

Cornell Waste Management Institute



Compost Air Emissions Health Studies

<http://cwmi.css.cornell.edu/composthealth.pdf>

Summary of the literature by:

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Summary of Articles on Compost Air Emissions Health Studies

This paper is an abridged version of a more comprehensive document. This paper summarizes only those articles that deal specifically with health impacts, while the full paper includes papers that address air emissions as well as health (see <http://cwmi.css.cornell.edu/compostairemissions.pdf>).

The summaries below are arranged chronologically. They indicate that workers show health effects (note that the Millner article that concludes that compost facilities do not pose significant health risks is based on a lack of impacts to workers predates these articles that demonstrate worker health impacts). Few studies of health of nearby residents have been done. Herr et al have shown respiratory and general health complaints in neighbors. Browne et al studying the Islip composting facility did not assess whether nearby residents had greater incidence of illness, but rather their work did assessed the relationship between neighbor's reports of symptoms and *A.fumigatus* concentrations. They did not find a correlation between symptoms reported and concentrations of *A.fumigatus*. However, large temporal variations in *A.fumigatus* concentrations were noted, and other bioaerosols were not monitored.

- Bunger, J., B. Schappler-Scheele, R. Hilgers, and E. Hallier. 2006. A 5-Year Follow-Up Study on Respiratory Disorders and Lung Function in Workers Exposed to Organic Dust from Composting Plants. International Archives of Occupational and Environmental Health. Online: <http://www.springerlink.com/content/82u23r2371414873/fulltext.pdf>

Conclusion: exposure to organic dust at composting workplaces is associated with adverse acute and chronic respiratory health effects. Compost workers were compared to controls at 41 German compost facilities (mixed household biowaste plus yard wastes). Exposure measurements revealed high concentrations of fungi and actinomycetes. Compost workers report significantly higher prevalence of mucosal membrane irritation of eyes and upper airways as well as more conjunctivitis. A significant decline in forced vital capacity was measured. Results differ from workers exposed to organic dust in other facilities, maybe due to thermotolerant fungi and bacteria in compost plants.

- Muller, T., R. A. Jorres, E. M. Scharrer, H. Hessel, D. Nowak, and K. Radon. 2006. Acute Blood Neutrophilia Induced by Short-Term Compost Dust Exposure in Previously Unexposed Healthy Individuals. International Archives of Occupational and Environmental Health. 79:477-482.

Conclusion: Short-term exposure of healthy young subjects to organic dust at composting facilities had mild but measurable effect in eliciting acute systemic alterations. 17 healthy subjects not working with wastes were exposed to a composting facility for 2 hrs doing moderate exercise. Changes in white blood cell counts, an increase in neutrophils and decrease in eosinophils was measured.

- Herr, C. E. W., A. zur Nieden, H. Seitz, S. Harpel, D. Stinner, N. I. Stilianakis, and T. F. Eikmann. 2004. Bioaerosols in Outdoor air - Statement of Environmental Medical Assessment Criteria on the Basis of an Epidemiological Cross Sectional Study. *Gefahrstoffe Reinhaltung Der Luft*. 64(4):143-152.

Total bioaerosols (total bacteria, molds and thermophilic actinomycetes) were found at $>10^5$ CFU/m³ in outdoor air in the vicinity of an outdoor composting facility, dropping to **background concentrations within 550 m. There was an association between irritative respiratory symptoms and general health complaints and distance to the site.** There was no higher prevalence of reported allergies or infectious diseases. Individual odor annoyance was not associated with symptoms.

- Herr, C. E. W., A. zur Nieden, N. I. Stilianakis, and T. F. Eikmann. 2004. Health Effects Associated With Exposure to Residential Organic Dust. *American Journal of Industrial Medicine*. 46:381-385.

Significantly higher than background concentrations of thermophilic actinomycetes, total bacteria and molds were measured in air down wind 200 m from an outdoor composting site, dropping to near background within 300 m. These levels are similar to occupational composting exposures. **A physician-administered survey found airway symptoms but not odor annoyance were observed in residents in highest exposure (150-200 m downwind) vs further away (400-500 m). An association was demonstrated between residential bioaerosol pollution and irritative airway complaints as well as excessive fatigue and shivering (which symptoms are reported at workplaces handling such materials).** Residents reporting odors did not “overreport” health disturbances.

- Herr, C. E. W., A. Zur Nieden, R. H. Bodeker, U. Gieler, and T. F. Eikmann. 2003. Ranking and Frequency of Somatic Symptoms in Residents Near Composting Sites With odor Annoyance. *International Journal of Hygiene and Environmental Health*. 206:61-64. This brief paper reports results of an epidemiologic study of people living in the vicinity of three composting plants. **Residents living near one of the sites at which concentrations of microorganisms were high experienced increased symptoms relative to the control population. Nausea was associated with strong odors.**

- Browne, M. L., C. L. Ju, G. M. Recer, L. R. Kallenbach, J. M. Melius, and E. G. Horn. 2001. A Prospective Study of Health Symptoms and *Aspergillus fumigatus* Spore Counts Near a Grass and Leaf Composting Facility. *Compost Science and Utilization*. 9(3):241-249.

Aspergillus fumigatus spore concentrations are higher in vicinity of 40 acre yard waste composting site than background. **Participant diaries showed no correlation between symptoms and *A. fumigatus* concentrations.** However there are caveats: large short term variations in concentrations of *A. fumigatus* were measured and the spore counts used were averages and were taken at sampling locations not specific to personal exposures.

- Bunger, J., M. Antlauf-Lammers, T. Schulz, G. Westphal, M. Muller, P. Ruhnau, and E. Hallier. 2000. Health Complaints and Immunological Markers of Exposure to Bioaerosols Among Biowaste Collectors and Compost Workers. *Occupational and Environmental Medicine*. 57:458-464.

Compost workers had significantly more symptoms and diseases of the airways and skin than control subjects. Some workers quit due to airway complaints leading possibly to underestimation of health effects. Increased anti-body concentrations against fungi and actinomycetes were found in compost workers. There was an association between the diseases

and increased antibody concentrations in compost workers. A “healthy worker” effect is indicated by the under representation of atopic (allergic) diseases among compost workers.

- Douwes, J., I. Wouters, H. Dubbeld, L. v. Zwieten, P. Steerenberg, G. Doekes, and D. Heederik. 2000. Upper Airway Inflammation Assessed by Nasal Lavage in Compost Workers: A Relation With Bio-Aerosol Exposure. *American Journal of Industrial Medicine*. 37(5):459-468.

“Compost workers are at risk of developing acute and possibly chronic inflammatory responses in the upper airways...” Workers in compost plant that stored and processed source-separated food and yard waste indoors were studied using nasal lavage (NAL) (in which fluid is inserted in the nose and then removed and analyzed for various markers). The study included two time periods, one before and one after process improvements were made to try and decrease exposure to bioaerosols in the facility. **Compared with controls, before the facility improvements the workers had higher indicators inflammatory markers** even on Monday morning before work. Comparing pre and post-shift, workers showed an increase in markers.

- Ivens, U. I., J. Hansen, N. O. Breum, N. Ebbelohj, M. Nielsen, O. M. Poulsen, H. Wurtz, and T. Skov. 1997. Diarrhoea Among Waste Collectors Associated With Bioaerosol Exposure. *Annals of Agricultural and Environmental Medicine*. 4:63-68.

A survey of Danish waste collectors demonstrated an association between the level of exposure of workers to fungal spores and self-reported diarrhoea. However, the group with high exposure to either total fungi or total microorganisms reported fewer symptoms compared to the less exposed group.

- Marth, E., F. F. Reinthaler, K. Schaffler, S. Jelovcan, S. Haselbacher, U. Eibel, and B. Kleinhapl. 1997. Occupational Health Risks to Employees of Waste Treatment Facilities. *Annals of Agricultural and Environmental Medicine*. 4:143-147.

Several measures of allergy, inflammation and lung function were measured in 117 workers at 2 composting and 3 waste sorting facilities and compared with a control group. **Although elevated IgE was detected, no statistically significant increase in allergic diseases was found. Eye and mucous membrane irritation, coughing and decreased lung function were measured.**

- Cobb, N., P. S. Sullivan, and R. A. Etzel. 1995. Pilot Study of Health Complaints Associated with Commercial Processing of Mushroom Compost in Southeastern Pennsylvania. *Journal of Agromedicine*. 22(2):13-25.

In response to residents’ complaints, a symptom questionnaire was administered to 100 residents living within 3000 feet and living between 3000 and 5000 feet from a mushroom composting facility and to a control group. Local physicians were interviewed and some air and water testing were performed. **No statistically significant impact on health was found.**

- Millner, P. D., S. A. Olenchock, E. Epstein, R. Rylander, J. Haines, J. Walker, B. L. Ooi, E. Horne, and M. Maritato. 1994. Bioaerosols Associated with Composting Facilities. *Compost Science and Utilization*. 2(4):6-57.

This paper is a review based on a workshop.

Conclusion “Composting facilities do not pose any unique endangerment to the health and welfare of the general public” is based primarily on “the fact that workers were regarded as the most exposed part of the community and where worker health was studied.., no significant adverse health impacts were found. .. [and] in most cases the measured concentrations of the targeted aerobic bacteria, thermophilic (heat loving) fungi, and AF bioaerosols in the residential zones around composting facilities showed that the airborne concentrations of bioaerosols were not significantly different from background.”

There are few data on bioaerosol concentrations, particularly for yard waste composting sites. Some of the non-yard waste studies have down-wind monitoring far away (like half mile and 1 mile). Slightly elevated levels of *Aspergillus fumigatus* at nearest monitoring station (500 feet) downwind of compost pad (WSSC Site 2, Clayton Environmental Consultants, Ltd., 1983) were detected in one study.

Current data are not sufficient to resolve questions regarding the potential health impacts of siting a large yard waste composting facility in relatively close proximity to neighbors.

Recommendations to minimize impacts:

- Design
 - Material handling processes downwind or maximum distance from receptors
 - Forest buffer
- Siting
 - Consider meteorologic and topographic features
 - Proximity can be mitigated with enclosure, good management practices, increased mechanization
- Operation/Mgmt
 - Minimize handling and time it when
 - potential for off-site movement is minimal
 - receptor population is least
 - Minimize disturbance of dusty areas by vehicles
 - Add moisture to minimize dust

References Cited Listed Alphabetically

- Browne, M. L., C. L. Ju, G. M. Recer, L. R. Kallenbach, J. M. Melius, and E. G. Horn. 2001. A Prospective Study of Health Symptoms and *Aspergillus fumigatus* Spore Counts Near a Grass and Leaf Composting Facility. *Compost Science and Utilization*. 9(3):241-249.
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