16.03: continued

a. the center accepts only food materials from residents of the municipality;
b. the food material is stored in a container which is kept sealed when food material is not being added;
c. no more than one ton of food material is collected per day and no more than three tons are on-site at any time;
d. the food material is stored at the center and removed from the center in a manner that does not create public nuisance conditions, such as, but not limited to, odors or vectors. In no case shall food material be on-site for more than seven days after receipt; and
e. at least 30 days prior to commencement of operations, the owner or operator notifies the Department and the board of health, in writing, using a form provided by the Department.

4. Land Application of Manure. The land application or composting of manures in normal farming activities.
5. Residential Composting. At a residence, composting of organic materials generated at the residence.
6. Residential Disposal of Stumps, Trees and Brush. Disposal of stumps, trees and brush at a single family home or farm where the stumps, trees and brush are generated and disposed within the boundaries of such home or farm by the occupant or resident of that home or farm.
7. Handling of Clean Wood. The handling and use of clean wood as defined in 310 CMR 16.02.
8. Leaf and Yard Waste Transfer Operation. A leaf and yard waste transfer operation provided that all materials are transferred off-site within seven days of receipt.

16.04: General Permit for Recycling, Composting or Aerobic and Anaerobic Digestion Operations

(1) Applicability. The following operations are eligible for a general permit and do not require a site assignment, a facility permit pursuant to 310 CMR 19.000: *Solid Waste Management*, or a recycling, composting, or conversion permit pursuant to 310 CMR 16.05, provided the operation meets the requirements of 310 CMR 16.04:

(a) a recycling operation that receives no more than 250 tons per day of recyclable materials, not including paper;
(b) a composting operation that:
1. receives no more than 105 tons per week and no more than 30 tons per day of Group 2 organic materials, listed at 310 CMR 16.04(3)(b): *Table 1. Examples of Organic Materials*, or other organic materials with a carbon to nitrogen ratio of 30:1or less;
2. contains less than 5,000 cubic yards of organic materials per acre; and
3. has less than 50,000 cubic yards of organic materials on site at any one time; or
(c) an aerobic or anaerobic digestion operation that receives no more than 100 tons per day of organic material from on or off site, based on a 30 day rolling average.

(2) General Permit Requirements for a Recycling Operation. The owner and operator of an operation that handles recyclable materials shall:

(a) ensure the operation and its products do not result in an unpermitted discharge of pollutants to air, water, land or other natural resources of the Commonwealth, create a public nuisance, or present a significant threat to public health, safety or the environment;

16.20: continued

(b) Prefiled Direct Testimony. The Hearing Officer may, on his/her own motion, order all Parties to file within a reasonable time in advance of the public hearing full written text of the testimony of their witnesses on direct examination on issues pertinent to site assignment, including all exhibits to be offered into evidence, or on issues specified by the Hearing Officer. Such testimony shall be filed by or before a time specified by the Hearing Officer and shall be available to examination and copying as provided in 310 CMR 16.20(8)(a). The Hearing Officer may also require the filing of written rebuttal testimony within a reasonable time after the filing of the direct testimony described in the preceding sentence. All testimony filed pursuant to this rule shall be subject to the penalties of perjury. All witnesses whose testimony is filed pursuant to this rule shall appear at the hearing on the merits and be available for further examination or cross-examination at the discretion of the Hearing Officer. If a witness is not available for further examination or cross examination at the hearing on the merits, the written testimony of the witness shall be excluded from the record unless the Parties agree otherwise.

(9) Intervention and Participation.

(a) Intervention. Any Person who with good cause wishes to intervene in a public hearing shall file a written request (petition) for leave to intervene. Persons whom the Hearing Officer determines are specifically and substantively affected by the hearing shall be allowed to intervene. For the purpose of the Public Hearing the following persons shall be considered to be specifically and substantively affected by the hearing and shall be eligible to register as a Party to the hearing:

1. Abutters. Any abutter or group of abutters to the proposed facility shall be a Party to the hearing by timely submission of a Party Registration Statement in accordance with 310 CMR 16.20(9)(b).

2. Ten Citizens Groups. Any group of ten or more persons may Register collectively as a Party to the public hearing in which damage to the environment, as defined in M.G.L. c. 214, § 7A, or public health and safety are or might be at issue; provided, however, that such intervention shall be limited to the issues of impacts to public health, safety and damage to the environment and the elimination or reduction thereof in order that any decision in the public hearing shall include the disposition of such issue.

(b) Registration. The registration of an abutter, group of abutters or ten citizen groups as a Party or the petition of a person to be an intervenor to the public hearing shall be valid only if submitted prior to the commencement of the hearing. The registration statement shall be signed under pains and penalty of perjury and contain the following information:

1. name and address of the registrant(s);
2. proposed party status (abutter, group of abutters, ten citizen group or intervenor);
3. identity of the Authorized Representative, if any;
4. for individuals wishing to register as an abutter a description of the abutting property including its boundaries and current use and a statement that the registrant is the owner of the parcel; and
5. for individuals or groups of individuals petitioning to be an intervenor a statement indicating how they will be substantially and specifically affected by the proposed facility.

If no Authorized Representative is identified in the Registration Statement the first person mentioned in the Statement as a member of the group shall be deemed the Authorized Representative of the group. Said Authorized Representative shall have the sole authority to sign submissions by the group. A group that registers as a Party shall be collectively deemed a Party and shall have the rights of participation of a Party as set forth in 310 CMR 16.20, except as limited by 310 CMR 16.20(9).

16.04: continued

Should toxics be detected in the final products at levels that pose a significant threat to public health, safety or the environment for any likely use of the product, the plan shall also include a contingency plan that identifies steps to be taken to reduce toxics in incoming organic materials, describes corrective actions to be taken for management of the organic materials and products, and identifies how any contaminated products are to be used or disposed;

6. ensure that the amount of residuals generated does not average more than 5% by weight of the materials received during any quarter;

7. ensure that all solid and liquid materials produced as a result of the operation are managed in accordance with all other applicable regulations and approvals, including but not limited to, a beneficial use determination;

8. not allow materials, in their as-received, in-process or processed condition, to be stored for more than one year from the date of their receipt at the operation. This time limit may be exceeded in the case of storage of a processed material pending accumulation of one full container load;

9. maintain accurate records for at least three years to demonstrate compliance with 310 CMR 16.04 and submit a report to the Department annually by February 15th on a form provided by the Department that shall include, but not be limited to, the amounts and types of organic materials received and composted and the amount of residuals managed during the previous calendar year; and

10. submit a compliance certification in accordance with 310 CMR 16.06(1).

(b) Additional Requirements for a Composting Operation. The owner and operator of a composting operation shall comply with 310 CMR 16.04(3)(a) and shall:

1. ensure that no more than 25%, by volume, of the total compost mixture shall be a Group 2 Organic Material listed at 310 CMR 16.04(3)(b): *Table 1. Example of Organic Materials* or other organic materials with a carbon to nitrogen ratio of 30:1 ~~or less;~~

2. ensure that adequate and appropriate bulking material (consisting of Group 1 organic materials listed at 310 CMR 16.04(3)(b): *Table 1. Example of Organic Materials* or other organic materials with a carbon to nitrogen ratio of greater than 30:1) is readily available on-site to mix with incoming Group 2 organic materials or other organic materials with a carbon to nitrogen ratio of 30:1 or less;

3. ensure that all Group 2 organic material or other organic materials with a carbon to nitrogen ratio of 30:1 or less is mixed into the compost windrows or piles to such an extent that it is unrecognizable as a separate material as soon as possible but no later than the close of business each day, or transferred off-site by the close of business on the same day that it is received at the operation; and

4. ensure timely and regular aeration of the compost to ensure proper aerobic, temperature, moisture and porosity conditions.

Compost, which is formed through the decomposition of organic material, contains bacteria, spores and fungi that can become airborne as bioaerosols and are potentially harmful to humans.
It typically takes 3 months for organic waste to turn into usable compost, during which time temperatures inside the compost heaps can reach up to 65C.
Most of the compost sites use open-air techniques where waste is piled in the open and regularly turned over by heavy machinery, which aids composition but spreads dust.
At some sites the process is now carried out in giant tanks or indoors to reduce emissions.

NTRODUCTION

Bioaerosols are usually defined as aerosols or particulate matter of microbial, plant or animal origin that is often used synonymously with organic dust. Bioaerosols or organic dust may consist of pathogenic or non-pathogenic live or dead bacteria and fungi, viruses, high molecular weight (HMW) allergens, bacterial endotoxins, mycotoxins, peptidoglycans, β(1→3)-glucans, pollen, plant fibres, etc.

The interest in bioaerosol exposure has increased over the last few decades. This is largely because it is now appropriately recognized that exposures to biological agents in both the occupational and residential indoor environment are associated with a wide range of adverse health effects with major public health impact, including contagious infectious diseases, acute toxic effects, allergies and cancer. Several new industrial activities have emerged in recent years in which exposures to biological agents can be abundant. One example is the waste recycling industry. Workers in this industry (e.g. waste sorting, organic waste collection and composting) are often exposed to very high levels of microorganisms (van Tongeren *et al.*, 1997; Douwes *et al.*, 2000a) and several studies have indicated a high prevalence of respiratory symptoms and airway inflammation in these industries (Sigsgaard *et al.*, 1994; Poulsen *et al.*, 1995; Thorn and Rylander, 1998a; Douwes *et al.*, 2000a; Wouters *et al.*, 2002

The Association for Organics Recycling

4.3 Bioaerosols and health People who work with composting materials, or those who are located in close proximity to the agitated compost, can potentially inhale large amounts of bioaerosols. The human respiratory system can adequately filter out larger dust particles through a combination of hairs which line the nose and specialized cells in the upper parts of our airways. Unfortunately, the smaller bioaerosol particles escape capture by these mechanisms and can penetrate deep into the lungs (Figure 4.5). As our lungs have a very large surface area and carry out a specialized function, they can easily be affected by bioaerosols

The effects of bioaerosol exposure can range from mild acute symptoms that initially have very little impact on everyday life to severe chronic conditions that are considerable and debilitating in nature. The most common conditions and associated signs and symptoms are listed in Figure 4.6.

By Richard Gray, Science Correspondent

9:00PM BST 27 Jun 2009

Researchers fear that the rapid spread of commercial open air composting sites may bring a rise in respiratory infections, asthma and skin complaints among nearby residents. Workers at the sites have already been found to be at risk of diseases such as farmer's lung, which is caused by inhaling bacteria.

The warning comes as a Government-backed study has found that many of the industrial-scale composting sites have failed to assess correctly the risk to communities living in the area.

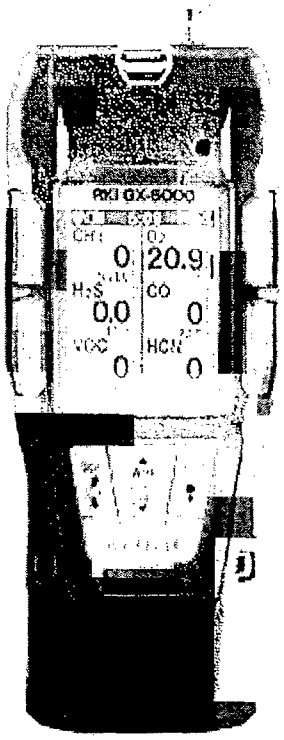
The study, by public health and environmental researchers at the Government's **Environment Agency** and Cranfield University, concluded that among 44 sites, which recycle thousands of tons of household waste a year, only eight had produced adequate risk assessments on protecting the surrounding area from emissions of bacteria, spores and fungi, known as "bioaerosols".

Growing numbers of people living near to large composting plants are also reporting health problems are claimed to be a result of potentially harmful organic material being thrown into the air during the composting process.

Related Articles

According to lawyers, some are seeking to sue composting firms over alleged health problems they blame on emissions, as well as over bad smells emitted by the sites.

Critics say that rotting food and increased numbers of rodents and flies will help to spread disease.



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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.

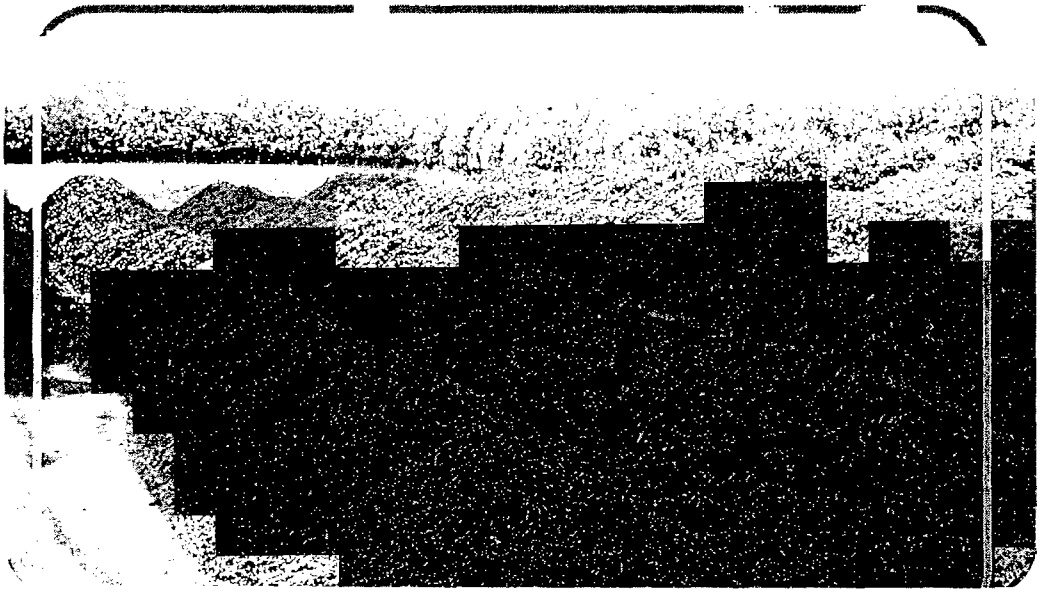
Many of the microorganisms found in the dust generated during the process are known respiratory sensitisers which may cause asthma or similar lung-related illness.

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 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

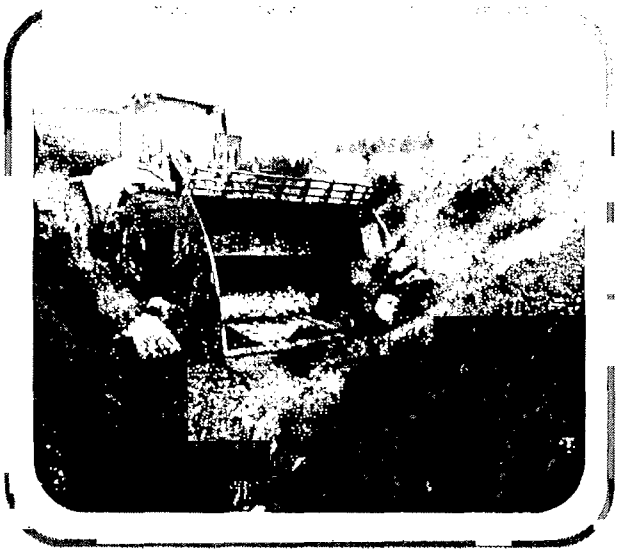
- ✓ Manual handling
- ✓ Vehicle injuries/collisions
- ✓ Injuries including cuts from sharps, , being struck by objects,
- ✓ Slips and trips – floors are often wet and slippery
- ✓ Vehicle and machinery noise
- ✓ Poor lighting/visibility

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

			OELV (8-hour reference period)		OELV (15 min reference period)		
Chemical Substance	EINECS No.	CAS No.	ppm	mg/m³	ppm	mg/m³	Notes
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

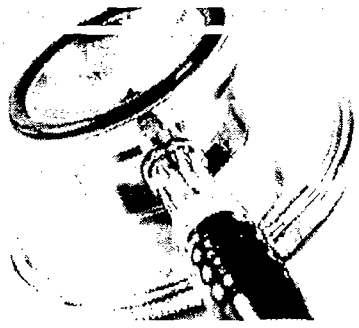
All PPE should be supplied in compliance with the Safety, Health and Welfare at Work (General Applications) Regulations, 2007.

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
- 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.

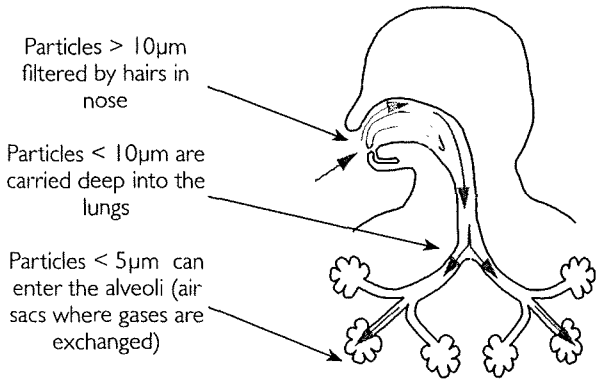


Figure 4.5 Bioaerosols can penetrate deep into the lungs

During the course of our daily activities, we inhale airborne microbes. This is as much a feature of normal everyday life as eating or drinking. Most individuals' bodies are perfectly capable of coping adequately with the presence of these 'invaders' and do not suffer any ill effects. It is only when airborne microbes, such as those generated during the composting process, are present in high concentrations that they may become harmful to human health. As an example, we all need to eat and drink everyday, however, too much can have detrimental effects.

Composting results in the formation of high concentrations of bioaerosols and selects for certain types of microbes which tend to produce very tiny spores. However, without even being close to composting activities, **we continually encounter these same microbes in our everyday lives at low concentrations**. They are present naturally and are essential in the 'recycling' of nutrients in our gardens, parks and countryside.

We all react to bioaerosols in different ways. It depends upon a variety of factors and is difficult to predict; some people have worked at composting sites for many years without apparently displaying any adverse health effects. But although they seem healthy today, does not mean there will be no long-term risks; a precautionary approach is always recommended.

Factors, such as prior exposure to bioaerosols, individual susceptibility, bioaerosol concentration and composition (the numbers and types of microbes present) and the length of time and frequency to which people are exposed all contribute to the way in which their bodies react. There are three main

- **Allergy**
  This is an immunological response that results in the body becoming 'sensitised' following exposure. The next time the body encounters the substance it 'over-reacts', even if the substance is present in extremely low concentrations. When such a substance affects a person's lungs in this way it is referred to as a '**respiratory sensitiser**'.
  Sensitisation does not usually occur immediately; rather it is a consequence of inhaling a substance over a period of months or even years.

- **Inflammation**
  This is a response of body tissues to an injury. It typically results in swelling, redness and pain.

- **Toxin poisoning**
  This is a disturbance of the normal bodily functions caused by a specific substance, known as a toxin. It differs from both allergic and inflammatory responses.

SIGN
Irregularity in a person's health that can be determined through examination e.g. breathlessness, wheezing.

SYMPTOM
Abnormal sensation a person experiences, which is not obvious through examination. These are described by the patient e.g. headache, nausea.

The effects of bioaerosol exposure can range from mild acute symptoms that initially have very little impact on everyday life to severe chronic conditions that are considerable and debilitating in nature. The most common conditions and associated signs and symptoms are listed in Figure 4.6.

It is important to note that these conditions are **not** due to **infections**. A clear distinction must be made between these allergic, irritative or toxic conditions and infections.

INFECTION
The invasion by and growth of micro-organisms in body tissues.

PATHOGEN
A micro-organism that causes disease through

Condition	Cause	Common Signs & Symptoms
Asthma	An irritation / hypersensitivity of the lungs 'Over-reaction' of lungs following exposure to a respiratory sensitiser	• Difficulty in breathing • Wheezing
Alveolitis	Irritative inflammation of the alveoli (sac-like structures where gas exchange takes place) in the lungs. There are two types:	Similar to the 'flu: • Fever • Fatigue • Difficulty breathing
	Toxic alveolitis • Also known as Organic Dust Toxic Syndrome (ODTS) • Caused by exposure to endotoxin	• Brief illness of flu-like symptoms occurring 6-12 hours after exposure lasting for about 4 hours.
	Allergic alveolitis • Allergic reaction • Includes the condition known as 'Farmer's lung'	• Lasts for a long time
Mucous membrane irritation	Inflammation / irritation of exposed tissues in the eyes, nose and throat. (Rhinitis or conjunctivitis could also be present).	• Watering/prickly eyes • Running or stuffy nose • Sore throat
Chronic bronchitis and coughs (COPD – Chronic Obstructive Pulmonary Disease)	An inflammation of the respiratory tract caused by long-term exposure to noxious dusts, biological agents and gases.	• Coughing • Wheezing • Long-term illness
Gastro-intestinal disorders	Toxin poisoning	• Nausea • Vomiting • Diarrhoea • Occurs within hours of exposure
Skin disorders	Exposure to high levels of endotoxin or dust containing bacteria and fungi	• Sore, inflamed skin • May result in eczema

Figure 4.6 Conditions that may be caused by inhaling bioaerosols

Infections are caused by **pathogenic** microbes which are capable of invading body tissues and growing within an individual. Spots and boils are both examples of microbial infections.

Organic wastes which contain materials of animal origin such as food waste may contain a number of human pathogens (microbes that are capable of infecting humans) on delivery to a facility, such as the stomach bugs *Escherichia coli* (or *E. coli*, as it is commonly called) and *Salmonella*.

The fungus, *Aspergillus fumigatus*, is particularly associated in plants) and surviving at high temperatures ('in excess of' 60°C). As part of its life cycle, *Aspergillus fumigatus* produces very tiny spores. If inhaled as a bioaerosol, these spores may cause allergies and inflammations, resulting in some of the conditions described in Figure 4.6.

However, *Aspergillus fumigatus* can also infect certain people, a condition caused aspergillosis. Aspergillus species are therefore classed as opportunistic pathogens which means that they will only infect an individual whose immune system does not work properly. Such altered immunity sometimes develops

Bronchopulmonary Aspergillosis (ABPA), although very rare, has been reported following exposure to Aspergillus species, particularly *Aspergillus fumigatus*. This condition usually occurs in individuals with pre-existing respiratory conditions such as asthma or cystic fibrosis and exacerbates existing symptoms of sufferers.

A note on Volatile Organic Compounds (VOCs)
These are organic chemicals in the gaseous phase and are known to be emitted during the composting process as part of microbial breakdown of material, particularly during the early stages of the composting process. The types and concentrations of VOC emissions from composting activities are not well characterised at this current time but VOCs are known respiratory irritants and are also known to act in combination with other bioaerosol components to increase the human immunological response following exposure. However, it is important to note that being able to smell a gas does not necessarily mean it is harmful, our noses are very sensitive!

4.4 Similar occupational diseases

The adverse health effects described above are by no means unique to composting. Whilst there is still limited understanding of the risks to compost worker's health from exposure to the bioaerosols generated during composting, other industries such as agriculture, swine and poultry farming, textile and cotton mills have reported adverse health effects in workers form exposure to agents known to be present in compost bioaerosols. For this reason the hazard potential of compost bioaerosols should be recognised and, in the absence of definite evidence, employers should adopt a precautionary approach in managing these potential risks. Chapter 5 embraces this concept and identifies the need for employers to reduce workers exposure to bioaerosols *'so far as is reasonable practical'* in accordance with health and safety legislation.

Examples of recognised occupational diseases from exposure to organic dust or bioaerosols include:

- **Farmer's lung**
  Associated with the handling of mouldy grains, straw and hay and working in intensive livestock barns
- **Mushroom worker's lung**
  Associated with the production of mushroom substrate
- **Bird breeder's or Pigeon Fancier's lung**
  Caused by bacteria from feathers and droppings

Medically these are referred to as 'extrinsic allergic alveolitis' and occur as a result of inhalation of spores.

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