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Guidance Document – Final Report

Composting Wood or Cardboard Waste with Green Garden or Household Kitchen Waste

A practical guide to help compost producers who are intending to compost cardboard or wood waste.

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Contents

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1. Introduction

This Guidance Document for the Composting of Wood or Cardboard Waste with Household Garden or Kitchen Waste is a practical guide to help compost producers who are intending to:

- **Receive cardboard in the waste collected by councils**
- **Add cardboard from another source**
- **Use waste wood waste in the composting process.**

Purpose and intended use

It is assumed that compost producers following the guide are implementing good composting practices, which, for the purpose of this report, are the general principles set out in The Publicly Available Specification for Composted Materials (BSI PAS:2005).

This guidance emerged from research undertaken by ADAS, funded by the Waste Resources Action Programme, reported in 'Feasibility of Composting Wood and Cardboard Waste with Green Garden or Household Kitchen Waste.' The research report involved a review of current practice through both a literature review and survey of composting sites, culminating in composting trials. Overall the research demonstrated that wider waste streams including cardboard and panel wastes can be composed if the process is manipulated.

Structure of document

The sections of this guidance document have been structured to guide the compost producer through the process.

Section 2 provides the general guidance on the site management process.

Sections 3-6 each deal with a different waste, within each section the composter will be guided on assessing the suitability of waste for composting for the composting process and the uses and limitations of the process and products.

- Section 3 – Cardboard;
- Section 4 – Chipboard;
- Section 5 - Medium Density Fibreboard; and
- Section 6 – Market waste.

- Section 7 - The final section gives a summary of the costs and incomes related to composting wood and cardboard.

2. Site Management

The site management principles set out in the 'Publicly Available Specification for Composted Materials PAS100:2005' are widely accepted in the composting industry. These principles are not material specific but relate to the process, so the same management processes should be applied to the composting of cardboard, wood wastes or other materials.

The alignment of site practices to PAS100 ensures control over the composting process by putting in to operation standard procedures (referred to as SOP's, site operating procedures). The desired quality of the end product is the starting point for the development of these procedures. The compost producer must set limits on what level of hazards (e.g. pathogens, heavy metals) are acceptable in the end product, and then must identify each step within the process where the risk from those hazards can be controlled. At each process point a limit is set for each hazard that can be controlled at that point, and an action plan is pre-formulated to rectify any limits exceeded. End product testing confirms that the procedures are working effectively. This procedure is often referred to as Hazard Analysis and Critical Control Point (HACCP) planning, an example of which is shown in Table 1.

Table 1: Example of hazard identification for hazard planning

Process step	Hazard	Action (if limit exceeded)
Input materials Input materials should be biodegradable materials that have been separately collected from non-biodegradables. The cardboard component can be obtained from kerbside collections, commercial sources or recycling centres.	Contamination	Reject load Hand sort Pre-screen Change the intended end use Reduce size of end-product screening
Shredding Reduction in particle size to increase surface are availability, and ensure the centre of the particle can achieve sufficient temperature to sanitise the material.	Inappropriate size Bioaerosols	Re-shred Fit aperature screen to shredder Enclose Protective clothing
Sanitisation (in-vessel or turned windrow) Each batch of composting material should undergo an identifiable sanitization step, usually a defined time at a pre-determined temperature. If the feedstock material contains catering waste (Including domestic kitchen waste) this sanitization step must follow the requirements of the Animal By-Products Regulations (2003).	Pathogens	Sanitization step repeated. Waste analysed for suitable characteristics for composting Alter charactertics by mixing, adding water etc. Reject as non-conforming material
Stabilization (windrow) The stabilization stage follows sanitization. The level of stabilization achieved should be within the requirements of the standard operating procedures and be of a level that is commensurate with the intended use of the compost.	Malodours Bioaerosols Low/high moisture	More frequent turning Assess weather conditions prior to turning to reduce impact on environmental receptors Protective clothing Alter moisture

Table 1: Example of hazard identification for hazard planning

Maturation (windrow) This optional stage is carried out if the intended use of the compost, e.g. as a component in growing media, requires it.	Malodours Bioaerosols Low/high moisture	Same as stabilisation phase
Screening Material is screen to the appropriate size for the application. The step also improves the quality of the compost.	Physical contaminants Inappropriate size	Re-screen material Hire wind sifter Non-conforming batch. Reject or change end use.
Product dispatch The suitability of the material for its intended purpose is assessed.	End user does not use the compost for its intended purpose. Physical contaminants Stones, sharps, immature compost, weeds and propagules, aesthetic quality.	Product labelling Communication with end users

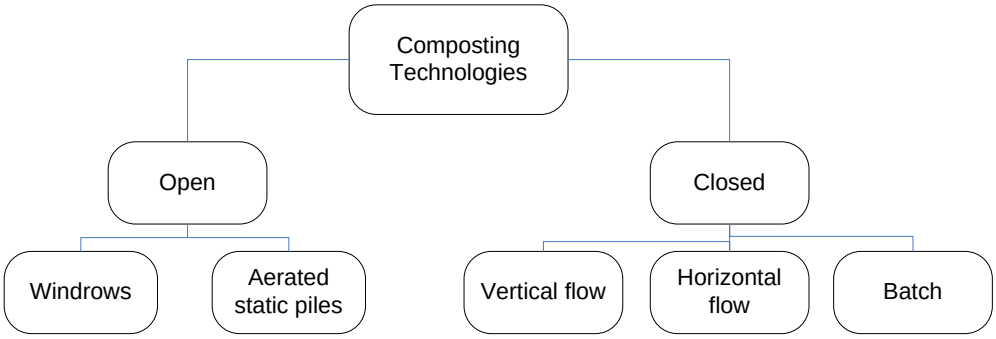
To exert effective control over the HACCP plan and site operating procedures, a Quality Management System must be adopted. In order for procedures to work effectively then all the people involved, managers and operatives, must fully understand them. All procedures need to be documented so that suitably qualified staff can be employed, existing staff can be trained, and if there is a changeover of personnel the knowledge is maintained at the site. All documentation pertaining to the quality of the end

product, process control, and traceability of the material should be maintained.

Choice of composting technology

The choice of composting technology made by the composter will be based upon many different considerations. From the point of view of composting feedstocks containing cardboard (or wood wastes) no specific composting technology is excluded or has particular advantages. The basic types of composting technology currently available are shown in Figure 1 below.

Figure 1: Composting technologies



3. Cardboard

Increasingly, compost producers are requested by local authorities to take cardboard. This supports the authority by enabling them to increase their recycling rates, and it can provide an alternative recycling route for local authorities that wish to separate low grade cardboard from high grade paper collections. For the compost producer the advantage is an increased gate fee, increased bulk and water absorption when mixed with 'wet' catering wastes.

Assessing suitability for composting

In the UK, waste cardboard is mainly produced as packaging materials. There are two main types:

- corrugated card, usually used for packing; and
- flat cardboard, for example used as cereal boxes and shoe boxes.

Most cardboard waste can be composted; however care should be taken with cardboard that has been laminated with another material. Pervious trials work has shown that problems may be experienced with Tetra packs©, where the non-degradable foil lining remains after the outside cardboard coat has composted, and moisture resistant coated paper cups, which are difficult to compost within the accepted timeframe, if at all depending on the type of coat.

Care should be taken to determine the source and type of cardboard presented for composting. In most cases the cardboard will be in a household waste feedstock, but card sourced from commercial sources and civic amenity sites is also acceptable.

It is advisable for producers to agree an acceptable limit for contaminants when cardboard is included in kerbside collections, and to assist the council in communicating to householders to prevent contamination with inert materials.

Whether the material has arisen from municipal, commercial or industrial sources it is advisable to:

- Visit the source;
- Request samples; and
- Trial a small quantity of material.

This will enable a better judgement to be made regarding the suitability of the material for the process. Even if the source is clean some of the following contaminants may be expected:

- Staples;
- Adhesives;
- Tape;
- Plastic liners;
- Waxes;
- Colouring agents;
- Bonding agents;
- Printing ink;
- Polystyrene; and
- Original contents of packaging, e.g. food.

The contaminants can be broadly split into two types; chemical and physical. It is usually unfeasible to remove the chemical contaminants because the technology does not exist or it is uneconomical to do it. However, these are usually at very low concentrations so pose only a small risk. Physical contaminants, however, are often present at levels that pose a significant risk.

Previous ADAS survey work has identified plastic packaging as the most common contamination issue for all composting sites. While this was prevalent at sites that accepted cardboard, the inclusion

of kitchen wastes is the principal factor in relation to **plastic contamination**.

Physical contaminants can be removed before or after composting but it is considered 'best practice' to reduce them as far as possible in the feedstock:

- Agree with the supplier an acceptable limit for plastic contamination, whereby the load will be rejected if that level is exceeded;
- Agree with the supplier an acceptable limit for contamination, whereby there will be an extra processing charge if the level is exceeded;
- Hand sort the delivered material;
- Pre-screen the material to remove plastics;
- Educate the supplier of the process;
- Help the council to educate householders and develop appropriate literature; and
- State categorically that only plastic that meets EN13432 (the European Norm for compostable packaging) can be allowed in the composting collection, and advising the council to educate householders about the differences between compostable and degradable plastics.

Once accepted, small quantities of large plastic items are often removed by hand sorting. The most common technique to remove plastic is a corollary of the screening process, where separating the end product into a various size fractions also results in less plastic in the smaller product fractions and more plastic is removed to the larger product fractions (often referred to as oversize). However, this limits the development of potential uses of the oversize fraction, and at this stage the plastic has already been shredded so this can result in a large percentage of contaminated oversize material.

An alternative is to screen at the start of the process, when the plastic is larger, but at this stage the waste is wet and the particle

size of the organic waste larger, so a large proportion of organic material could also be removed. It is possible to employ a more advanced removal technique by fluidising the material in air, thus separating the heavy material (compost) from the light materials (plastics), but this requires additional processing.

Trials were carried out by ADAS to assess the suitability of composting cardboard in terms of the process and quality of the end product. Analysis of the quantity of cardboard in a kerbside collection (16%, wet weight) was carried out prior to composting. This resulted in a successful composting process, producing a product suitable to be used as a soil amendment. In another trial a further c. 5% (wet weight) was added, making a total 20% (wet weight) card - this made the material more difficult to shred and screen – even though a suitable soil ameliorate was produced.

After the trials were completed cardboard was screened out of the finished product. The large pieces of cardboard did not degrade well for two reasons: Firstly, there was a small surface area available for degradation, and secondly large bits of card did not wet very well. **The key factors to take into consideration were therefore shredding and wetting the material.** The material wetted far easier when small, so the use of a powerful shredder could resolve both problems.

The waste composted had a high level of physical contamination (particularly plastic) in agreement with the findings of the survey work. It was unclear from the trials whether this was a result of cardboard or catering waste being included in the collection. In any case the advice given earlier to reduce contamination by plastic should be followed.

Compost uses and limitations

If cardboard is mixed with green waste or kerbside collected green/kitchen waste at 10% (wet/weight) or less, the resultant compost should not be significantly different from composts made without the addition of cardboard and should attract similar markets – agriculture, landscaping, or blended in topsoil or horticultural products.

4. Chipboard

Chipboard is produced from mechanically fracturing wood into small samples. After drying the graded chips are mixed with resin and formed into boards by curing. It is a common construction material, which is difficult to recycle but can be composted.

Assessing the suitability for composting

Whether chipboard is suitable for composting is largely dependent in what form the wood is presented and what glues are used. Providing the wood is clean (not coated) and can be reduced to a suitable size and shape for shredding then it may be suitable for composting, as long as the other main component of the chipboard, the resin, is safe.

There are several types of bonding resins used, with a predominately formaldehyde base. These resins irreversibly harden as temperatures are increased, and therefore bond the wood chips together. The different types of resins commonly used are listed below:

- Urea formaldehyde;
- Melanine-formaldehyde;
- Melanine-urea formaldehyde;
- Phenol-formaldehyde; and
- Isocyanates / polyurea.

The ADAS trials only used chipboard bonded with urea formaldehyde, and this was successfully composted. There was no specific evidence in the literature review about the behaviour of melanine-formaldehyde, phenol formaldehyde or isocyantes during composting.

However, phenol formaldehyde contains polyaromatic hydrocarbons and a alcohol group: The literature search revealed evidence that polyaromatic hydrocarbons degrade during composting, and alcohols are usually degradable. Melanine urea contains atrazines, which are herbicides and do not readily biodegrade. Isocyanates will break down rapidly in the environment, but can consist of nitro-benzenes, which are slow to degrade. It is therefore recommended that the waste is characterised and end product tested if dealing with resins other than urea formaldehyde.

Health and safety is an important consideration. During composting operations volatile organic compounds will be released into the atmosphere, unless fully contained. Isocyanates are classified as respiratory sensitisers under the EU classification system so it is advisable to avoid composting these. Formaldehyde has also been linked to respiratory sensitisation so protective clothing should be worn and sufficient ventilation maintained. Levels should be monitored to ensure they are within the maximum exposure limit (MEL) of two parts per million (2ppm), time weighted average over eight hours, and the short-term limit (averaged over ten minutes) of 2ppm.

Trials indicate that inclusion rates of chipboard at 5–10% (dry weight) in shredded green/kitchen can be composted to produce a quality end product.

There are difficulties with processing, in particular, dust concentration will be increased so the risk to workers needs to be mitigated, and there is potential for machinery blockages.

As the chipboard is very dry it is essential that it is pre-wetted prior to being mixed with amendment material. Mixing with the other shredded materials should also be carried out very thoroughly to prevent the formation of patches of shredded chipboard. Further wetting during the composting process may also be required.

Compost uses and limitations

Compost produced from chipboard and green waste composting trials had a higher nitrogen content, which is the major nutrient associated with supporting plant growth. The compost may be lighter in colour than pure green waste compost, which may deter users more familiar with traditional peat based, darker, materials.

The bonding agents may be reduced significantly by the composting process but are unlikely to degrade completely. The urea formaldehyde was still present in the composts produced during the trials, but the compost was still able to support plant growth without any observed abnormalities.

Urea formaldehyde has been used safely as a slow release fertiliser for many years, so should not pose any problem in the end product. Growing media manufacturers have used composted chipboard in peat-free mixes to produce horticultural products with a long successful track record.

One of the problems experienced by manufacturers that add bark or wood chips is that the nitrogen becomes ‘locked up’ as the wood chips are degraded. The introduction of chipboard, which contains slow release nitrogen in the form of urea formaldehyde, is likely to counteract this effect. Likewise, a similar effect on the release of nitrogen may be experienced when immature composts are applied to land. If counteracted by the addition of chipboard, the compost could be applied to the land earlier and processing time reduced.

5. Medium Density Fibreboard (MDF)

MDF is produced from chips of wood, reduced to a pulp by mechanical or pressure heating. The material is mixed with resins and pressed at high temperature. It is a very common material in household waste, but is difficult to recycle. Some compost producers are already incorporating it into their processes.

Assessing the suitability for composting

To compost MDF it is critical to ensure the source of the material is clean. This can be difficult with post consumer MDF which is often coated with plastics not suitable for composting. Therefore visual inspection of the waste at source is advisable. This will enable physical contaminants, plastic or chemical (paints) coatings to be identified, and minimise the risk of rejecting material. Like chipboard, even the clean material will need to be further assessed to ensure the resins are safe to compost. MDF waste can also be sourced from the manufacturing process as fines or as off-cuts, which should also be checked at the source of production.

Off-cuts of MDF or post consumer waste need shredding before composting. **Processing of this very dry material can produce excess dust for machinery and workers.** The process should take place out of doors or with sufficient ventilation, and operators should be supplied with suitable personal protective equipment. It is essential that the MDF is pre-wetted prior to being mixed with shredded green/kitchen waste. Mixing can then take place using a front loader. The mixing process should be carried out thoroughly to prevent the formation of patches of MDF material.

Composting trials showed that with 10% MDF (dry weight), the final product provided agricultural/horticultural benefit. Composting MDF at lower incorporation rates should result in equal success. A higher rate of incorporation, however, may result in compaction due to small fibrous fine material.

Compost use and limitations

The compost produced during trials had sufficient nutrients to support plant growth, so would be suitable as a soil amendment to provide agricultural or horticultural benefit. Although formaldehyde was still present in the end product this did not have a negative impact on plant growth.

Other resins, which can contain phenols, melanine and isocyanates, require greater care to assess their suitability. Evidence gathered in the literature review suggests that only phenols are suitably degradable, while the breakdown products of melanine and isocyanates are resistant to biodegradation. Even though phenols have been shown to degrade, these will not reduce completely and some formaldehyde formulations are more resistant to degradation, so end product testing is recommended

Compost made with MDF can appear visually lighter. This may have implications when selling to horticultural users who are more familiar with darker, traditional peat based mixes. Compost made with MDF is less dense which can be beneficial if sold by volume and provide transportation cost savings.

There may also be issues with perception. People may be concerned about MDF waste being used in compost because they generally associate MDF with coated (i.e. contaminated) products.

6. Market Waste

Although market waste is only a small fraction of total waste arisings, there is considerable interest from local authorities in tackling it, because it effects many of them and there are opportunities to tackle the biodegradable waste fraction through existing infrastructure.

Assessing the suitability for composting

Market waste can consist of a variety of materials – textiles, packaging, floor sweeping, as well as food waste etc. A large proportion of markets sell fruit, vegetables, meat fish and have restaurant facilities. Trials carried out with market waste focused on fruit and vegetable waste, as these were common to most markets.

Considerable resources need to be applied to the source separation of the wastes to provide a clean feedstock. Typical non-compostable wastes that need to be excluded are floor sweepings, coated packaging, textiles, drinks cartons, and damaged electrical goods. Depending on the composting source, the feedstock may also include compostable wastes that contain meat, in which the costs are significantly increased due to the requirement to compost in an in-vessel composting system that can meet the time-temperature regime (60^{o}C for 48 hours twice) of the Animal By-Product Regulations. Cardboard and wood are compostable in their own right, and can be included in the composting mix.

The research report on the market waste trials showed that market waste may be composted with green waste or green/kitchen waste amendment. The percentage of market waste that can be incorporated is limited by its high moisture content, and is also dependent on the 'dryness' of the amendment material. Therefore, testing of both waste streams is required, and the addition of dry waste streams is beneficial.

Composting fruit and vegetable waste has potential to generate odours. It is recommended to store the material in an enclosed facility and compost in-vessel even though fruit and vegetable waste, not arising from a kitchen, can be composted in-windrows. Alternatively, odour may be controlled by management methods: turning the windrows when the wind is travelling in the opposite direction to the nearest receptors; incorporating more bulking agents; or processing the fruit waste in a part of the site which is furthest away from the nearest receptor.

Compost uses and limitations

Compost, with the inclusion of market waste as a feedstock component, should attract similar markets to green waste derived compost. Like green waste compost the product is suitable for use as a soil amendment or can be blended with products (reducing the salinity) to make a horticultural grade product or blended to produce a topsoil.

Compost provenance is a major concern for producers and retailers of fresh fruit, vegetables and salads. As a result, growers and retailers may have specific compost feedstock requirements, for example, that compost is based purely on green waste.

Similarly, compost derived from kitchen waste could not be used in organic agriculture, as composts made from food waste are excluded from the certification process, and even green waste must have prior approval from The Soil Association.

7. Processing Costs and Income

Efficient and economic composting of cardboard, MDF, chipboard or market waste is site-specific, and will depend on the following factors:

- Gate fee obtained for the waste;
- Capacity compared to waste that is easier or more difficult to process;
- Capacity compared to waste that obtains a higher or lower gate fee;
- Transport costs;
- Processing costs;
- Length of contract; and
- Capital investment required.

The cost of processing waste including card should not differ greatly, as the incremental cost increase of processing more waste is covered by the increased gate fee. Trials indicate that capital investment may be required for a suitable shredder. There is also likely to be a higher volume of oversize material compared to composting green waste alone. Any additional oversize may incur further costs associated with processing or disposal.

A literature view indicated that the cost of processing wood wastes is in the region of £10-20/tonne. However, if chipboard or MDF is incorporated into an existing process it may require additional processing steps. The costs of cleaning machinery, adding water, providing H&S equipment and product testing also need to be determined. These are likely to increase the processing cost by an estimated £5-6/tonne.

Appendix I - Definitions

Animal by-product: entire bodies or parts of animals or products of animal origin referred to in Articles 4, 5 and 6 of *(Regulation (EC) No 1774/2002 not intended for human consumption).*

Biodegradable: capable of being degraded by biological processes to produce carbon dioxide, water, biomass, and other inorganic compounds.

Batch: a traceable unit of production produced using uniform parameters.

Batch tunnel: a containerised method of processing compost in which a mass of material is loaded in to a tunnel, processed and unloaded in a discreet batch.

Catering waste: all waste food originating in restaurants, catering facilities and kitchens, including central kitchens and household kitchens *(Annex I, Regulation (EC) No 1774/2002).*

Chipboard: A particle board made from wood chips produced by mechanically fracturing wood, such as forest thinnings and industrial wood waste, into small fragments. After drying, the graded chips are mixed with resin and formed into boards by curing in a heated press.

Composting: the autothermic and thermophilic biological decomposition and stabilisation of biodegradable waste under controlled aerobic conditions that result in a stable sanitised material that can be applied to land for the benefit of agriculture, horticulture or ecological improvement. *(The Waste Management Licensing Amendment (Scotland) Regulations 2004).*

Critical limit: a criterion used to establish acceptability and non-acceptability (The Composting Association, 2003)

Hazard Analysis and Critical Control Point (HACCP): A system that identifies, evaluates and controls hazards which are significant for safety *(Publicly Available Specification for Composted Materials PAS100:2005)*.

Kerbside collected waste: a method of collecting household, commercial and industrial waste usually at the curtilage of the property.

Medium Density Fibreboard (MDF): A fibre composite manufactured by a dry or wet process using resin glue. The homogeneous cross section and smooth faces of MDF give high quality surfaces that are ideal for painting.

Putrescible waste: any animal or vegetable waste (including wood) which is capable of undergoing anaerobic or aerobic decomposition.

Sanitised: degree of processing and biodegradation at which any human, animal and plant pathogens present have been reduced to acceptable levels.

Screening : process stage usually involving the separation of compost particle according to size, by various means, in order to achieve one or more separate grades.

Sharps: inorganic contaminants (such as glass fragments, nails and needles) that are greater than 2 mm in any dimension that may cause physical injury to the hands of the user of compost, or a product that includes it, when handled without protective gloves or to a user of the receiving soil or turf *(Publicly Available Specification for Composted Materials PAS100:2005).*

Stabilised: degree of processing and biodegradation at which the rate of biological activity under conditions favourable for aerobic biodegradation has slowed and microbial respiration will not significantly resurge under altered conditions, such as manipulation of moisture or oxygen levels, or temperature or the addition of a source of water soluble nitrogen. *(Publicly Available Specification for Composted Materials PAS100:2005).*

Standard operating procedures: documents stating the procedures followed during composting or associated activities.

Appendix II – Sampling and Testing Procedures

General testing procedures should be carried out in accordance with the '*Publicly Available Specification for Composted Materials PAS100:2005*', as summarised below.

- Each grade of product should be sampled:
- When the batch has completed the composting process;
- After any particle size screening; and
- Before any blending with other wastes, materials, composts, products or additives.

Each sample should be representative of a batch and should be sent promptly for testing by an independent laboratory. Details of how to obtain a representative sample are given in BS EN 12579. The statistically valid number of sub-samples to take from a batch and then be thoroughly mixed is given by for formula $n_{sp} = 0.5 (V^{1/2})$, where V is the volume of the batch. A minimum of 12 and a maximum of 30 sub-samples should be taken. Thus for a batch of 250 m^3 or 500 m^3 of compost 12 sub-samples should be taken. For batches of 1,000 m^3 or 2,000 m^3 16 and 22 sub-samples should be taken. For a batch size of 3,600 m^3 or more 30 sub-samples should be taken. At least half of a representative sample should be archived for at least 6 months by storage in a dark, dry place between 1 and 10ºC.

Each sample should be recorded as follows:

- Name of sampler;
- Date;
- Code of batch from which sample is taken;
- Approximate quantity of sampled batch;
- Compost particle size (if screened);
- Sample code;
- Analytical laboratory; and
- Identification of archived sample.

Details of the required frequency of sampling are shown in the following Table.

Table 2: Minimum frequency for compost sampling and testing

Parameter	**Minimum number of representative samples per quantity of compost produced**
Pathogens (human and animal indicator spp.) in Animal By-Products Compost	As specified by competent authority
Pathogens (human and animal indicator spp.) in non - Animal By-Products Compost	1 per 5,000 m^3 or 1 per 12 months whichever occurs sooner
Potentially Toxic Elements	1 per 5,000 m^3 or 1 per 12 months whichever occurs sooner
Stability/maturity	1 per 5,000 m^3 or 1 per 12 months whichever occurs sooner
Physical contaminants and stones	1 per 5,000 m^3 or 1 per 12 months whichever occurs sooner
Plant response	1 per 5,000 m^3 or 1 per 12 months whichever occurs sooner
Weed seeds and propagules	1 per 5,000 m^3 or 1 per 12 months whichever occurs sooner

Details of the parameters required for testing and the upper limits for each parameter are shown in the following Table.

Table 3: Minimum compost quality for general use

Parameter	**Unit**	**Upper Limit**
Pathogens		
Salmonella spp	25g fresh mass	Absent
Escherichia coli	CFU g^{-1} fresh mass	1,000
Potentially Toxic Elements		
Cadmium	mg kg^{-1} dry matter	1.5
Chromium	mg kg^{-1} dry matter	100

Table 3: Minimum compost quality for general use

Parameter	Unit	Upper Limit
Copper	mg kg^{-1} dry matter	200
Lead	mg kg^{-1} dry matter	200
Mercury	mg kg^{-1} dry matter	1.0
Nickel	mg kg^{-1} dry matter	50
Zinc	mg kg^{-1} dry matter	400
Stability/maturity		
Microbial respiration rate	Mg CO_2 /g organic matter/day	16
Plant response		
Germination and growth test	Reduction in germination of plants in amended compost as % of germinated plants in peat control	20
	Reduction in plant mass above surface in amended compost as % of plant mass above surface in peat control	20
	Description of any visible abnormalities	No abnormalities
Weed seeds and propagules		
Germinating weed seeds or propagule growth	Mean number per litre of compost	0
Physical contaminants		
Total glass, metal plastic and any other non-stone fragments >2 mm	% mass/mass of 'air dry' sample	0.5 (of which 0.25 is plastic)
Stones		
Stones > 4 mm in grades other than 'mulch'	% mass/mass of 'air dry' sample	8
Stones > 4 mm in 'mulch' grade	% mass/mass of 'air dry' sample	16

Appendix III – Contacts and Further Information

ENVAR contact details

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Research report

'Feasibility of Composting Wood and Cardboard Waste with Green Waste or Household Kitchen Waste: Trials Research Report' (2006) WRAP.
http://www.wrap.org.uk/wrap_corporate/publications/index.html

Site management – PAS 100:2005

Publicly Available Specification for Composted Materials PAS100:2005.
http://www.wrap.org.uk/composting/production/index.html

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