

Bioaerosols

Just a lot of hot air?

by Paul van der Werf

Composting is a microbiological process in which microorganisms proliferate within organic waste. Due to aeration microorganisms may become airborne or aerosolized. As a result there are occupational and public health and safety issues with regard to aerosol exposure, including the risk of worker inhalation and also the potential for bioaerosols to migrate to areas beyond a compost facility perimeter.

It should be noted that bioaerosols are not the exclusive domain of composting. They are found in many non-occupational settings (e.g., home lawn, wooded areas, attics) and occupational settings (farms, mushroom production, timber processing and cotton dust).

Given its nefarious-sounding name and the fact that it describes something you can't see, bioaerosols have been a source of panic for some. Like any other potential risk it's wise to assess the issues and take appropriate steps to minimize risk and gain perspective.

Potential health effects

The main bioaerosols of concern in the context of composting include *Aspergillus fumigatus* (AF) — a secondary fungal pathogen — and endotoxins, toxins found within the walls of gram-negative bacteria. Organic dusts are also important because they may carry microbial constituents that may result in adverse health effects.

The responses to bioaerosols are host and dose dependent; some individuals may respond to a dose that does not affect others.

To date most cases of aspergillosis, the condition caused by AF, occur in immuno-compromised individuals. Instances of aspergillosis in healthy individuals are rare, even when they're involved in occupations associated



Bioaerosols are generated when a composting pile is agitated, particularly via mechanical mixing but also potentially via its mechanical aeration. The photo depicts bioaerosols at a Canadian composting facility.

with exposures to high levels of airborne AF.

Responses to endotoxins can range from mild cases of inflammation and allergy to serious tissue or systemic

responses (e.g. mild itching, watery eyes/nose to asthma).

Composting facilities

Bioaerosols are generated when a composting pile is agitated, particularly via mechanical mixing but also potentially via its mechanical aeration.

A recent study undertaken in New York State reports that the level or type of bioaerosols can be a function of the type of feedstock and that the level of bioaerosols in the atmosphere of a facility or area surrounding a facility can be a function of facility design and operation.

Bioaerosols also appear to be a function of dust — that is, dustier, drier facilities generate more bioaerosols.

It has also been noted in a number of

“Given its nefarious-sounding name and the fact that it describes something you can't see, bioaerosols have been a source of panic for some.”

infection by secondary pathogens. Allergenic responses may stimulate inflammatory responses as well as a broad range of typical allergenic

Continues on page 22 →

December/January 2003

studies that bioaerosol concentrations decline rapidly from the point of generation. According to one study, bioaerosol concentrations tended to be higher than background levels in a downwind community during windrow turning. A comprehensive companion health study reveals no measurable health effects (i.e. allergies, asthma). It was noted that non-compost facility factors such as ozone, ragweed, temperature and time since the start of the study were significantly associated with allergy and asthma incidence.

Control plan

A bioaerosol control plan should be prepared prior to the siting and design of a compost facility and refined during site operation. This plan can include the following aspects:

- A prescribed buffer zone can assist in the dispersion of bioaerosols from a composting facility, much in the same way that it can for potential odours. (The buffer zones developed to deal with issues such as odour are likely suitable for bioaerosols as well.)
- Appropriate dust filtration should be considered for the cabs of machinery.

- For indoor facilities there should be sufficient ventilation within the composting building to reduce the risk to workers.

Once the facility is operational the key to bioaerosol control is to maintain a proper environment and in particular

“A bioaerosol control plan should be prepared prior to the siting design of a compost facility.”

reduce the generation of dust. Regular and thorough mixing will aid proper composting. Optimal moisture content for windrows is 50-60 per cent. Dust levels can be greatly reduced if moisture levels are maintained at optimal levels.

All facility operators and compost workers should be trained in methods of dust and bioaerosol control. It may

also be prudent to undertake some level of screening to identify potentially predisposed individuals. All employees should receive training in the composting process to be aware of the potential risks and instruction on how to employ operational controls to reduce bioaerosol generation. Workers who mechanically agitate compost should have at minimum a dust-mist class (NIOSH Class N-95) mask. In an enclosed facility site operators should always wear the mask during composting agitation.

Also, there should be no eating, smoking or drinking allowed in the composting facility at any time, except in designated areas. Workers should wash their hands before engaging in any such activity. ♻️



Paul van der Werf owns and operates composting and waste management consultancy 2cg, based in London, Ontario. To contact Paul, visit www.2cg.ca