

COMPOSTING

Information Sheet

October 2014

Overview

Composting is a natural biological process of decomposing organic waste material. Under the right conditions, the micro-organisms naturally present in the organic waste multiply and metabolise the organic matter, turning it into compost. Some of these micro-organisms are pathogenic and suitable controls must be put in place to prevent employee exposure. In Ireland, there are large industrial scale composting facilities which process 1000 to 50,000 tonnes of waste.

Biological Hazards

The aerobic process of waste composting leads to heat generation and by controlling the temperature of the waste most of the pathogenic (health threat) organisms are destroyed although the growth of certain bacterial and fungal species can occur.

Any handling/tossing/turning/lifting of composting materials may generate aerosols (suspension of fine particles in air) of these micro-organisms, which are referred to as bio-aerosols.

Workers on composting sites may therefore be at risk of exposure to bio-aerosols depending on their work task, their proximity to the bio-aerosol source and the control measures put in place.

Many of the microorganisms found in the dust generated during the process are known respiratory sensitisers which may cause asthma or similar lung-related illness.

Chemical Hazards

As well as the biological exposure there is also a risk of chemical exposure as the waste decomposes. The generation of chemical agents depends on the nature of the composting and the organic materials being composted. Ammonia, methane, carbon dioxide and hydrogen sulphide are four possible off-gasses that may be generated.

Ammonia is a colourless alkaline gas with a pungent distinctive odour. It can irritate or burn the eyes, skin and respiratory system and this irritation may vary

depending on the individual, the concentration of ammonia and the duration of exposure.

Methane is an odourless, highly flammable gas which is not toxic but by replacing air will act as a simple asphyxiant.



Carbon dioxide is an odourless gas which is not toxic but by replacing air will also act as a simple asphyxiant.

These asphyxiant gasses are odourless and therefore their presence may not be obvious. In confined spaces or areas, with poor or no ventilation, an asphyxiant can displace oxygen and exposure in such circumstances can be very serious to fatal.

Hydrogen sulphide is a colourless, **very poisonous** (CLP classification - Acute tox 2, fatal if inhaled), flammable gas with the characteristic foul odour of rotten eggs. It often results from the bacterial breakdown of organic matter in anaerobic conditions. **As the concentration of Hydrogen sulphide increases it incapacitates the olfactory nerve (nose) and its odour no longer becomes detectable. The serious hazard may, in such circumstances, may not be appreciated.**

Scrubbers are used in some composting site to remove odours/ammonia from the air. These scrubbers use corrosive materials in their operation (e.g. sulphuric or hydrochloric acid). Contact with these corrosive materials can be highly hazardous. For further information on safe use of chemicals and hazardous substances see the HSA website under the heading Chemicals (www.hsa.ie). There are a number of fact sheets and guidance documents on chemicals available on the site under publications.

Most composting operations are conducted indoors for environmental reasons. As a result, bio-aerosols and chemical aerosols may be contained and concentrated within the workplace buildings. Appropriate ventilation is necessary.

As the materials decompose and heat is generated the workplace atmosphere can become very humid. High humidity can effect respiration and damp clothing can increase skin contact with aerosols. Suitable ventilation eliminates high humidity.

Other Hazards

- ✓ Manual handling
- ✓ Vehicle injuries/collisions
- ✓ Injuries including cuts from sharps, , being struck by objects,
- ✓ Slips and trips – floors are often wet and slippery
- ✓ Vehicle and machinery noise
- ✓ Poor lighting/visibility

Routes of Exposure & Exposure Levels

The main risks of exposure are by skin contact and inhalation. High humid conditions in some indoor plants may increase the dermal contact with biohazards.

Occupational Exposure Limits

Occupational limits for bio-aerosols have not been developed. As during the composting process, heat produced by microbial activity kills plant and animal pathogens, environmental monitoring focuses on the species such as actinomycetes (spore forming bacterial species) and fungal species such as *Aspergillus Fumigatus*.



Occupational limits for chemical substances

Chemical Substance	EINECS No.	CAS No.	OELV (8-hour reference period)		OELV (15 min reference period)		Notes
			ppm	mg/m ³	ppm	mg/m ³	
Ammonia	231-635-3	7664-41-7	20	14	50	36	IOELV
Carbon dioxide	204-696-9	75-15-0	5000	9000	15000	27000	IOELV
Hydrogen sulphide	231-977-3	7783-06-4	5	7	10	14	IOELV
Methane	200-812-7	74-82-8	1000				Asphx

See 2011 Code of Practice for the Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001 for a fuller explanation of OELVs.

Health Effects

Some of the species can cause allergic (or asthma like) respiratory disease such Farmer's Lung disease, Mushroom Worker's Lung disease, allergic rhinitis and occupational asthma, following excessive exposure. In addition, the thermotolerant fungus *Aspergillus Fumigatus*. is recognised as an opportunistic respiratory pathogen for immunocompromised persons.

Sewage sludge may contain enteric pathogens; they are generally transmitted by the oral route and may lead to enteric infection. Where sewage sludge is a component in the composting process, the nature and concentrations of pathogens in sewage will depend on the health and the size of the population in the catchment.

Recommended Control Measures

Employees are at greatest risk of exposure to bioaerosols during handling of compost materials. Accordingly, work processes should aim to reduce exposures during shredding, turning, moving and any process step where an aerosol can be generated.

Engineering controls such as containment, isolation, local exhaust ventilation, ventilation pressure differentials may be provided to prevent employee exposure.

Vehicles for handling/moving composting materials should have:

- ✓ Sealed cabs with air conditioning supply
- ✓ Air filtration systems which include pre-filters to protect the HEPA filter,
- ✓ Pressure gauges to indicate the status of the air filtering system
- ✓ Alarms when filters block
- ✓ Positive pressure within cab (>10 Pa) to prevent dust ingress.
- ✓ Vents to relieve excess pressure
- ✓ Self-closing, sealed doors.
- ✓ Check that the clean air is turned on and working.
- ✓ Check any air conditioning self-test every time you start the vehicle.
- ✓ Keep doors and windows closed.
- ✓ If this is not possible, use RPE for moving compost.

The vehicle driver will have to leave their cab on occasion. The driver must then wear suitable RPE.

Administrative controls controls such as hygiene measures such as personnel washing facilities and regular site cleaning should be in place. Proper hygiene measures are necessary to prevent contamination by ingestion or inhalation. The number of employees who have potential to be exposed should be kept to a minimum. Access to the composting area should be controlled. If employees are likely to work in confined spaces, then procedures in line with HSA's Guidance on Confined Spaces should be put in place.

PPE

All PPE should be supplied in compliance with the Safety, Health and Welfare at Work (General Applications) Regulations, 2007.

Suitable coveralls, gloves, boots should be provided.

RPE must be worn where adequate control cannot be achieved by other means. As a minimum, a FFP2 respirator must be worn in the work area.

Health Advice

Health surveillance should be offered to employees at composting sites. Several of the biological agents likely to be present are allergens and appropriate surveillance under an occupational healthcare professional should be provided.



Key points

- During the composting process, heat produced is controlled to sanitise the organic matter, and under the right conditions kills plant and animal pathogens.

- Heat generation encourages the growth of thermophilic species such as actinomycetes (spore forming bacterial species) and in some cases thermotolerant fungal species such as *Aspergillus fumigatus*.
- Sludge, if a constituent raw material, may contain enteric pathogens.
- Chemical Agents where present may be corrosive, very poisonous or simple asphyxiants.
- Ergonomic and physical (manual handling, noise etc.) hazards are also likely to be a concern.
- Allergic (or asthma like) respiratory disease such as Farmer's Lung disease, Mushroom Worker's Lung disease, allergic rhinitis and occupational asthma can occur following excessive exposure. Sewage enteric pathogens may lead to enteric infection.
- Engineering controls such as containment, isolation, local exhaust ventilation, ventilation pressure differentials may be provided to prevent employee exposure.
- Administrative controls such as hygiene measures such as personnel washing facilities and regular site cleaning should be in place.
- All PPE should be supplied in compliance with the Safety, Health and Welfare at Work (General Applications) Regulations, 2007.
- RPE must be worn where adequate control cannot be achieved by other means. As a minimum, a FFP2 respirator must be worn in the work area.
- Vehicle cabs should be sealed and supplied with properly filtered air.
- Health surveillance should be offered to employees at composting sites.

For further information contact the Health & Safety Authority at wcu@hsa.ie or LoCall 1890 289 389.