

NOT MUCH ROOM FOR ERROR

Meeting the ABPR with Mushroom Batch Tunnel Composting Technology

The Team

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Introduction

The disastrous outbreak of Foot and Mouth Disease that hit the farming industry so badly, and the subsequent tug-of-war over the Animal By-Products Regulations (ABPR), has forced regulators and the UK composting industry into a frenzy of activity over the past few years. Now, the dust has settled, and it's back to business – and the question remains; can and how do we achieve the temperature regimes required by the ABPR to ensure the safe sanitisation of catering waste during enclosed composting?

With the financial support granted by WREN (using the Waste Recycling Group plc Landfill Credits), a £162,000 project was set up to answer this, and many other questions, affecting the viability of enclosed composting of biodegradable municipal waste.

This poster presents some of the findings observed in the attempt to meet the temperature requirements of the ABPR using the batch composting tunnels traditionally used to make compost for the mushroom industry.

The members of the project team have many years of practical, scientific and technical expertise from all sectors of the composting industry. They are David Border (David Border Composting Consultancy), Charlie Trousdell, Peter Johnston and Paddy Johnston (TJ Composting Ltd), Mike Hayward (Blue Prince Mushrooms Ltd), Roger Dunn (AEA Technology Ltd) and Phil Wallace and Joe Short (Enviros Consulting Ltd)

Background

The mushroom composting industry has been well established in the UK for many years. It prepares compost to grow the commercial white mushroom (*Agaricus bisporus*) from cereal straw and poultry manure.

The industry has developed a sophisticated enclosed composting technology – batch tunnel composting – in order to produce the high-specification, consistent, sanitised compost required.

Mushroom batch composting tunnels have, therefore, been developed to closely monitor and control optimal environmental conditions, including temperature, within the composting mass through careful climate control mechanisms.

This project examines the batch composting tunnels in the mushroom composting industry, and is developing ways of transferring the use of this technology to the waste composting industry.

OBJECTIVES:

The objectives of the project are to:

- 1. Examine the use of mushroom composting tunnel technology to process municipal organic waste streams; and**
- 2. Determine the extent to which the use of this technology will satisfy the Animal By-products Regulations time/temperature requirements.**

Methodology

The batch composting tunnels at the Hensby Composts Ltd composting facility at Woodhurst, Cambridgeshire were used to carry out the trials. This site has been making compost for 40 years.

Shredded civic amenity green waste was used as the standard feedstock. Similar results would be expected for materials controlled by the ABPR, such as kerbside collected kitchen waste.

Tunnels (See Figure 1 and Figure 2) were loaded as evenly as possible, to a depth of c. 2 metres, using a combination of elevator, conveyor and oscillating head, to ensure a uniform flow of air through the composting matrix, thereby allowing even temperatures to be maintained during the composting process.

A batch composting tunnel, normally used to make mushroom compost, was used for the trials. The tunnels consisted either of concrete walls and a perforated aeration floor, contained within an insulated poly-tunnel (see Figure 2), or of entirely concrete and steel construction (see Figure 1).

In both types of tunnels a fan blows air through the floor and through the compost. The air is then recirculated, ensuring that all the compost is within a very narrow temperature range. A computer allows fresh air to enter the system, thereby controlling the temperature of the compost to a predetermined level.

Temperature probes recorded temperatures in the composting matrix (see T1, T2, and T3, in Figure 3) and

at various positions (1 to 8, see Figure 3) to measure temperatures at the inner surface of the tunnel wall and at both ends of the tunnel. Probe 1 was placed nearest to the perforated floor, with subsequent probes placed equidistant up the wall. All probes were attached to computer logging devices that recorded readings at 30 minute intervals. This positioning of the probes ensured that the temperatures of the coolest parts and the hottest parts of the composting matrix were recorded.

The shredded green waste was composted until the minimum temperature inside the composting matrix was held at 60°C or more, for at least 48 hours. The material was then removed from the tunnel, mixed, and reloaded into the same tunnel.

Although compost temperatures in excess of the requirements of the ABPR were routinely obtained by microbial action alone, steam was introduced into the recirculating air at the time of pasteurization in order to ensure that these temperatures were guaranteed for all parts of the composting matrix. The introduction of steam in this way is standard procedure in the manufacture of compost for the growing of mushrooms.

Results

Figures 5 and 6 show some of the temperature profiles achieved.

Figure 5 shows that in one run, temperatures in excess of 70°C were obtained in the bulk of the compost (probes T1, T2 and T3) for longer than 12 hours both before and after refilling. This is considerably in excess of the 1 hour required under the ABPR.

Figure 6 shows that temperatures in excess of 70°C were obtained at the wall and corners of the tunnel (probes 1-8) for longer than 12 hours both before and after refilling. This is considerably in excess of the 1 hour required under the ABPR.

Although the theoretical existence of small cool spots with temperatures lower than the above could not be totally discounted, this trial shows that the temperatures of the coolest parts of the compost measured were in excess of the required minimum temperature for times considerably in excess of the requirements of the ABPR.

Discussion

i
From these findings it is clear that the time/temperature requirements of the ABPR are achievable using batch tunnel composting technology, although even with this very sophisticated composting system operations must still be monitored and controlled closely.

The requirements for a one barrier composting system (70° for 1 hour) have been shown to be achieved, using the batch tunnel technology described. The trials have also shown that the requirements for a two-barrier composting system (60°C for 48 hours twice) can also be achieved using this technology.

It is important to note that, in a properly carried out batch tunnel composting process, composting temperatures tend to rise above the levels required and the composter is actively seeking to cool the compost to avoid excess heating.

The current results go along way towards highlighting the magnitude of the task presented by the ABPR, even when using an extremely robust composting technology with a long track record.

These results suggest that operators using alternative aerated systems (without insulated air recirculation), such as in-building or covered bays, static aerated piles, or windrows, will find the temperature requirements of the ABPR very difficult to achieve.

As we have seen, whether different technologies are validated as being able to meet the requirements of the ABPR will also depend on the detail of the temperature monitoring involved. During this trial temperature

probes placed in the composting matrix, as expected, will give higher temperature readings. If the State Veterinary Service interpret the rules such that all of the compost must reach the require temperatures, probes should be placed at the bottom corners/surfaces of the composting matrix (as was conducted during this trial) in order to ensure that the minimum temperatures in the system are measured. It is not sufficient, and can be very misleading, just to measure the maximum temperatures.

We suggest to the regulators and the composting industry that our work has shown that compliance with the temp/time regime under ABPR is not straightforward. While data would indicate compliance is possible, it has already shown the level of difficulty in meeting both barriers of a two barrier system. If systems are validated using the strict positioning of sufficient probes and in the correct sensitive areas (cool spots), many systems will have the potential to fail in the absence of supplementary heat input from steam, or something similar.

There will be an increase in the number of composting technology providers coming into the UK market, making claims about the ability of their systems to meet the ABPR. To create a fair and objective market place, it is imperative that all such systems should be put through similar, independent, validation trials.

We are certain that rigorous scrutiny would expose limitations of some systems. We feel that our results highlight the serious challenge set by the ABPR. We hope these results will stimulate further debate in what we feel is a crucial area that still requires final clarification.

Figure 1: Gicom batch composting tunnels – concrete and steel construction - with filling equipment



Figure 2: Poly-tunnel batch composting tunnel – concrete internal walls and insulated poly-tunnel cover



Figure 3: Schematic diagram of a batch composting tunnel showing air circulation and temperature probe positions

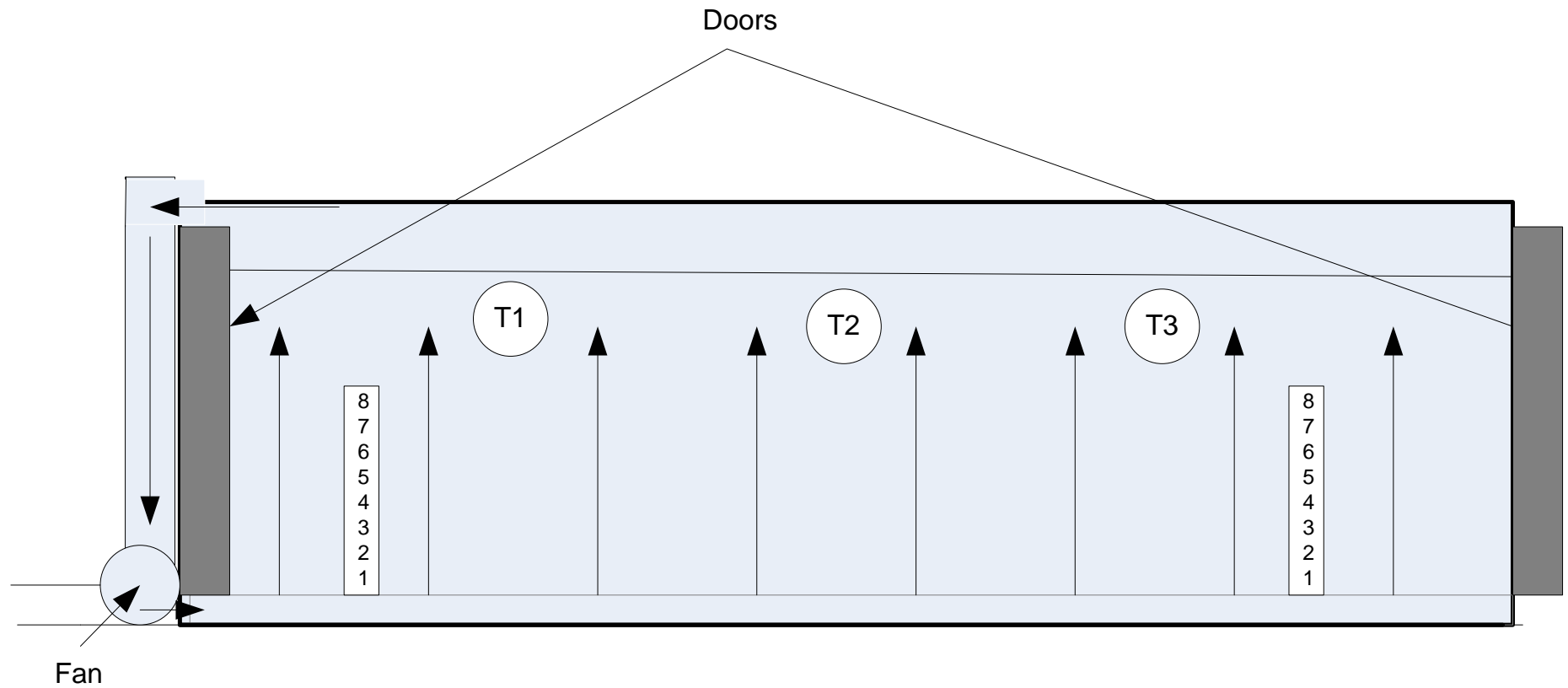
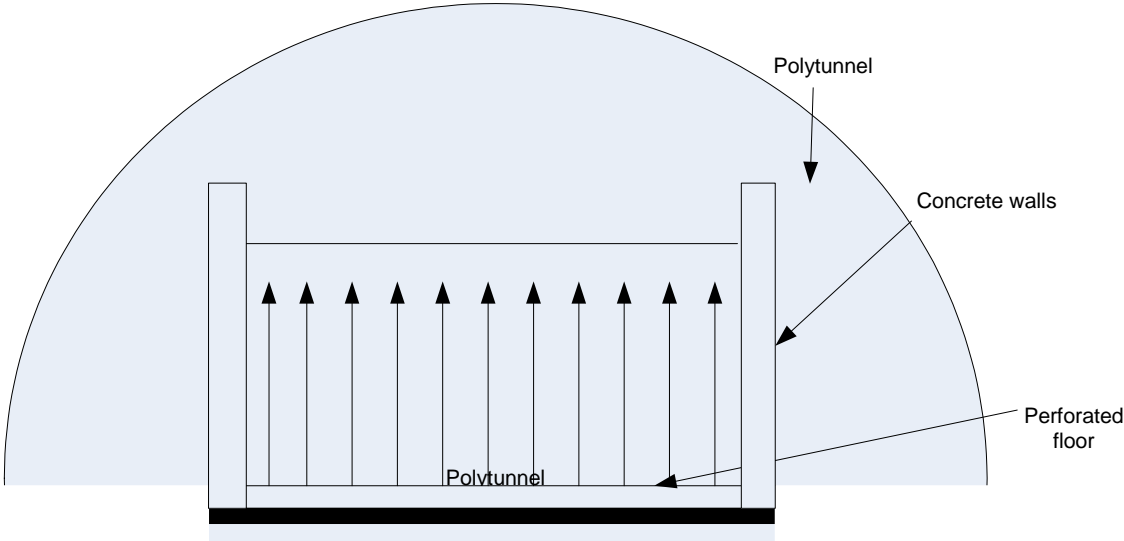
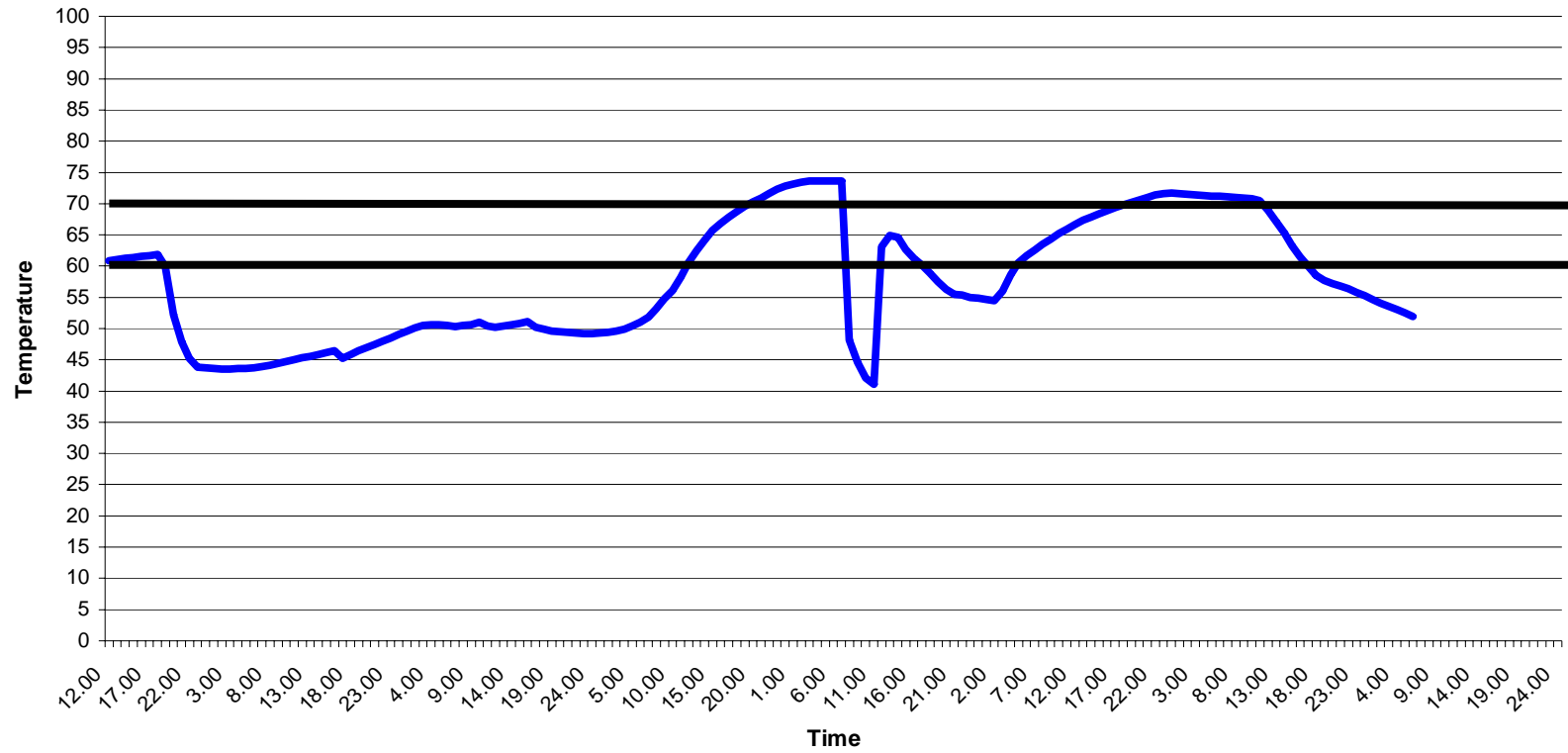


Figure 4: Schematic diagram of a batch composting tunnel – cross section



**Figure 5: Average of compost temperature probes T1, T2, T3
(60°C and 70°C levels marked)**



**Figure 6: Temperature probes at the inner surface of the tunnel wall
(60°C and 70°C levels marked)**

