

OVERVIEW

- Potential health issues from waste composting.
- What are the controls?
- HSE/HSL waste composting bioaerosol research.
- Future HSE initiatives.

Commercial compost methods



Compost handling will create dust and bioaerosol!



Potential issues

Public concern:

- Aesthetic
- Traffic
- Noise
- Odour
- **Bioaerosols – airborne micro-organisms and their products**



What are the health issues?

- Exposure to bioaerosols
- Constituents of compost bioaerosols include fungi such as *Aspergillus fumigatus* (allergen, opportunist pathogen); thermophilic actinomycetes (allergens)
- Workers' exposure
- Dispersion off site → neighbours (other workplaces, passers by, residents)

Evidence for occupational ill health?

- Review by Swan *et al* (HSE Research Report 130, 2003) <http://www.hse.gov.uk/research/rrhtm/rr130.htm>;
- **WR0606 “Exposure-response relationships for bioaerosol emissions from waste treatment processes”** (Searl; IOM study for Defra, 2009) – acknowledged difficulty of interpreting health effect data – variable background and variation in human health response

<http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=15140&FromSearch=Y&Publisher=1&SearchText=WR060%20&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description> .

How HSE views this

- Despite limited dose-response data, clear that compost bioaerosols are potential respiratory sensitisers;
- Therefore, under COSHH 2002 Reg 7(1) exposure needs to be ‘adequately controlled so far as reasonably practicable’;
- Parallel with HSE statement of evidence on poultry dust

<http://www.hse.gov.uk/agriculture/poultry/index.htm>

Evidence for public health concern?

Residential or peripheral exposure:

- If compost bioaerosols contain allergens and pathogens, how much is a hazardous exposure?
- How much above 'background' or 'normal' bioaerosol levels is hazardous?
- What is a 'normal' level of bioaerosol?
- How far away until a compost bioaerosol returns to 'background'?

Compost bioaerosol dispersion

- what we do and don't know



- Bioaerosols from compost handling will remain airborne and travel off site;
- Dilution and dispersion effects in open air will reduce concentration;
- How far until they are fully dispersed?
- Various published studies on compost bioaerosol dispersion – variable results;
- Consensus is that >200m levels return to background.

How Environment Agency views this



- Established a position statement in 2001, revised in 2007;
- In summary, need for bioaerosol risk assessment if dwellings or workplaces are within 250m of site boundary;
- Based on risk assessment, bespoke permit issued;
- Any plans to revise position statement currently on hold.

What are the controls?

To workers' exposure:

- Air conditioned vehicle cabs
- Respiratory protection
- Work Practice – establishment of risk zones

Residential/peripheral:

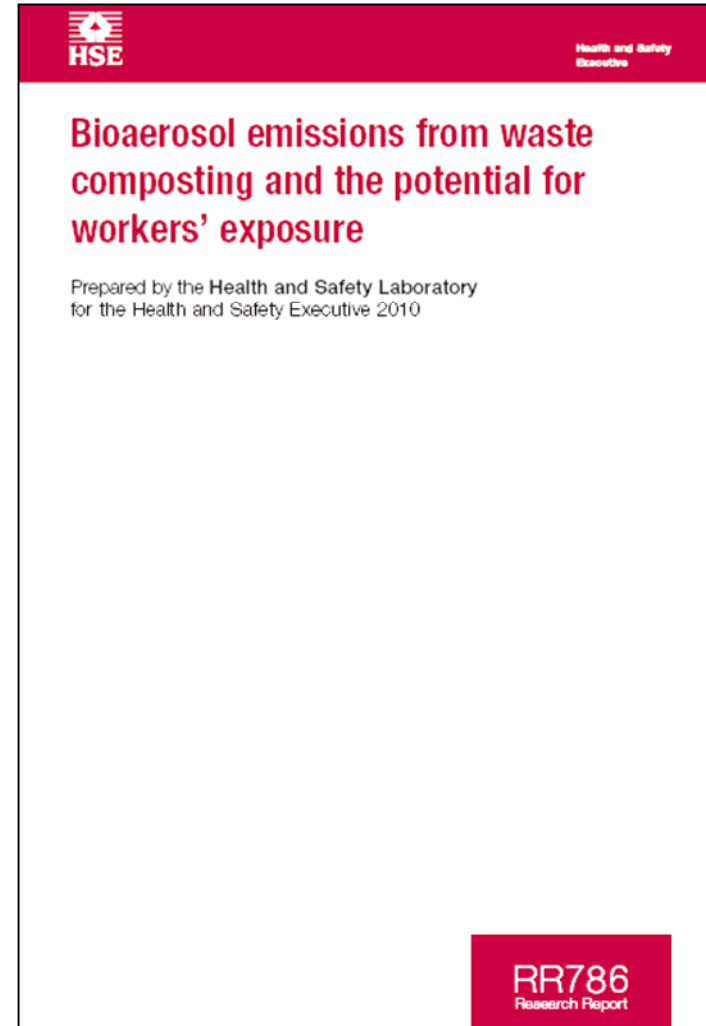
- Exclusion distances (Environment Agency 250m guide)
- Site design and operation

HSL Bioaerosol Monitoring

Exposure levels – HSL's recent work:

<http://www.hse.gov.uk/research/rrhtm/rr786.htm>

- Workers' personal exposure;
- Deriving source terms for modelling dispersion;
- Measuring levels at different distances downwind to validate models and establish risk zones.



Methods for monitoring bioaerosols on compost sites

Air sampling – methods used by HSL



Monitoring bioaerosols on compost sites: overview of HSL work

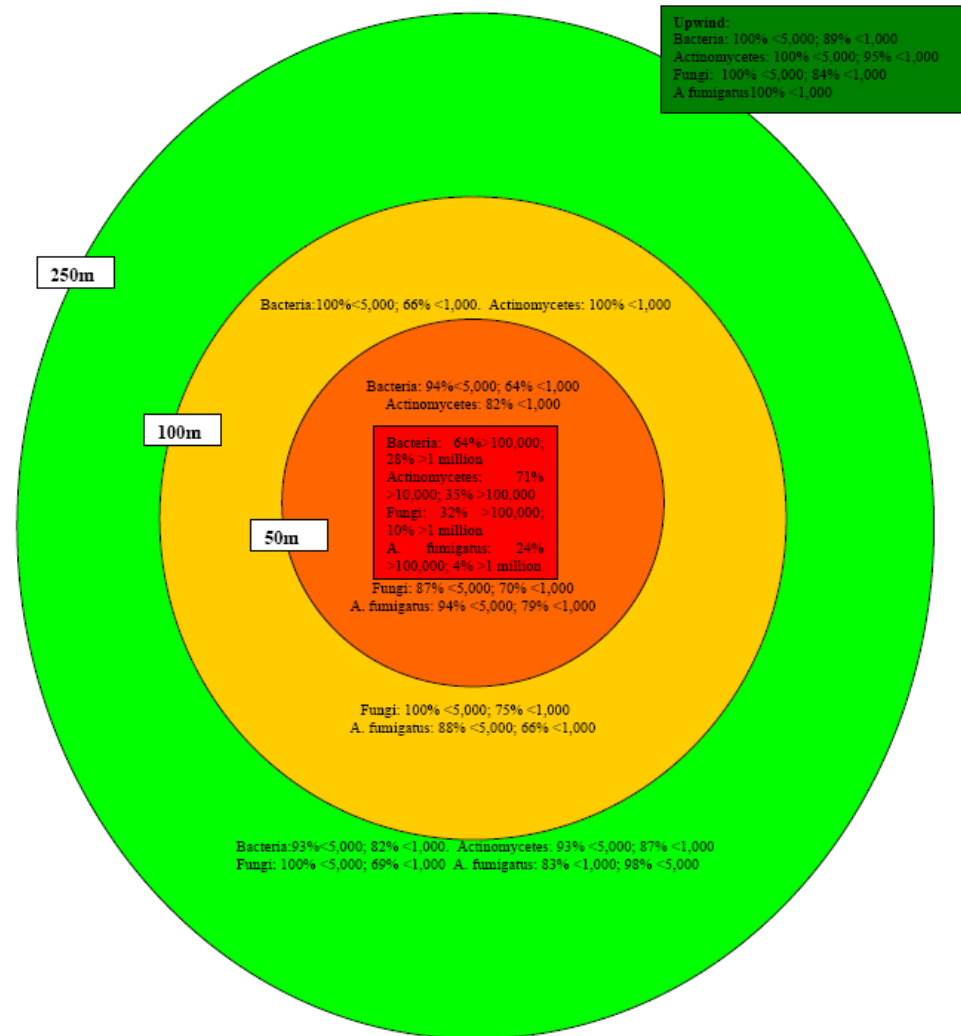


Andersen, Partisol and IOM samples -culture based microbiological analysis:

- Six composting facilities;
- Fourteen site sampling visits for bioaerosol measurement;
- Sampling at different times of year;
- 'Exposure banding' of potential bioaerosol exposures.

Risk Zones (HSL Report Data)

- **Red zone** – next to composting activity;
- **Amber zone** – within 50m
- **Yellow zone** – 50 to 100m
- **Green zone** – 100 to 250m
- **Green box** – background 50m+ upwind



Red zone exposure data

If you are working next to composting handling machinery and **not** protected within a vehicle cab:

- There is a 64% chance of being exposed to more than 100,000 cfu/m³ bacteria and a 28% chance of being exposed to more than 1 million cfu/m³ bacteria;
- There is a 24% chance of being exposed to more than 100,000 cfu/m³ *Aspergillus fumigatus* fungus spores and a 4% chance of being exposed to more than 1 million cfu/m³ *Aspergillus fumigatus* spores.

Amber zone exposure data

If you are working further away from compost handling machinery, and up to 50 metres from composting:

- There is only a 6% chance that exposure to airborne bacteria will be greater than 5,000 cfu/m³ and 36% chance of it being greater than 1,000 cfu/m³ ;
- There is only a 6% chance that exposure to airborne *Aspergillus fumigatus* spores will be more than 5,000 cfu/m³ and 21% chance that exposure to airborne *Aspergillus fumigatus* spores will be more than 1,000 cfu/m³ .

Yellow zone exposure data

If you are working further away from composting handling machinery, between 50 and 100 metres from composting:

- No samples of airborne bacteria were greater than 5,000 cfu/m³ and a 34% chance of exposure being greater than 1,000 cfu/m³ ;
- There is only a 12% chance that exposure to airborne *Aspergillus fumigatus* spores will be more than 5,000 cfu/m³ and 34% chance that exposure to airborne *Aspergillus fumigatus* spores will be more than 1,000 cfu/m³ .

Green zone exposure data

Nearer the site boundary, that is, 100 to 250 metres from composting:

- There is only a 7% chance that exposure to airborne bacteria will be greater than 5,000 cfu/m³ and 18% chance of it being greater than 1,000 cfu/m³ ;
- There is only a 2% chance that exposure to airborne *Aspergillus fumigatus* spores will be more than 5,000 cfu/m³ and 17% chance that exposure to airborne *Aspergillus fumigatus* spores will be more than 1,000 cfu/m³ .

Background exposure data

Beyond the site boundary, at least 50 metres upwind from composting:

- No samples of airborne bacteria yielded more than 5,000 cfu/m³ and an 11% chance that exposure to airborne bacteria will be more than 1,000 cfu/m³ ;
- No samples of airborne fungal spores yielded more than 5,000 cfu/m³ and a 16% chance that exposure to airborne fungal spores will be more than 1,000 cfu/m³ ;
- No samples of airborne *Aspergillus fumigatus* spores yielded more than 1,000 cfu/m³ .

Further observation

Working with composting handling machinery and protected by a vehicle cab:

- The chance of being exposed to more than 100,000 cfu/m³ bacteria drops from 64 to 28% and for more than 1 million cfu/m³ bacteria from 28 to 5%;
- The chance of being exposed to more than 100,000 cfu/m³ *Aspergillus fumigatus* spores drops from 24 to 13%; no samples had more than 1 million cfu/m³ *Aspergillus fumigatus*.

What this adds to current data

Compost bioaerosol exposure levels – from HSL's recent work:

- Workers' potential personal exposure;
- Task-specific bioaerosol exposure data;
- Possible protection afforded by vehicle cabs;
- 'Risk zone' approach applicable on sites;
- Deriving source terms for modelling downwind dispersion;
- Measuring levels downwind to validate models.

TO SUMMARISE

- Workplace issues – potential for respiratory ill health, requiring controls.
- Environmental issues – is there a realistic potential for respiratory ill health? **Our data suggests low risk.**
- This work by HSL enhances evidence base reviewed by IOM study for Defra on respiratory health risks from composting.

NEXT STEPS

- Discuss with HSE, EA, waste composting industry what messages should be disseminated and how;
- Guidance and presentations;
- Peer reviewed publications
- Follow up work to establish protection from working in vehicles.