Guidelines for Compost Storage and Utilisation - Odour Abatement

Odour complaints and odour emissions are the single biggest threat to the continued operation of any large-scale composting facility. The operator must be vigilant in all things they do. Focus is usually given to waste reception and storage, and the composting process itself but the important area of product maturation, storage and use are often ignored. There are four fundamental factors that influence the release of nuisance odours during product storage and utilisation, these are:

- Product Maturity
- The size of storage piles and the frequency of movement
- Local site topography, wind-flow and neighbours
- Application techniques

Each of these factors will impact on the others. However, provided the guidelines that follow are adhered to then the composting facility manager should be able to guarantee odour-free operations, or at least “no discernible odours past the boundary”, which is the usual licensing requirement.

Product Maturity

The maturity of the compost produced by any given process is a function of the efficiency of aeration and subsequent microbial degradation. The HotRot composting system ensures both by providing regular, periodic aeration via a combination of shaft rotation and supplementary air injection, as well as providing an insulated environmentally controlled vessel in which the composting process occurs.

Odour emission rates rapidly decrease as a function of composting time. Generally, odour emission rates are reduced by 85% 10 days into the process, with stable compost usually having an odour emission rate approximately 95% less than the raw material. In addition, the type of odour causing compounds released also changes as a function of time and changes in biochemical processes. Volatile acids cause initial odours, whereas the odour from product storage is dominated by ammonia and earthy smells.

The HotRot system is designed to manage the high levels of odours emitted in the first 10 days (the general residence time of the material in the unit). Appropriate maturation and storage will be required to manage odours generated by the product post discharge from the HotRot units.

The operator should focus on ensuring the composting process proceeds optimally and product maturity is tested regularly. It is most important that material to be composted has moisture content between 40-60% (ideally 45-55%) by mass and a structure that allows efficient aeration in the HotRot unit; this generally means the material can be lifted by the tines on the central shaft and to fall freely from these without excessive adhesion. It is also important that material being

discharged from the process does not have moisture content of less than 35-40%, as this would indicate that the material may have been too dry, and the process retarded towards the end. The HotRot system monitors the moisture content in the exhaust air and uses variable speed exhaust fans to regulate moisture removal, but this relies on efficient temperatures and aeration.

Storage Piles

The main function of product storage is the management of ammoniacal residuals and permit the mesophilic stage of composting to continue. Ammonia is the primary odourant in compost. During the composting process, nitrifying bacteria that are responsible for converting ammoniacal-nitrogen to plant-available nitrate-nitrogen are unable to survive the elevated temperatures. It is essential that the product is allowed to cool and nitrifying bacteria allowed to colonise the compost during storage.

The most effective mechanism for cooling compost and assisting colonisation is to spread the compost immediately following production and till into the soil. It is recognised that this is often not possible. Regardless, fresh compost can be used sparingly on established pasture immediately after production or as a mulch around trees. Where compost must be stored it must be done so as follows. Product that is to be bagged may require extended maturation and storage to prevent ricks or heating and odours occurring in sealed bags.

Compost is an extremely good heat insulator. Even material that is stable or mature but has a small amount of residual activity will heat up in the centre of larger storage piles. This heat build-up will inhibit nitrification and can result in odorous ammonia being released whenever a loader is used to move the material.

It would be normal for the compost discharged from the HotRot units to be conveyed to a temporary compost storage bunker at the end of each unit before being transferred to a storage or maturation area using a wheel-loader or farm trailer. Initially storage piles must be kept as small as possible, it is recommended that maturation windrows be no higher than 1.5-1.8m high and 2.0m wide for the first 10-14 days – this ensures rapid cooling of the product and minimises the build-up and release of ammonia when piles are moved. Piles should also be turned or mixed ever 2-3 days using a loader or small windrow turner that we can supply.

After this initially period, and assuming core temperatures in these windrows are less than 55^{o}C, windrow heights can be increased to 2 - 3.5m and after a further 3-4 weeks (also assuming core temperatures are less than 40^{o}C) the material may be placed in storage windrows up to 4-5m high. The moisture content of piles must be monitored and maintained above 35-45% to prevent dust and the risk of spontaneous combustion.

Site Topography, Wind-flow and Neighbours

Attention must be paid to the location of any storage areas. Ideally these should be as far away from property boundaries or neighbouring housing as possible. The site should not be in a hollow where still air may be trapped and should not be near areas where treelines or shelter belts can channel air movement towards neighbouring properties.

If the HotRot facility is in, or close to, an urban area it may be desirable to transport compost to a second rural site for storage, maturation, screening and packaging.

The storage site should be exposed to prevailing winds but should also incorporate a row of trees or a solid fence on the leeward side of the site. The trees or fence will create turbulence and

mixing of any odours with the moving air. Natural landforms such as ridges, etc., may also provide similar conditions.

Odours are going to be more of a problem during cold, still conditions. In these conditions odours will tend to follow land contours and as such can become concentrated along watercourses, etc., particularly if these are in the bottom of a sheltered valley. In short, where possible maximise wind turbulence and dispersion and avoid disturbing piles during still cool conditions.

Odour masking compounds can be used but these should be a last resort as they increase operational costs.

Application Techniques

Immediate cultivation of compost into the land following application is the most effective mechanism for eliminating odours at this stage. However, there are several other key practices that can assist:

- Do not apply compost during cool and still conditions; some wind will aid dispersion of any odours. Conversely do not apply compost in strong winds where dust issues may become a concern.
- If possible, apply immediately after or before rain. If applying before rain, ensure there is good pasture cover that will prevent excess runoff into local waterways.
- Do not apply compost if it has moisture content less than approximately 30% by mass, as dust generation may become an issue.
- If material cannot be tilled into the soil and is applied to pasture, etc., apply a little often rather than a lot at one time.
- Ensure the discharge from the mechanical spreader is as close to the surface of the land as possible.