



## United Kingdom

# Setting The Standards For Compost

As composting becomes more widely used, an updated standard sets the basis for feedstocks, stability tests, monitoring procedures and overall certification methods.

*Sharon Russell and Lee Best*

**THE COMPOSTING** industry in the United Kingdom (UK) is rapidly developing in line with key commercial and regulatory drivers. Mounting landfill charges and recycling targets set by the UK Government and the European Union have brought about a huge increase in the amount of the country's organic waste finding its way into composting. This upward trend is likely to continue — a recent survey found that 38 percent of UK domestic household waste contains biodegradable organics, which means that composting has a key role to play in meeting those targets.

Four years ago, the composting industry acknowledged the need for a nationally recognized quality standard. The dual intention was to raise standards in the compost industry itself and to increase confidence in the product among end users. The British Standards Institution's Publicly Available Specification 100 (BSI PAS 100) was launched in November 2002, in conjunction with WRAP (the Waste & Resources Action Programme) and The Composting Association (TCA). As one of the first quality assurance plans for composted products in the UK, BSI PAS 100 gives professional end users, such as horticulturalists, landscapers and

greenskeepers, the confidence that they are buying a safe and consistent product.

### Development Of BSI PAS 100

WRAP was established in 2001 in response to the UK Government's Waste Strategy 2000 with a mission to promote sustainable waste management. As a not-for-profit company funded by DEFRA (Department of Environment, Food & Rural Affairs) and the political authorities in Wales, Scotland and Northern Ireland, its aims are to create and support markets for materials made from recycled products, and to increase public awareness of the need to reduce and recycle waste. With composting being a key area, developing a standard was one of its first priorities.

TCA is a membership organization for the composting industry in the UK. In 2000, TCA launched its own standard for composted products, and it was decided this would be a good basis for the new specification. An initial draft of BSI PAS 100 was developed by enhancing the content and language of the original document, and then it was offered for consultation across the composting industry. This stage was vital to ensure industry acceptance.

Four major stakeholders were included in the consultation process: Compost producers; Government departments and other agencies, such as DEFRA, the Soil Association, the National Farmers' Union and the Henry Doubleday Research Association; End users, such as the Growing Media Association, landscape architects and farmers; and Composting consultants, academics and members of the BSI steering group. Driven by a tight schedule set by WRAP, PAS 100 was completed in November 2002.

### Updating The Standard

At the original consultation, it was agreed that PAS 100 would be reviewed after two years to make any necessary improvements or to reflect updated legislation if required. In June 2005, following an intensive stakeholder review and consultation, a new, updated PAS 100:2005 was published. The updated specification has a number of improvements and enhancements, including reference to the Animal By-Products Regulations (2003) for catering and animal derived wastes that have come into effect since it was originally published.

The enhancements and additions include:

- Introduction of a new compost stability test to the PAS baseline for compost quality.
- Addition of sewage sludge cake and biodegradable packaging (certified to standard EN13432, DIN V 54900 or ASTM V 6400) as allowable inputs, subject to adequate risk control.
- The enhancement of Hazard Analysis and Critical Point planning for all compost hazards.
- Updated sanitization guidance and more pragmatic composting batch monitoring requirements.

- Simplified minimum frequency for compost sampling and testing.

There are currently more than 1 million metric tons of BSI PAS 100 composting capacity in the UK, either certified or in the certification process. Based on recent figures from TCA, this represents almost 50 percent of the UK's total processing capacity. There are now over 70 compost producers in the program, operating over 75 composting facilities, and manufacturing a range of different products suitable for landscaping, horticultural and agricultural applications.

Certification to BSI PAS 100 is achieved through TCA; it is the only UK program providing third party assessment of conformity with the specification. Compost certified by TCA is quality assured, safe, traceable and reliable, and approved producers are entitled to use the TCA mark — a seal that guarantees their compost meets these high specifications.

**BSI PAS 100:2005 Details**

BSI PAS 100:2005 covers biodegradable materials that have been kept separate from nonbiodegradables, and applies to composted feedstocks produced at centralized, on-farm and community composting facilities, although it is aimed at those organizations wanting to take composting to a commercial scale. The specification covers the whole composting process — from raw materials, process and quality control, to laboratory testing and traceability. Gaining certification by TCA involves the following phases:

*Application Phase:* Compost producers request an application packet from TCA. Standard Operating Procedures (SOP), Hazard Analysis and Critical Control Points (HACCP) and quality policy documents (explained below) are prepared. WRAP offers free consultancy support to compost producers in the application phase, which includes helping to prepare these documents. The completed application form and documentation are sent to TCA for assessment.

*Qualification Phase:* A process validation phase is carried out when first evaluating conformity with BSI PAS 100:2005 and then whenever necessary, e.g. where the compost producer makes changes in their process that could affect the quality of compost. Three batches are selected and sampled and these must pass all parameters (see Table 2) to gain BSI PAS 100. All records must be completed and kept up to date. An in-depth audit is carried out by TCA.

*Renewal Phase:* Once certification to BSI PAS 100:2005 has been achieved, it is valid for 12 months. Compost producers on the TCA certification program are audited annually and must adhere to the strict requirements of process control and monitoring as well as sampling throughout the year.

As mentioned, compost producers must submit the following documents: 1) Standard Operating Procedures describe how the risks are controlled and managed in the composting process on a day to day basis to ensure the requirements of PAS; 2) HACCP Plan is a process design tool that complements the role of quality assurance and ensures the control of hazards that are significant for compost safety; 3) Quality Policy includes a statement of commitment to achieving minimum compost quality.

A number of records need to be maintained as well. These relate to: Input material; Any feedstock that has been rejected; Staff training; Calibration of monitoring equipment; Batch for-

mation and management (temperatures, moisture, turning and weather); Maintaining traceability through the process and once the compost is sold; Compost batch appraisal; Compost sampling and analysis request records; History of laboratory results; Process validation and management review; and Product information sheets and product dispatch sheets.

A process control system, supported by accurate record keeping and document control procedures, is maintained throughout the composting process, and the system is reviewed and updated on a regular basis as part of compliance with BSI PAS 100. Included within the SOP are parameters for sanitization. Each batch must undertake a sanitization phase that acts as the control for human, animal and plant pathogens. For example, the following regime is required for eradication of selected pathogens during sanitization of green waste in a windrow system: Temperature- $\geq 65^{\circ}\text{C}$ ; Time-7 days; Moisture- $\geq 5\%$  mass/mass; Mixing/Turning- $\geq 2$  times.

During the actively managed phase, each composting batch is monitored for critical limits, including temperature, time, moisture and turning frequency. Once each phase is complete, the monitored records are evaluated to ensure that they fall within the limits stated in the SOP. If they fall outside the limits, corrective action is taken, e.g., if a batch fails to meet sanitization temperature criteria, appropriate corrective action might be to mix the batch with fresh feedstock and re-compost. Table 1 outlines the minimum process monitoring requirements.

Each compost batch that requires sampling is sent to an independent laboratory for testing. Compost is tested for all the parameters in Table 2.

BSI PAS 100 is seen as the baseline benchmark to achieve. Compost producers are encouraged to ensure that the compost they produce is "fit for purpose". The aim of the BSI PAS 100 program is to assure end users that they are buying a safe and consistent product. This consistency aspect is key and is the basis for the feedstock traceability and process control requirements of the program.

**Special Composts**

To complement BSI PAS 100, WRAP has consulted end users to develop other voluntary specifications which set further requirements e.g. pH, bulk density etc., for specific end use applications. The aim is to enable compost users to find products that not only meet the demands of the national specification, but are fit for their particular purpose. Two major end user specifications have been developed so far: Compost specification for the landscape industry; and Guidelines for the specification of composted green materials used as a growing medium component.

The compost specification for the landscape industry was launched in November 2003 and was developed in conjunction with the Landscape Institute (the landscape architects' organization) and BALI (the British Association of Landscape Indus-

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**TABLE 1. Minimum process monitoring**

Parameter	Minimum Monitoring Frequency		
	Sanitization Step	Stabilization Step	
Temperature	Every working day	Once per week	
Moisture	In vessel: once at end; Outdoor windrow: once at start	Once per week	
Batch Zone	Location And Number Of Monitoring Points		
	Turned Windrow (Open-Air or Housed)	In-vessel	Aerated static pile
Surface	0	1 per up to 250m <sup>3</sup>	1 per up to 250m <sup>3</sup>
Core	1 per up to 250m <sup>3</sup>	1 per up to 250m <sup>3</sup>	1 per up to 250m <sup>3</sup>
Basal	0	1 per up to 250m <sup>3</sup>	1 per up to 250m <sup>3</sup>

**TABLE 2. Minimum compost quality for general use**

Parameters	Test Method	Unit	Upper Limit
Pathogens			
<i>Salmonella</i> spp	ABPR 2003, schedule 2, part II or BS EN ISO 6579	25g fresh mass	Absent
<i>Escherichia coli</i>	BSI ISO 11866-3	CFU <sup>-1</sup> fresh mass	1000
Potentially toxic elements			
Cadmium	BS EN 13650 (soluble in aqua regia)	mg kg <sup>-1</sup> dry matter	1.5
Chromium	BS EN 13650 (soluble in aqua regia)	mg kg <sup>-1</sup> dry matter	100
Copper	BS EN 13650 (soluble in aqua regia)	mg kg <sup>-1</sup> dry matter	200
Lead	BS EN 13650 (soluble in aqua regia)	mg kg <sup>-1</sup> dry matter	200
Mercury	BS ISO 16772	mg kg <sup>-1</sup> dry matter	1.0
Nickel	BS EN 13650 (soluble in aqua regia)	mg kg <sup>-1</sup> dry matter	50
Zinc	EN 13650 (soluble in aqua regia)	mg kg <sup>-1</sup> dry matter	400
Stability/maturity			
microbial respiration rate	ORG0020	Mg CO <sub>2</sub> /g organic matter/day	16
Plant response			
germination & growth test	BSI PAS 100: 2005, Annex D	Reduction in germination of plants in amended compost as % of germinated plants in peat control	20
		Reduction of plant mass above the 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			
Germination weed seeds or propagules regrowth	BSI PAS 100: 2005, Annex D	Mean number per litre of compost	0
Physical contaminants			
Total glass, metal, plastic and any "other" nonstone fragments >2mm	BSI PAS 100: 2005, Annex E	% mass/mass of 'air-dry' sample	0.5 (of which 0.25 is plastic)
Stones			
Stones >4mm in grades other than "mulch"	BSI PAS 100: 2005, Annex E	% mass/mass of 'air-dry' sample	8
Stones >4mm in "mulch" grade			16

tries). One of the principal authors was Ron Alexander (R. Alexander Associates, Inc., Apex NC).

The guidelines for the specification of composted green materials used as a growing medium component were developed in conjunction with The Growing Media Association and launched in June 2004. Plans to develop a specification for agriculture are currently underway.

**Case Studies**

BSI PAS 100 compost has many satisfied users, and it is being applied in a wide variety of successful projects throughout the UK — in landscaping, horticulture, sports amenity pitches, topsoil manufacture and agriculture. Case studies include the following:

*Cardiff County Council:* Cardiff County Council Park and Gardens has been using compost produced at the Lamby council site for the past three years for both landscaping and seasonal planting. The project has been so successful that last year the council was awarded the Gold Award in the Britain in Bloom large city category. The council attributes part of this success to the compost used on the city's flowerbeds.

The Lamby Way composting site began operating in 2003, and has grown in size each year as quantities have increased. Household garden waste is collected and composted at Lamby Way, and returned to the city's parks and gardens — closing the recycling loop. "We've found the compost to be very beneficial for the soil and have seen some great results," notes the park's maintenance manager Robert Jones. "The compost helps to improve the soil structure: the soil drains better, but also manages to hold moisture in dry conditions, which reduces the need for watering."

*Eden Project, Cornwall:* The Eden Project in Cornwall was established as one of the UK's landmark Millennium projects and is now Cornwall's largest tourist attraction. Built on an old china clay quarry, the project's two vast greenhouses (biomes) contain plants, crops and landscapes from tropical regions of the world.

During the development of the 15 hectare site, natural soil was in short supply — so the project founders decided to manufacture their own topsoil using compost. With the help of the University of Reading, 85,000 metric tons were produced from a combination of mined material and composted garden waste. On a

# Compost Certification Successes On Both Sides Of The Atlantic

**Ron Alexander**

**Certification program** components vary from country to country, but typically possess a few key elements. These include: Involvement, or management, by the “trade” organization that represents the nation’s commercial composting industry; Compost quality testing; and Outreach to the marketplace.

I have been fortunate to be involved (although at different levels) with the compost certification programs in both the United States and the United Kingdom (UK) since their inception. Both programs — PAS 100 in the UK and Seal of Testing Assurance in the U.S. — certainly have their merits and have assisted their respective composting industries to establish suitable testing protocols and expand compost usage.

The following table compares the similarities and differences between the two programs. Clearly, there are far more similarities than differences. Experience with certification programs has shown that the components required to operate them will vary based upon the cultural differences and the economics of their respective industries. For instance, I have noticed that industries in the UK are more process oriented than similar industries in the U.S., often expecting process related requirements within their related regulation. Further, buyers in the UK are often more cautious (conservative) when evaluating new products than buyers in the U.S.. The PAS 100 program appropriately accounts for these cultural differences. Accordingly, the U.S. program allows for differences in state regulations and vast differences in soil and feedstock type across the country.

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## Certification comparisons

Program Components	USCC Seal of Testing Assurance Program	UK’s PAS 100 Program
Industry goals for creation	<ul style="list-style-type: none"> <li>• Improve customer confidence in compost selection and utilization</li> <li>• Improve overall customer satisfaction as well as ‘field’ results</li> <li>• Allow customer-oriented composters to differentiate themselves</li> </ul>	<ul style="list-style-type: none"> <li>• Raise quality standards for compost</li> <li>• Improve consumer confidence in compost</li> <li>• Assure end users that they are buying safe and consistent product</li> </ul>
Compost parameters tested	pH, electrical conductivity, major plant nutrients (N,P,K,Ca, Mg), moisture, organic matter, particle size, stability (evolved CO <sub>2</sub> ), maturity (plant response test), select pathogens, trace metals	Selected pathogens, potentially toxic metals, stability/maturity (evolved CO <sub>2</sub> ), weeds/propagules, plant response test, physical contaminants (stones, glass, metal & plastic), stones – plus certain operational parameters
Health & environmental standards	Must meet USEPA Part 503 standards and any other state requirements (within the state the facility is located)	Must meet program standards, which take account of requirements in European Union regulations
Complementary product standards/specifications (voluntary)	Landscape and erosion control specifications – Developed through various funding sources and loosely affiliated	Landscape and growing media specifications – Developed through Waste & Resources Action Programme (WRAP) funding and closely affiliated
Management	US Composting Council (USCC)	The Composting Association (TCA)
Sponsorship	USCC	TCA; WRAP heavily sponsors promotional activities to end users and specifiers
Current composter involvement	106 facilities, 130 products, 2.5 million tons	70 producers, 78 facilities, 1 million tons (Mt)
Certifiable feedstocks	All	Only source-separated (can include biosolids and compostable packaging)
Certification covers	Compost product (more product driven) – facilities only audited if necessary	Raw materials, process management, product, labeling and materials traceability at the facility (more process driven) – facilities are audited annually
Testing laboratories	Certified through program; test methods and procedures are specified	Certified through program; test methods and procedures are specified
Promotional activities to end users and specifying organizations	Various - funded through participation fees	Various – funded through WRAP



day to day basis, the Eden project uses a variety of recycled materials including soil improvers, composted chicken manure, bark and forestry by-products and woodchip mulch. To date, the project has used more than 200 cubic meters of BSI PAS 100 compost.

"The plants have grown superbly," says Tony Kendle, one of the directors of the Eden Project. A key factor in the decision to use compost, he adds, was the huge strides that have been made in recent years to improve the quality of the product, and the implementation of the BSI PAS 100 quality specification.

*Cantelo Nurseries:* Cantelo Nurseries is a family-run nursery based in Somerset. In 1998, it allocated 2.8 hectares of its glasshouse output to organic produce, starting with tomatoes and gradually moving into growing organic peppers and cucumbers for two large supermarket chains in the UK. The nursery uses up to 100 metric tons of BSI PAS 100 compost per hectare to improve soil health and increase yields. The compost also meets the Soil Association and Assured Produce standard for organic produce.

The nursery produces three cucumber crops and one pepper crop per year and has found that one application of com-

post is sufficient, even though cucumbers are a heavy feeding crop. Using compost allows the nursery to plant the same crop year after year as the compost replenishes nutrients and improves soil structure, which in turn leads to stronger roots and better moisture retention.

#### Future Developments

Since its launch, BSI PAS 100 has made great strides in becoming the recognized benchmark for the composting industry and end users alike. The Animal-By-Products Regulations now mean that kitchen and catering wastes are increasingly being collected and composted with in-vessel systems as part of the process. BSI PAS 100 will have an important role in complementing the requirements of these Regulations to ensure a suitable product for end use markets.

Britain is in the middle of a construction boom. The rising number of households in the UK is driving a need for new homebuilding, and the Government has set a target for 60 percent of all new homes to be built on brownfield (old derelict) land. On land contaminated by previous industrial use, soil health is a real issue. WRAP believes that there is

## On land contaminated by previous industrial use, soil health is a real issue. WRAP believes there is huge potential for using compost for land restoration projects.

huge potential for using compost for land restoration projects in the future.

There is still work to be done to increase awareness of the certification program outside the composting industry, and to educate potential users about the benefits of compost. Nonetheless, the BSI PAS 100 specification is a big step towards assuring that high quality, consistent compost is available in the UK. ■

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