<sup>3</sup> for bacteria. When workers were involved

in mobile tasks away from the rooms, these averages were 0.5 mg/m<sup>3</sup>, 25.7 EU/m<sup>3</sup>, 28000 CFU/m<sup>3</sup> and 5100 CFU/m<sup>3</sup> respectively. The application by households of instructions to include pots, trays and film with other recyclable plastic packaging led to an increase in exposure to endotoxins, fungi and bacteria at MRFs. For an increase of 0.5 kg per inhabitant per year in the pots, trays and film recycling stream, exposure in sorting rooms rose by a factor of 1.4 to 2.2, depending on the biological agent. Exposure during mobile tasks increased by a factor of 3.0 to 3.6. The age of the waste amplified the effect of the extension of sorting instructions on exposure to fungi, bacteria and endotoxins. Factors that had a significant influence on the exposure of workers to dust and/or bioaerosols included the presence of paper, newspapers and magazines in the sorted waste, the order in which incoming waste was treated and the quality of the ventilation system in the sorting rooms.

The levels of exposure observed in this study highlight the need to implement appropriate preventive measures against bioaerosols at MRFs for dry waste. There are grounds to justify these preventive measures, both inside sorting rooms and for the MRF as a whole, regardless of whether the decision to extend sorting instructions for household plastic waste is adopted. Particularly, sorting rooms should be fitted with a ventilation system that enables operators to work directly under a unidirectional clean air flow. In addition, our findings suggest that, for the purpose of microbial quality of air the FIFO (*first in, first out*) order of treatment of the incoming waste would be more appropriate.

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This abstract summarizes the article:

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Eco-Emballages, 2014.

[http://www.ecoemballages.fr/sites/default/files/documents/rapport\\_1pwc\\_experimentation.pdf](http://www.ecoemballages.fr/sites/default/files/documents/rapport_1pwc_experimentation.pdf)

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