Integrated Pollution Prevention and Control (IPPC) Reference Document on the General Principles of Monitoring July 2003

Section/ Aspect	BAT	How the BAT requirements will be met at the O'Toole Composting facility
	1. "Why" monitor? There are two main reasons why monitoring is included in IPPC requirements: • For compliance assessment, and • For the environmental reporting of industrial emissions. However, monitoring data can often be used for many other reasons and objectives and indeed it is often more cost effective when monitoring data obtained for one purpose can serve other purposes. In all cases it is important that the objectives for undertaking the monitoring are clear for all the parties involved.	Monitoring will be carried out in compliance with the EPA licence at the OTCL facility.
	2. "Who" carries out the monitoring? The responsibility for monitoring is generally divided between the competent authorities and the operators, although competent authorities usually rely to a large extent on "self monitoring" by the operator, and/or third party contractors. It is highly important that monitoring responsibilities are clearly assigned to all relevant parties (operators, authorities, third party contractors) so that they are all aware of how the work is divided and what their own duties and responsibilities are. It is also essential that all parties have appropriate quality requirements in place.	The monitoring will be carried out by the operator, an independent contractor and the Agency. A schedule of monitoring will be drawn up as part of the Environmental Management Plan and responsibility for each monitoring and reporting action will be assigned.
	3. "What" and "How" to monitor. The parameters to be monitored depend on the production processes, raw materials and chemicals used in the installation. It is advantageous if the parameters chosen to be monitored also serve the plant operation control needs. A risk-based approach can be used to match various levels of potential risk of environmental damage with an appropriate monitoring regime. To determine the risk the main elements to assess are the likelihood of exceeding the emission limit value (ELV) and the severity of the consequences (i.e. harm to the environment). An example of a risk-based approach is presented in Section 2.3. 4. How to express ELVs and monitoring results.	The ELV's shall be set by the EPA or determined by the operator with reference to published guideline values. The ELV's will be expressed in the appropriate parameters and

	The way ELVs, or equivalent parameters, are expressed depends on the objective for monitoring these emissions. Different types of units can be applied: concentration units, units of load over time, specific units and emission factors, etc. In all cases, the units to be used for compliance monitoring purposes should be clearly stated, they should preferably be internationally recognised and they should match the relevant parameter, application and context.	the monitoring results compared with these. The units will be clearly stated, be internationally recognised and match the relevant parameter application and context.
	5. Monitoring timing considerations. Several timing considerations are relevant for setting monitoring requirements in permits, including the time when samples and/or measurements are taken, the averaging time, and the frequency. The determination of monitoring timing requirements depend on the type of process and more specifically on the emission patterns, as discussed in Section 2.5., and should be such that the data obtained are representative of what is intended to be monitored and comparable with data from other plants. Any timing requirement of the ELV and associated compliance monitoring must be clearly defined in the permit so as to avoid ambiguity.	Timing considerations in the EPA licence will be complied with.
	6. How to deal with uncertainties. When monitoring is applied for compliance checking it is particularly important to be aware of measurement uncertainties during the whole monitoring process. Uncertainties need to be estimated and reported together with the result so that compliance assessment can be carried out thoroughly.	Uncertainties will be reported and included in the result in order that a compliance assessment can be carried out. Where necessary a repeat sample will be taken.
	Monitoring requirements to be included with ELVs in permits. These requirements should cover all relevant aspects of the ELV. To this end it is good practice to take into account the issues specified in Section 2.7, i.e. with regard to the: • Legal and enforceable status of the monitoring requirement • Pollutant or parameter being limited • Location for sampling and measurements • Timing requirements of sampling and measurements • Feasibility of limits with regard to available measurement methods • General approach to the monitoring available for relevant needs • Technical details of particular measurement methods	Monitoring will be carried out in accordance with the good practice issues specified.

	• Self-monitoring arrangements • Operational conditions under which the monitoring is to be performed • Compliance assessment procedures • Reporting requirements • Quality assurance and control requirements • Arrangements for the assessment and reporting of exceptional emissions.	
	The production of monitoring data follows several consecutive steps that all need to be performed according to either standards or method-specific instructions to ensure good quality results and harmonisation between different laboratories and measurers. This data production Chain consists of the following seven steps, described in Section 4.2: 1. Flow measurement. 2. Sampling. 3. Storage, transport and preservation of the sample. 4. Sample treatment. 5. Sample analysis. 6. Data processing. 7. Reporting of data	The procedures adopted by the operator or any contractor appointed by the operator will include these.
	The monitoring approach to be adopted in a compliance monitoring programme may be chosen, proposed or specified for use by: • The competent authority - the usual procedure • The operators –usually a proposal which still needs approval by the authority • An expert –usually an independent consultant who may propose on behalf of the operators; this proposal still needs approval by the authority. When deciding whether to approve the use of an approach in a relevant regulatory situation the competent authority is generally responsible for deciding whether the method is acceptable, based on the following considerations: • Fitness for purpose, i.e. Is the method suited to the original reason for monitoring as shown, for example, by the limits and performance criteria for an installation? • Legal requirements, i.e. Is the method in line with EU or national law? • Facilities and expertise, i.e. Are the facilities and expertise	This will be carried out by the Agency or by the operator in consultation with the Agency.

	available for monitoring adequate for the proposed method, e.g. Technical equipment, staff experience?	
	Monitoring techniques for direct measurements (specific quantitative determination of the emitted compounds at the source) vary with the applications and can be divided mainly into two types: a) Continuous monitoring b) Discontinuous monitoring. (a) Two types of continuous monitoring techniques can be considered: • Fixed in-situ (or in-line) continuous reading instruments. Here the measuring cell is placed in the duct, pipe or stream itself. These instruments do not need to withdraw any sample to analyse it and are usually based on optical properties. Regular maintenance and calibration of these instruments is essential • Fixed on-line (or extractive) continuous reading instruments. This type of instrumentation continuously extracts samples of the emission along a sampling line, transport them to an on-line measurement station, where the samples are analysed continuously. The measurement station may be remote from the duct, and therefore care must be taken so that the sample integrity is maintained along the line. This type of equipment often requires certain pre-treatment of the sample. (b) The following types of discontinuous monitoring techniques can be considered: • Instruments used for periodic campaigns. These instruments are portable and are carried to and set up at the measurement location. Normally a probe is introduced at an appropriate measurement port to sample the stream and analyse it in situ. They are appropriate for checking and also for calibration. Further information regarding campaign monitoring is given later in this section • Laboratory analysis of samples taken by fixed, in-situ, on-line samplers. These samplers withdraw the sample continuously and collect it in a container. From this container a portion is then analysed, giving a mean concentration over the total volume accumulated in the container. The amount of sample withdrawn can be proportional to time or to flow • Laboratory analysis of spot samples. A spot sample is an	Discontinuous monitoring is proposed by the operator in accordance with the specified techniques.

	instantaneous sample taken from the sampling point, the quantity of sample taken must be enough to provide a detectable amount of the emission parameter. The sample is then analysed in the laboratory providing a spot result, which is representative only of the time at which the sample was taken. Continuous monitoring techniques have the advantage over discontinuous measurement techniques that they provide a greater number of data points. They therefore provide data that is statistically more reliable and can highlight periods of adverse operating conditions for both control and evaluation purposes. Continuous monitoring techniques may also have some drawbacks: costs they may not be of much use for very stable processes the accuracy of on-line process analysers may be lower than discontinuous laboratory Analyses retrofitting an existing continuous monitoring may be difficult or even unpractical When considering the use of continuous monitoring in a particular case it is good practice to take into account the following issues, although this list may not be exhaustive: • Continuous monitoring may be a legal requirement for the sector • Continuous monitoring may be given as part of a bat technique for the sector • The required level of uncertainty • Local issues may prompt the use of continuous monitoring (e.g. Is this plant the source of higher emission levels? Is it heavily contributing to reduced local air quality?) • Public confidence tends to be higher when using continuous monitoring • Sometimes continuous monitoring is the most economical option (e.g. If continuous monitoring is needed for process control) • Extent of the environmental risk associated to the emission • Likelihood of periodic upsets • Ability to control or mitigate excessive emission • Availability of continuous measurement equipment • The requirements for the determination of total loads • Applicability of ippc directive article 10 (monitoring for air quality assessment) may be a criterion for continuous monitoring • Reliability of continuous measurement equipment • The requirements for emission trading • Availability of a system to promptly act according to the	

	continuous data.	

7. "Why" monitor?

There are two main reasons why monitoring is included in IPPC requirements:

- For compliance assessment, and
- For the environmental reporting of industrial emissions. However, monitoring data can often be used for many other reasons and objectives and indeed it is often more cost effective when monitoring data obtained for one purpose can serve other purposes. In all cases it is important that the objectives for undertaking the monitoring are clear for all the parties involved.

8. "Who" carries out the monitoring?

The responsibility for monitoring is generally divided between the competent authorities and the operators, although competent authorities usually rely to a large extent on "self monitoring" by the operator, and/or third party contractors. It is highly important that monitoring responsibilities are clearly assigned to all relevant parties (operators, authorities, third party contractors) so that they are all aware of how the work is divided and what their own duties and responsibilities are. It is also essential that all parties have appropriate quality requirements in place.

9. "What" and "How" to monitor.

The parameters to be monitored depend on the production processes, raw materials and chemicals used in the installation. It is advantageous if the parameters chosen to be monitored also serve the plant operation control needs. A risk-based approach can be used to match various levels of potential risk of environmental damage with an appropriate monitoring regime. To determine the risk the main elements to assess are the likelihood of exceeding the emission limit value (ELV) and the severity of the consequences (i.e. harm to the environment). An example of a risk-based approach is presented in Section 2.3.

10. How to express ELVs and monitoring results.

The way ELVs, or equivalent parameters, are expressed depends on the objective for monitoring these emissions. Different types of units can be applied: concentration units, units of load over time, specific units and emission factors, etc. In all cases, the units to be used for compliance monitoring purposes should be clearly stated, they should preferably be internationally recognised and they should match the relevant parameter, application and context.

11. Monitoring timing considerations.

Several timing considerations are relevant for setting monitoring requirements in permits, including the time when samples and/or measurements are taken, the averaging time, and the frequency. The determination of monitoring timing requirements depend on the type of process and more specifically on the emission patterns, as discussed in Section 2.5., and should be such that the data obtained are representative of what is intended to be monitored and comparable with data from other plants. Any timing requirement of the ELV and associated compliance monitoring must be clearly defined in the permit so as to avoid ambiguity.

12. How to deal with uncertainties.

When monitoring is applied for compliance checking it is particularly important to be aware of measurement uncertainties during the whole monitoring process. Uncertainties need to be estimated and reported together with the result so that compliance assessment can be carried out thoroughly.

13. Monitoring requirements to be included with ELVs in permits.

These requirements should cover all relevant aspects of the ELV. To this end it is good practice to take into account the issues specified in Section 2.7, i.e. with regard to the:

- Legal and enforceable status of the monitoring requirement
- Pollutant or parameter being limited
- Location for sampling and measurements
- Timing requirements of sampling and measurements
- Feasibility of limits with regard to available measurement methods
- General approach to the monitoring available for relevant needs
- Technical details of particular measurement methods
- Self-monitoring arrangements
- Operational conditions under which the monitoring is to be performed
- Compliance assessment procedures
- Reporting requirements
- Quality assurance and control requirements
- Arrangements for the assessment and reporting of exceptional emissions.

The production of monitoring data follows several consecutive steps that all need to be performed according to either standards or method-specific instructions to ensure good quality results and harmonisation between different laboratories and measurers. This data production
Chain consists of the following seven steps, described in Section 4.2:

1. Flow measurement.

2. Sampling.
3. Storage, transport and preservation of the sample.
4. Sample treatment.
5. Sample analysis.
6. Data processing.
7. Reporting of data

The monitoring approach to be adopted in a compliance monitoring programme may be chosen, proposed or specified for use by:

- The competent authority - the usual procedure
- The operators –usually a proposal which still needs approval by the authority
- An expert –usually an independent consultant who may propose on behalf of the operators; this proposal still needs approval by the authority.

When deciding whether to approve the use of an approach in a relevant regulatory situation the competent authority is generally responsible for deciding whether the method is acceptable, based on the following considerations:

- Fitness for purpose, i.e. Is the method suited to the original reason for monitoring as shown, for example, by the limits and performance criteria for an installation?
- Legal requirements, i.e. Is the method in line with EU or national law?
- Facilities and expertise, i.e. Are the facilities and expertise available for monitoring adequate for the proposed method, e.g. Technical equipment, staff experience?

Monitoring techniques for direct measurements (specific quantitative determination of the emitted compounds at the source) vary with the applications and can be divided mainly into two types:

c) Continuous monitoring
d) Discontinuous monitoring.

(c) Two types of continuous monitoring techniques can be considered:

- Fixed in-situ (or in-line) continuous reading instruments. Here the measuring cell is placed in the duct, pipe or stream itself. These instruments do not need to withdraw any sample to analyse it and are usually based on optical properties. Regular maintenance and calibration of these instruments is essential

- Fixed on-line (or extractive) continuous reading instruments. This type of instrumentation continuously extracts samples of the emission along a sampling line, transport them to an on-line measurement station, where the samples are analysed continuously. The measurement station may be remote from the duct, and therefore care must be taken so that the sample integrity is maintained along the line. This type of equipment often requires certain pre-treatment of the sample.

(d) The following types of discontinuous monitoring techniques can be considered:

- Instruments used for periodic campaigns. These instruments are portable and are carried to and set up at the measurement location. Normally a probe is introduced at an appropriate measurement port to sample the stream and analyse it in situ. They are appropriate for checking and also for calibration. Further information regarding campaign monitoring is given later in this section
- Laboratory analysis of samples taken by fixed, in-situ, on-line samplers. These samplers withdraw the sample continuously and collect it in a container. From this container a portion is then analysed, giving a mean concentration over the total volume accumulated in the container. The amount of sample withdrawn can be proportional to time or to flow
- Laboratory analysis of spot samples. A spot sample is an instantaneous sample taken from the sampling point, the quantity of sample taken must be enough to provide a detectable amount of the emission parameter. The sample is then analysed in the laboratory providing a spot result, which is representative only of the time at which the sample was taken.

Continuous monitoring techniques have the advantage over discontinuous measurement techniques that they provide a greater number of data points. They therefore provide data that is statistically more reliable and can highlight periods of adverse operating conditions for both control and evaluation purposes.

Continuous monitoring techniques may also have some drawbacks:
costs they may not be of much use for very stable processes the accuracy of on-line process analysers may be lower than discontinuous laboratory Analyses retrofitting an existing continuous monitoring may be difficult or even unpractical

When considering the use of continuous monitoring in a particular case it is good practice to take into account the following issues, although this list may not be exhaustive:

- Continuous monitoring may be a legal requirement for the sector
- Continuous monitoring may be given as part of a bat technique for the sector
- The required level of uncertainty
- Local issues may prompt the use of continuous monitoring (e.g. Is this plant the source of higher emission levels? Is it heavily contributing to reduced local air quality?)
- Public confidence tends to be higher when using continuous monitoring
- Sometimes continuous monitoring is the most economical option (e.g. If continuous monitoring is needed for process control)
- Extent of the environmental risk associated to the emission
- Likelihood of periodic upsets
- Ability to control or mitigate excessive emission
- Availability of continuous measurement equipment
- The requirements for the determination of total loads
- Applicability of ippc directive article 10 (monitoring for air quality assessment) may be a criterion for continuous monitoring
- Reliability of continuous measurement equipment
- The requirements for emission trading
- Availability of a system to promptly act according to the continuous data.