Process Guidance Note 1/12 (10)

Part B Combustion of Waste Wood in Appliances Over 0.4MW

TWG DRAFT - NOVEMBER 2010

Statutory Guidance for Local Air Pollution Prevention and Control (LAPPC)

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1. Introduction

Legal basis

1.1 This note applies to the whole of the UK. It is issued by the Secretary of State, the Welsh Assembly Government, the Scottish Government and the Department of the Environment in Northern Ireland, (DoE NI), to give guidance on the conditions appropriate for the control of emissions into the air from the combustion of fuel manufactured from or comprised of waste wood in appliances between 0.4 and 3MW rated thermal input. It is published only in electronic form and can be found on the Defra, DoENI, SEPA and WAG websites. It supersedes PG1/12 (04) and NIPG 1/12 (05) Version 2.

1.2 This guidance document is compliant with the Code of Practice on Guidance on Regulation page 6 of which contain the "golden rules of good guidance". If you feel this guidance breaches the code or you notice any inaccuracies within the guidance, please contact us.

1.3 This is one of a series of statutory notes[1] giving guidance on the Best Available Techniques (BAT)[2]. The notes are all aimed at providing a strong framework for consistent and transparent regulation of installations regulated under the statutory Local Air Pollution Prevention and Control (LAPPC) regime in England and Wales, Scotland and Northern Ireland. The note will be treated as one of the material considerations when determining any appeals against a decision made under this legislation.

1.4 In general terms, what is BAT for one installation in a sector is likely to be BAT for a comparable installation. Consistency is important where circumstances are the same. However, in each case it is, in practice, for regulators (subject to appeal) to decide what is BAT for each individual installation, taking into account variable factors such as the configuration, size and other individual characteristics of the installation, as well as the locality (e.g. proximity to particularly sensitive receptors).

1.5 The note also, where appropriate, gives details of any mandatory requirements affecting air emissions which are in force at the time of publication, such as those contained in Regulations or in Directions from the Government. In the case of this note, at the time of publication, there were no such mandatory requirements.

[1] this and other notes in the series are issued as statutory guidance in England and Wales under regulation 64(2) of the Environmental Permitting Regulations. The notes are also issued as guidance in Scotland and statutory guidance in Northern Ireland

[2] further guidance on the meaning of BAT can be found for England and Wales, Scotland, and Northern Ireland.

1.6 In **Section 4** and **Section 5**, arrows are used to indicate the matters which should be considered for inclusion as permit conditions. It is important to note, however, that this should not be taken as a short cut for regulators to a proper determination of BAT or to disregard the explanatory material which accompanies the arrows. In individual cases it may be justified to:

- include additional conditions
- include different conditions
- not include conditions relating to some of the matters indicated.

In addition, conditions will need to be derived from other parts of the note, in particular to specify emission limits, compliance deadlines and mandatory requirements arising from directions or other legislation.

Who is the guidance for?

1.7 This guidance is for:

Regulators

- local authorities in England and Wales, who must have regard to the guidance when determining applications for permits and reviewing extant permits;
- the Scottish Environment Protection Agency (SEPA) in Scotland, and district councils or the Northern Ireland Environment Agency, (NIEA), in Northern Ireland.

Operators who are best advised also to have regard to it when making applications and in the subsequent operation of their installation.

Members of the public who may be interested to know what the Government considers, in accordance with the legislation, amounts to appropriate conditions for controlling air emissions for the generality of installations in this particular industry sector.

Updating the guidance

1.8 The guidance is based on the state of knowledge and understanding, at the time of writing, of what constitutes BAT for this sector. The note may be amended from time to time to keep up with developments in BAT, including improvements in techniques, changes to the economic parameters, and new understanding of environmental impacts and risks. The updated version will replace the previous version on the Defra website and will include an index to the amendments.

1.9 Reasonable steps will be taken to keep the guidance up-to-date to ensure that those who need to know about changes to the guidance are informed of any published revisions. However, because there can be rapid changes to matters referred to in the guidance – for example to legislation – it should not be assumed that the most recent version of this note reflects the very latest legal requirements; these requirements apply.

Consultation

1.10 This note has been produced in consultation with relevant trade bodies, representatives of regulators including members of the Industrial Pollution Liaison Committee, and other potentially-interested organisations.

Policy and procedures

1.11 General guidance explaining LAPPC and setting out the policy and procedures is contained in separate documents for England and Wales, Scotland and Northern Ireland.

When to use this note

1.12 This note applies to LAPPC installations for the combustion of waste wood in appliances between 0.4 and 3MW rated thermal input and in appliances under 3MW aggregating to between 0.4 and 3MW, and such appliances over 3MW which are related to another Part B activity.

2. Timetable for compliance and reviews

Existing processes or activities

2.1 This note contains all the provisions from previous editions which have not been amended or removed. For installations in operation at the date this note is published, the regulator should have already issued or varied the permit having regard to the previous editions. If they have not done so, this should now be done.

2.2 The new provisions of this note and the dates by which compliance with these provisions is expected are listed in the table below, together with the paragraph number where the provision is to be found. Compliance with the new provisions should normally be achieved by the dates shown. Permits should be varied as necessary, having regard to the changes and the timetable.

Table 1 - Compliance timetable

Guidance	Relevant Paragraph/Row in this Note	Compliance Date
Total particulate matter - emission limit value of 150mg/^{3} for all processes	Table 3, Row 2	December 31st 2012
Carbon monoxide: Pre-1995 processes - emission limit value of 1000mg/m^3	Table 3, Row 1	December 31st 2015
Carbon monoxide: New processes less than 1MW – emission limit value of 150mg/m^3	Table 3, Row 1	December 31st 2015
All other provisions		Within 12 months of the publication of this note.

2.3 Replacement plant should normally be designed to meet the appropriate standards specified for new installations/activities.

2.4 Where provisions in the preceding guidance note have been deleted or relaxed, permits should be varied as necessary as soon as reasonably practicable. **Section 6** provides a summary of all changes.

2.5 For new activities, the permit should have regard to the full standards of this guidance from the first day of operation.

2.6 For substantially changed activities, the permit should normally have regard to the full standards of this guidance with respect to the parts of the activity that have been substantially changed and any part of the activity affected by the change, from the first day of operation.

Permit Reviews

2.7 Under LAPPC the legislation requires permits to be reviewed periodically but does not specify a frequency. It is considered for this sector that a frequency of once every eight years ought normally to be sufficient for the purposes of appropriate Regulations[3]. Further guidance on permit reviews is contained in the appropriate Guidance Manual for England and Wales, Scotland and Northern Ireland. Regulators should use any opportunities to determine the variations to permits necessitated by **paragraph 2.2** above in conjunction with these reviews.

2.8 Conditions should also be reviewed where complaint is attributable to the operation of the process and is, in the opinion of the regulator, justified.

[3] For details see England and Wales, GGM chapter 26, Scotland, Practical guide section 10, Northern Ireland Part B Guidance page 9, Northern Ireland Part C Guidance chapter 17.

3. Activity description

Regulations

3.1 This note applies to LAPPC installations for the combustion of fuel manufactured from or comprised of waste wood in appliances between 0.4 and 3MW rated thermal input and in appliances under 3MW aggregating to between 0.4 and 3MW, and such appliances over 3MW which are related to another Part B activity.

3.2 The activities are listed for regulation as follows.

Table 2 - Regulations listing activities

LAPPC	England and Wales	Scotland	Northern Ireland
	EPR Schedule 1 reference	PPC Schedule 1 reference	PPC Schedule 1 reference
Part A	n/a		
Part B	Section 1.1 Part B	Section 1.1 Part B	n/a
Part C	n/a	n/a	Section 1.1 Part C
The links are to the **original** version of the Regulations. A consolidated version is not available on http://www.legislation.gov.uk			

Waste Incineration Directive (WID)

3.3 The Waste Incineration Directive 2000/76/EC (WID) is implemented by the Environmental Permitting Regulations 2010, particularly as amended by SI 2002 / 2980. Defra have published guidance on the WID. This guidance note (PG1/12) only applies to processes that are not caught by the Directive.

3.4 In the context of this note, "process" or activity comprises the whole process from receipt of raw materials via production of intermediates to dispatch of finished products, including the treating, handling and storage of all materials and wastes relating to the process.

3.5 Notwithstanding any specific guidance contained in this note, the note **does not apply** to any activities which fall within the scope of the EU Waste Incineration Directive.

This note applies to:

- processes and activities for the burning of waste wood in any appliance with a rated thermal input of less than 3 MW but more than 400 kW; **and** ·
- processes and activities where a number of <3MW appliances are used together (whether or not simultaneously) where the aggregate rated thermal input is 400kW or more. In determining whether two or more appliances are used together, regulators should have regard to the following points

a. could the function of the appliances equally be undertaken by a single larger appliance?

b. are the appliances fed from the same fuel storage silo?

c. are the appliances connected to a common indirect heating system?

- Part B appliances which are under 400kW and which escape the preceding bullet should apply the Clean Air Act standards.
- to processes or activities where waste wood is burned in an appliance with a net rated thermal input of 3 MW or more, and that process or activity is part of another process or activity prescribed for Part B. An example is a Part B timber process with a waste wood combustion appliance over 3MW both operated by the same person at the same location.

For combustion plant where wood is used as a fuel,

- 400kW approximates to a throughput of 90kg/hr of dry material;
- whilst 3 MW approximates to a throughput of 675kg/hr of dry material.

Under LAPPC, the 0.4MW threshold is “net rated thermal input”; the 3MW threshold is “rated thermal input”, which is taken as the gross thermal input. The gross rather thermal input is larger than the net rated thermal input by the amount of heat needed to vaporise water produced by the combustion of hydrogen in the fuel (the latent heat of condensation). For wood the gross rated thermal input is up to 5% above the net rated thermal input.

3.6 This note **does not apply** to gasification processes.

3.7 This note refers to the combustion of a range of waste wood used as fuel. Some examples are given below:

Wood based waste

3.8 Waste wood, such as offcuts, chip and dust produced by woodworking operations, not regulated under the Waste Incineration Directive. The note also details the requirements for processes involving the combustion of reconstituted, coated or preserved wood - for example by the application of a surface coating or by treatment with resins and binders to produce chipboard or fibreboard). Most waste wood combustion processes within the size range covered by this Note are operated in conjunction with timber manufacturing processes, for example, the manufacture of furniture and joinery.

3.9 Wood has a low ash content and a higher volatile content than coal and consequently, along with good control of the fuel size and moisture, good combustion chamber design is essential to achieve controlled combustion, for example, good turbulence characteristics and effective secondary air supply.

3.10 Wood may be introduced into the combustion chamber as offcuts, briquettes, pellets, woodchips, sawdust and fine dust. Often waste wood is transferred in a closed system by air from a woodworking process, through a cyclone directly to a storage hopper for automated feed into the furnace, and combustion of the waste wood is therefore an integral part of the arrestment plant for woodworking processes.

3.11 Wood as fuel is normally stored in bunkers and storage silos, dependant on the fuel type, wetness and size of product. The fuel is often fed automatically by mechanical feed systems using hydraulic pushing, walking floor and screw feed systems.

3.12 Wet wood and bark is normally stored in bunkers with walking floor mechanisms to allow movement of larger pieces and prevent bridging. Dry wood chips and dust are stored in steel or concrete silos, and mechanical discharge systems that meter the material.

3.13 Wood fuel is fed into the combustion chamber mechanically by screw helix, blown in, or hydraulically pushed. Inside the combustion chamber, wood is moved by underfeed screw, blown in or moving grate.

3.14 The amount of fuel fed into the combustion chamber is controlled automatically and balanced with the amounts of primary and secondary air to complete the combustion process. In the latest plant available, programmable logic controller (PLC) control the combustion time, temperature, oxygen levels and balanced primary and secondary air.

3.15 Combustion gases are then directed into a boiler section either to produce hot water, steam or thermal fluid. Energy produced might be used for process heat, building or district heat or for combined heat and power.

3.16 Particulate matter is removed from the exhaust gases, typically by multi-cyclones, or by electrostatic precipitation, bag-filters or ceramic filters.

3.17 Wood gasifiers are under development. During the combustion of wood, combustible gases are evolved from wood which then burn. Gasifiers separate these two steps and the combustion step is in an engine or separate boiler. However this note has **not** been written to provide guidance about gasifiers.

Fig 3.1 - Solid waste boiler

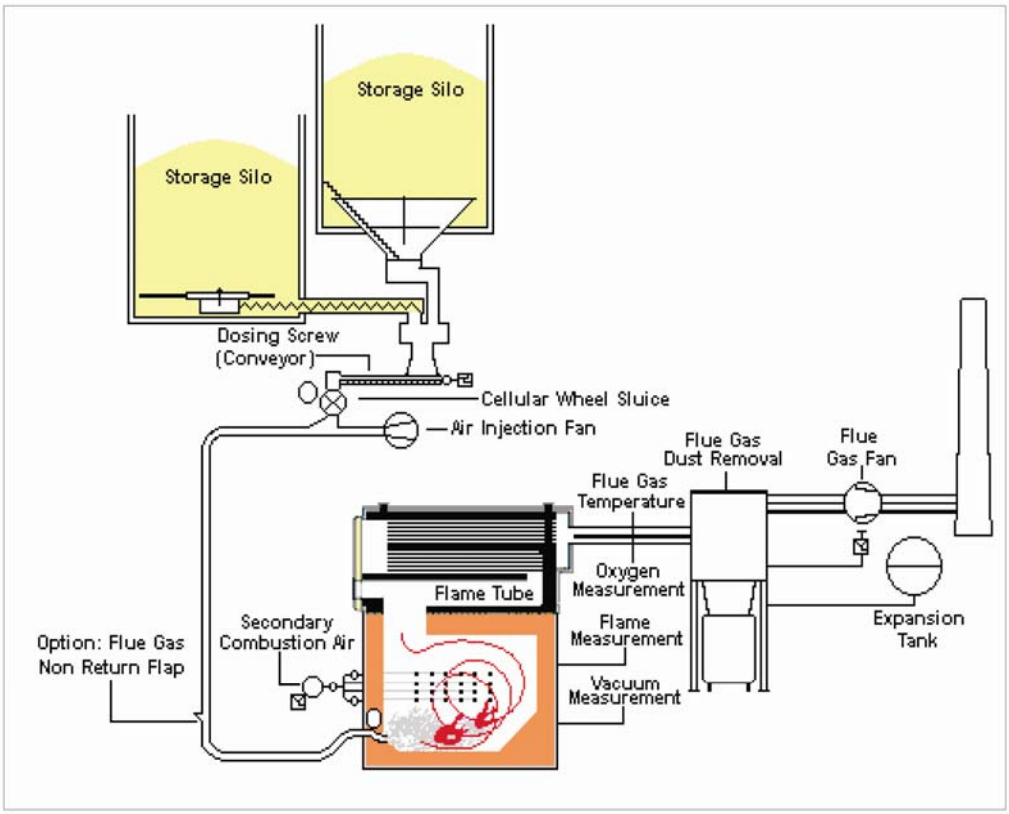
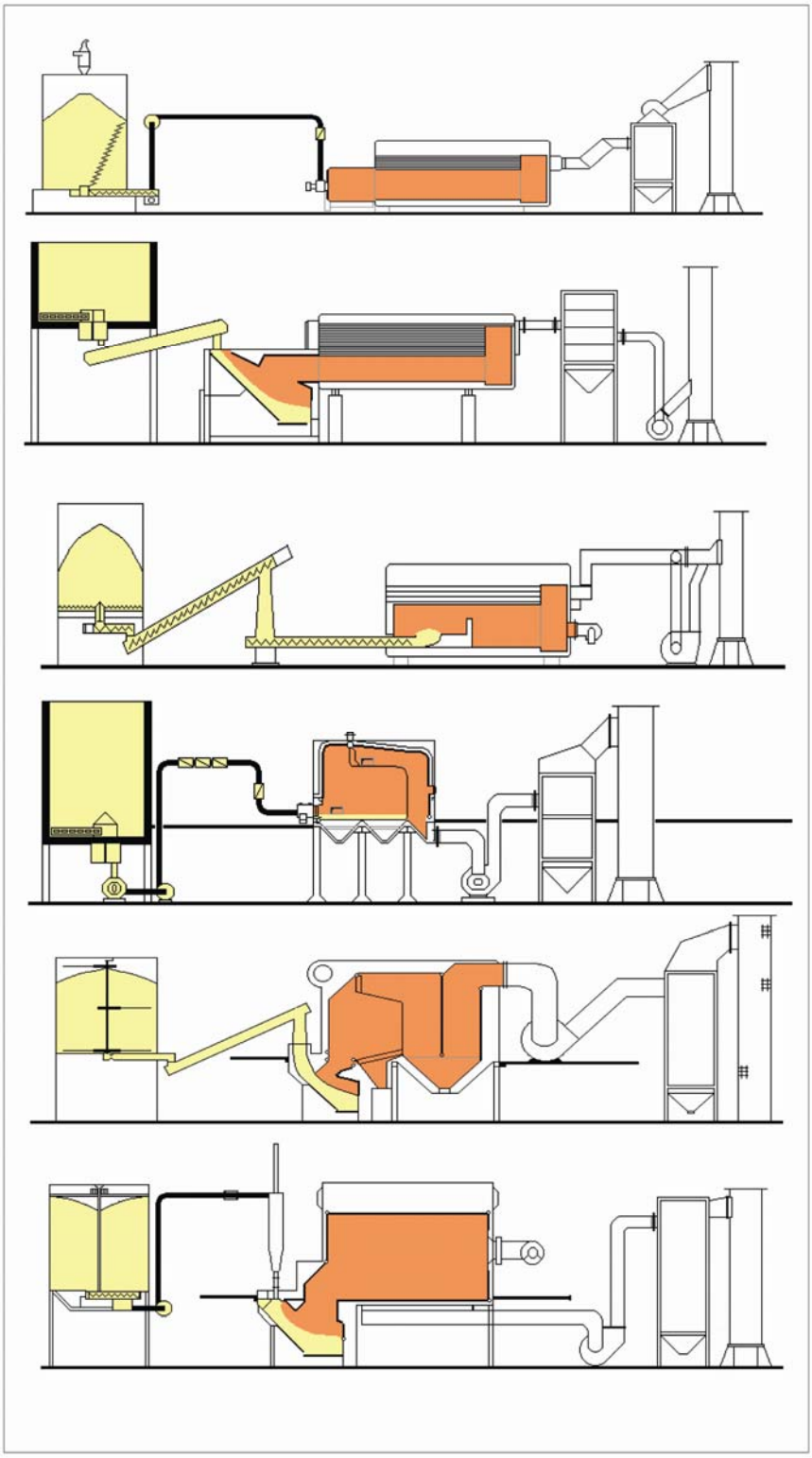


Fig 3.2 - Solid waste boiler and several feed configuarations



4. Emission limits, monitoring and other provisions

4.1 Emissions of the substances listed **Table 3** below should be controlled.

4.2 The emission limit values and provisions described in this section are achievable using the best available techniques described in **Section 5**. Monitoring of emissions should be carried out according to the method specified in this section or by an equivalent method agreed by the regulator. Where reference is made to a British, European, or International standard (BS, CEN or ISO) in this section, the standards referred to are correct at the date of publication. (Users of this note should bear in mind that the standards are periodically amended, updated or replaced. The latest information regarding the monitoring standards applicable can be found at the Source Testing Association website. Further information on monitoring can be found in Environment Agency publications (M1) and (M2)).

4.3 All activities should comply with the emission limits and provisions with regard to releases in **Table 3**.

The reference conditions for limits in **Section 4** are: 273.1K, 101.3kPa, 11% oxygen (or 9% carbon dioxide).

Table 3 - Emission limits, monitoring and other provisions

Row	Substance	Source	Emission limit/ provisions	Type of monitoring	Monitoring frequency (subject to paragraphs 4.19 – 4.21)
1	Carbon monoxide	Processes existing as at 1 Dec 1995	1000 mg/m^3	Continuous, quantitative monitoring, visual and audible alarm and record.	Continuous - see paragraphs 4.11 – 4.13, 4.15, 4.17 and 4.21
				PLUS	**PLUS**
				Manual extractive testing - see paragraphs 4.16, 4.17, 4.19 and 4.20	Annual
				Disregard: • 30 minutes from cold start	
		Processes less than 1MW	New Plant: • 150 mg/m^3	Continuous, quantitative monitoring, visual and audible alarm and record.	Continuous - see paragraphs 4.11 – 4.13, 4.15, 4.17 and 4.21
				PLUS	**PLUS**
				Manual extractive testing - see paragraphs 4.16, 4.17, 4.19 and 4.20	Annual
				Disregard: • 15 minutes from cold start	
			Existing Plant: • 250 mg/m^3	Continuous, quantitative monitoring, visual and audible alarm and record.	Continuous - see paragraphs 4.11 – 4.13, 4.15, 4.17 and 4.21
				PLUS	**PLUS**
				Manual extractive testing - see paragraphs 4.16, 4.17, 4.19 and 4.20	Annual
				Disregard: • 30 minutes from cold start	
		Processes over 1MW	New Plant: • 150 mg/m^3	Continuous, quantitative monitoring, visual and audible alarm and record.	Continuous - see paragraphs 4.11 – 4.13, 4.15, 4.17 and 4.21
				PLUS	**PLUS**
				Manual extractive testing - see paragraphs 4.16, 4.17, 4.19 and 4.20	Annual
				Disregard: • 15 minutes from cold start	
			Existing Plant: • 150 mg/m^3	Continuous, quantitative monitoring, visual and audible alarm and record.	Continuous - see paragraphs 4.11 – 4.13, 4.15, 4.17 and 4.21
				PLUS	**PLUS**
				Manual extractive testing - see paragraphs 4.16, 4.17, 4.19 and 4.20	Annual
				Disregard: • 30 minutes from cold start	

2	Total particulate matter	All processes	All processes: • 150 mg/m^3	Continuous, quantitative monitoring, visual and audible alarm and record.	Continuous - see paragraphs 4.11 – 4.13, 4.15, 4.17 and 4.21
				PLUS	**PLUS**
				Manual extractive testing - see paragraphs 4.16, 4.17, 4.19 and 4.20	Annual
3	Oxygen **or** Carbon dioxide	All processes where continuous carbon monoxide monitoring is provided	Continuous quantitative concentration and record - see paragraphs 4.11 – 4.13, 4.15, 4.17 and 4.21		
4	Organic compounds	All processes	20 mg/m^3	Manual extractive testing - see paragraphs 4.16, 4.17, 4.19 and 4.20	Annual
If appropriate, any of the following limits and provisions should be imposed:					
5	Hydrogen cyanide	For melamine-faced fuels	5 mg/m3	Manual extractive testing - see paragraphs 4.16, 4.17, 4.19 and 4.20	Annual
6	Formaldehyde	For plywood, chipboard, fibreboard and similar fuels	5 mg/m3	Manual extractive testing - see paragraphs 4.16, 4.17, 4.19 and 4.20	Annual
Continuous carbon monoxide monitoring is not required for plant burning only raw wood.					

Monitoring, investigating and reporting

4.4 The operator should monitor emissions, make tests and inspections of the activity. The need for and scope of testing, (including the frequency and time of sampling), will depend on local circumstances.

- The operator should keep records of inspections, tests and monitoring, including all non-continuous monitoring, inspections and visual assessments. The records should be:
  - kept on site
  - kept by the operator for at least two years; and
  - made available for the regulator to examine

- If any records are kept off-site they should be made available for inspection within one working week of any request by the regulator.

Information required by the regulator

4.5 The regulator needs to be informed of monitoring to be carried out and the results. The results should include process conditions at the time of monitoring.

- The operator should notify the regulator at least 7 days before any periodic monitoring exercise to determine compliance with emission limit values. The operator should state the provisional time and date of monitoring, pollutants to be tested and the methods to be used.
- The results of non-continuous emission testing should be forwarded to the regulator within 8 weeks of completion of the sampling.
- Adverse results from **any** monitoring activity (both continuous and non-continuous) should be investigated by the operator as soon as the monitoring data has been obtained. The operator should:
  - identify the cause and take corrective action
  - clearly record as much detail as possible regarding the cause and extent of the problem, and the remedial action taken.
  - re-test to demonstrate compliance as soon as possible; and inform the regulator of the steps taken and the re-test results.

Visible Emissions

4.6 The aim should be to prevent any visible airborne emission from any part of the process. This aim includes all sites regardless of location. Monitoring to identify the origin of a visible emission should be undertaken and a variety of indicative techniques are available. Further information on visible emissions monitoring can be found in Environment Agency publication **M9** (Ambient Monitoring Methods).

- Where ambient monitoring is carried out it may also be appropriate for the regulator to specify recording of wind direction and strength.
- Where combustion units are in use for dryers then the combustion process should be controlled and equipment maintained as appropriate.

4.7 Emissions from combustion processes should in normal operation be free from visible smoke. During start up and shut down the emissions should not exceed the equivalent of Ringelmann Shade 1 as described in British Standard BS 2742: 2009

- All other releases to air, other than condensed water vapour, should be free from persistent visible emissions.
- All emissions to air should be free from droplets.

Where there are problems that, in the opinion of the regulator, may be attributable to the installation, such as local complaints of visual emissions or where dust from the installation is being transported off the site, the operator should inspect in order to find out which operation(s) is the cause.

If this inspection does not lead to correction of the problem then the operator should inform the regulator in order to determine whether ambient air monitoring is necessary. Ambient monitoring may either be by a British Standard method or by a method agreed with the regulator.

Whilst problems are ongoing, a visual check should also be made once per day when an installation is being operated. The time, location and result of these checks, along with weather conditions such as indicative wind direction and strength, should be recorded. Once the source of the emission is known, corrective action should be taken without delay.

Emissions of Odour

4.8 The overall aim should be that all emissions are free from offensive odour outside the site boundary, as perceived by the regulator. However, the location of the installation will influence the assessment of the potential for odour impact for local meteorological conditions which may lead to poor dispersion conditions. Where the site has a low odour impact due to its remoteness from sensitive receptors, the escape of offensive odour beyond the installation would be unlikely to cause harm.

Where there are problems that, in the opinion of the regulator, may be attributable to the installation, such as local complaints of odour or where odour from the installation is being transported off the site, the operator should inspect in order to find out which operation(s) is the cause.

Whilst problems are ongoing, a boundary check should also be made once per day when an installation is being operated. The time, location and result of these checks, along with weather conditions such as indicative wind direction and strength, should be recorded. Once the source of the emission is known, corrective action should be taken without delay.

Abnormal Events

4.9 The operator should respond to problems which may have an adverse effect on emissions to air.

- In the case of abnormal emissions, malfunction or breakdown leading to abnormal emissions the operator should:
  - investigate and undertake remedial action **immediately**
  - adjust the process or activity to minimise those emissions; **and**
  - promptly record the events and actions taken.

- The regulator should be informed without delay, whether or not there is related monitoring showing an adverse result:
  - if there is an emission that is likely to have an effect on the local community; **or**
  - in the event of the failure of key arrestment plant, for example, bag filtration plant or scrubber units.

- The operator should provide a list of key arrestment plant and should have a written procedure for dealing with its failure, in order to minimise any adverse effects

Start up and shutdown

4.10 Higher emissions may occur during start-up and shut-down of a process. These emissions can be reduced, by minimising, where possible, the number of start-ups and shut-downs and having adequate procedures in place for start-up, shut-down and emergency shut-downs.

All appropriate precautions must be taken to minimise emissions during start-up and shutdown.

Continuous Monitoring

4.11 Continuous monitoring can be either “quantitative” or “indicative”. With quantitative monitoring the discharge of the pollutant(s) of concern is measured and recorded numerically. For pollution control this measurement is normally expressed in milligrams per cubic meter of air, (mg/m^3). Where discharge of the pollutant concerned is controlled by measuring an alternative parameter, (the “surrogate” measurement), this surrogate is also expressed numerically.

Continuous indicative monitoring is where a permanent device is fitted, for example, to detect leaks in a bag filter, but the output, whether expressed numerical or not, does not show the true value of the discharge. When connected to a continuous recorder it will show that emissions are gradually (or rapidly) increasing, and therefore maintenance is required. Alternatively it can trigger an alarm when there is a sudden increase in emissions, such as when arrestment plant has failed.

4.12 Where continuous indicative monitoring has been specified the information provided should be used as a management tool. Where used the monitor should be set up to provide a baseline output when the plant is known to be operating under the best possible conditions and emissions are complying with the requirements of the permit. Where used to trigger alarms the instrument manufacturer should be able to set an output level which corresponds to around 75% of the emission limit. Thus the alarms are activated in response to this significant increase in pollutant loading above the baseline, so that warning of the changed state is given before an unacceptable emission occurs. The regulator may wish to agree the alarm trigger level.

4.13 Where continuous monitoring is required, it should be carried out as follows:

- All continuous monitoring readings should be on display to appropriately trained operating staff.
- Instruments should be fitted with audible and visual alarms, situated appropriately to warn the operator of arrestment plant failure or malfunction.
- The activation of alarms should be automatically recorded.

- All continuous monitors should be operated, maintained and calibrated (or referenced, in the case of indicative monitors) in accordance with the manufacturers' instructions, which should be made available for inspection by the regulator. The relevant maintenance and calibration (or referencing, in the case of indicative monitors) should be recorded.
- Emission concentrations may be reported as zero when the plant is off and there is no flow from the stack. If required a competent person should confirm that zero is more appropriate than the measured stack concentration if there is no flow.
- Any CEM used should provide reliable data>95% of the operating time, (i.e. availability >95%). A manual or automatic procedure should be in place to detect instrument malfunction and to monitor instrument availability

Calibration and compliance monitoring

4.14 Compliance monitoring can be carried out either by use of a continuous monitor (CEM), or by a specific extractive test carried out at a frequency agreed with the regulator.

4.15 Where a CEM is used for compliance purposes it must be periodically checked, (calibrated), to ensure the readings being reported are correct. This calibration is normally done by carrying out a parallel stand-alone extractive test and comparing the results with those provided by the CEM.

4.16 For extractive testing the sampling should meet the following requirements:

- For batch processes, where the production operation is complete within, say, 2 hours, then the extractive sampling should take place over a complete cycle of the activity; **and**
- For all activities the sampling period should be sufficient such that at least 3 results are obtained.

4.17 Should the activity either be continuous, or have a batch cycle that is not compatible with the time available for sampling, then the data required should be obtained over a minimum period of 2 hours in total.

- For demonstration of compliance where a CEM is used no daily mean of all 15-minute mean emission concentrations should exceed the specified emission concentration limits during normal operation (excluding start-up and shut-down); **and**
- no 15-minute mean emission concentration should exceed twice the specified emission concentration limits during normal operation (excluding start-up and shut-down).
- For extractive testing, no result of monitoring should exceed the emission limit concentrations specified.

4.18 Exhaust flow rates should be consistent with efficient capture of emissions, good operating practice and meeting the requirements of the legislation relating to the workplace environment.

- The introduction of dilution air to achieve emission concentration limits should not be permitted.

Dilution air may be added for waste gas cooling or improved dispersion where this is shown to be necessary because of the operational requirements of the plant, but this additional air should be discounted when determining the mass concentration of the pollutant in the waste gases.

Varying of monitoring frequency

4.19 Where non-continuous quantitative monitoring is required, the frequency may be varied. Where there is consistent compliance with emission limits, regulators may consider reducing the frequency. However, any significant process changes that might have affected the monitored emission should be taken into account in making the decision.

4.20 The following should be considered when deciding whether compliance is consistent:

a. the variability of monitoring results, for example, results which range from 15 - 45mg/m^3, against an emission limit of 50mg/m^3 might not qualify for a reduction in monitoring.

b. the margin between the results and the emission limit, for example, results which range from 45 - 50mg/m^3 when the limit is 50mg/m^3 might not qualify for a reduction in monitoring.

Consistent compliance should be demonstrated using the results from at least;

- three or more monitoring exercises within two years; or
- two or more monitoring exercises in one year supported by continuous monitoring.

Where a new or substantially changed process is being commissioned, or where emission levels are near to or approach the emission concentration limits, regulators should consider increasing the frequency of testing.

4.21 Where continuous quantitative or indicative monitoring is required it is not appropriate that reduced monitoring be applied as the monitoring is required to demonstrate either compliance with emission limits on an ongoing basis or to demonstrate correct functioning of arrestment equipment.

Monitoring of unabated releases

4.22 Where emission limit values are consistently met without the use of abatement equipment, the monitoring requirement for those pollutants should be dispensed with subject to the “Varying of monitoring frequency” paragraphs above.

4.23 Care is needed in the design and location of sampling systems in order to obtain representative samples for all release points. The operator should ensure that adequate facilities for sampling are provided on vents or ducts. Sampling points on new plant should be designed to comply with the British or equivalent standards.

Where monitoring is not in accordance with the main procedural requirements of the relevant standard, deviations should be reported as well as an estimation of any error invoked.

Sampling provisions

4.24 Whether sampling on a continuous or non-continuous basis care is needed in the design and location of sampling systems in order to obtain representative samples for all release points.

- Sampling points on new plant should be designed to comply with the British or equivalent standards, (see **paragraph 4.2**).
- The operator should ensure that relevant stacks or ducts are fitted with facilities for sampling which allow compliance with the sampling standards.

5. Control techniques

Summary of best available techniques

5.1 The following table provides a summary of the best available techniques that can be used to control the process in order to meet the emission limits and provisions in **Section 4**. Provided that it is demonstrated to the satisfaction of the regulator that an equivalent level of control will be achieved, then other techniques may be used.

Table 4 - Summary of control techniques

Release Source	Fuel	Substance	Control Technique
Fuel Store	All fuels	Particulate matter	• Silos, or enclose, cover. • Automatic fuel feed
Flue gas	All fuels	Particulate matter	Cyclone or filter exhaust gases
		Carbon monoxide	Good combustion
		Volatile organic compounds including PAHs	Good combustion
	Plywood, chipboard, fibreboard etc	Formaldehyde	Good combustion
		Nitrogen oxides	Avoid excessive temperatures
	Melamine faced wood	Hydrogen cyanide, nitrogen oxides	Less melamine burnt, good combustion
Ash		Particulate matter	Contained ash storage and handling, filter emissions to air

Techniques to control emissions from contained sources

Good combustion

5.2 Good combustion needs management and control of a number of parameters:

- fuel content and its rate of feed;
- primary and secondary air;
- temperature in the chamber and the heat exchanger;
- oxygen levels

Controls that also use levels of carbon monoxide and inflammables are possible but uncommon.

Continuous feed produces better combustion than stop-start burning. Furnace design, combustion controls and operation are as important as fuel control to produce low levels of emissions.

Design

5.3 Modern boilers may have:

- Re-circulated flue gases to ensure optimum combustion, with minimum excess air.
- Sophisticated electronic control systems that monitor all the components of the flue gas, and make adjustments to fuel and air flows to maintain conditions within specified parameters.
- Greatly improved turndown ratios (the ratio between maximum and minimum firing rates) which enable efficiency and emission parameters to be satisfied over a greater range of operation.

5.4 Matching the heat requirement with the waste load promotes good control. When the heat requirement is low and the waste load is high, a heat dump will be needed to dissipate unwanted heat.

A multi-compartment combustor might be set up for different fuels in the separate compartments. Separate stokers could handle different sized fuels.

5.5 Leakage of gases in or out of the combustion and flue systems is undesirable and inefficient.

- Combustion chambers, casings, ductwork and ancillary equipment should be made and maintained as gas tight as is practicable.

5.6 The furnace should be designed with the aim of minimising the period of time during which the operator needs to gain access to the combustion space for the purpose of de-ashing.

For **existing** processes, automatic de-ashing systems should be used wherever practicable with regard to combustion plant design.

For **new** processes above 1MW:

- Automatic de-ashing systems should be used.

Oxygen Trim

5.7 Accurate control of the amount of air is essential to boiler efficiency. More air than the theoretical minimum requirement for complete combustion is usually supplied for the following reasons.

- Ensure stable combustion and prevent the formation of carbon monoxide (CO);
- Allow for variations in the required air-to-fuel ratio due to combustion air temperature, pressure and humidity changes;
- Allow for slight variations in the chemical composition of the fuel gas and its supply pressure;
- Allow for operating range inconsistencies of fuel-to-air ratio control equipment such as valves, linkages and regulators;
- Provide good air–fuel mixing in order to ensure complete combustion over the operating range of the burner;

5.8 Although it may be possible to monitor and adjust the burner on a daily basis, it is not practical. Automatic O_2 systems continuously monitor the flue gases and adjust the burner air supply. They are generically called 'O_2 Trim Systems'.

Burners and burner control systems

5.9 Burners are the devices responsible for:

- Proper mixing of fuel and air in the correct proportions, for efficient and complete combustion;
- Determining the shape and direction of the flame.

5.10 An important function of burners is turndown. This is usually expressed as a ratio and is based on the maximum firing rate divided by the minimum controllable firing rate.

5.11 Burner control systems range from very simple on/off types to complex modulating systems capable of matching boiler load across the whole turndown ratio, thereby saving energy and increasing efficiency.

Temperature

5.12 On start-up from cold, prior to the introduction of reconstituted wood into the furnace, the combustion zone temperature needs to be raised.

To meet the provisions of this note, either an ancillary burner fired by gas or oil, or raw wood should be used.

- Reconstituted wood should not be burnt during the start-up from cold.

Carbon monoxide

5.13 Carbon monoxide (CO) is a good indicator of poor combustion, formed by the incomplete combustion of carbonaceous fuels. No techniques are available for its removal, but good combustion will minimise it. Maintaining adequate oxygen levels is the main technique.

With too much excess air, however, there will be considerable particulate carryover, a drop in temperature and thermal efficiency, and increased production of PAH (polyaromatic hydrocarbons).

When the burner is idling, carbon monoxide concentrations can rise significantly.

- Idling should not be permitted.

Particulate Matter (PM_{10} and $PM_{2.5}$)

5.14 Good combustion techniques minimise emissions of uncombusted gaseous and solid carbon emitted as particulate matter (PM_{10}). Significantly greater quantities of PM_{10} are emitted by poor combustion, when ash plus black or brown carbon is emitted.

5.15 $PM_{2.5}$ is produced when there is poor combustion. When there is too high a temperature and insufficient oxygen, soot is formed (black carbon). When the temperature is too low, then combustion is incomplete and tarry matter is emitted that contains polyaromatic hydrocarbons (brown carbon).

Polyaromatic Hydrocarbons (PAH)

5.16 Polyaromatic hydrocarbon emissions (PAH) are minimised by good combustion. PAH is emitted principally at start up from cold, and also during ordinary combustion. Cool-down produces very little PAH. Fuel with a narrow size and moisture distribution burns much better than mixed-size fuels or fuel of variable moisture level. Limiting chlorine in the fuel, good combustion and low particulate emissions minimise the emission of PCDD/F (polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans).

Fuel control

5.17 Variation in fuel size and moisture content limits the ability of combustion control systems to produce good combustion. Uncovered storage of fuels should be avoided to keep fuel dry. The separate storage and feeding of offcuts, briquettes, woodchips and dust allows improved control if there are difficulties in complying with the emission limits.

5.18 Part of the chlorine in the material burnt becomes hydrogen chloride during combustion. Control is by restricting the amount of PVC and other chlorine containing materials burnt. PVC wrapping from baling systems would release chlorine into the combustion. Non-PVC wrapping is available.

- PVC wrappings should not be burnt.

Fuel feed

5.19 Automatic fuel feed systems prevent the emission of smoke fumes and other substances during charging and promote better combustion by charging little and often.

For **existing** processes, automatic feed systems should be used wherever practicable with regard to combustion plant design.

For **new** processes:

- Automatic fuel feed systems should be used.

Abatement of Particulate Matter

5.20 Abatement will be needed to remove soot and ash from the exhaust gases.

5.21 Multicyclones are often used as a first stage gas cleaning device, however they are limited in their capacity to efficiently separate particles smaller than 5microns. Additionally, where boilers for operated at part-load or with periodic on/off operation, particle removal is often ineffective.

Ceramic filters would be able to filter gases at raised temperature. Fabric filters would need the gases to be cooled before filtration.

Techniques to control fugitive emissions

5.22 Stocks of dusty, or potentially dusty, materials can be stored, for example, with covering and screening that prevent wind whipping. Ash and abatement plant dust can be kept enclosed and bag filters can prevent emissions to air at transfer points. Covering stocks of offcuts and bales of wood will prevent wind whipping of dust and rain increasing the moisture content. All woodchips and sawdust should be stored in covered containers or purpose-built silos.

Where the wood waste is delivered to the silo automatically from the production process, displacement air should be discharged through suitable arrestment plant, for example a bag filter.

Attention is drawn to the fire and explosion risks associated with moving wood dust and wood waste.

- All waste fuels and all dusty or potentially dusty materials should be stored in covered containers, purpose-built silos or undercover.

5.23 Normally, when producing woodchips or shredding bales, a machine under negative pressure will minimise the emission of particulate matter.

- Shredding of offcuts and bales should be done in a machine under negative pressure vented to suitable arrestment plant - for example a bag filter.

5.24 Dusty or potentially dusty spillages can be cleaned up promptly, without dry sweeping. Major spillages need vacuum cleaning which can be brought to site the same day. A high standard of housekeeping is needed. Prevention is preferable but external dust on structures and roofs is prone to wind entrainment, and needs clearing up. Loading to and from stockpiles should be carried out so as to minimise emissions to the air.

- All spillages should be cleared up promptly by vacuum cleaning, wet methods, or other appropriate techniques. Dry sweeping of dusty spillages should not be permitted. Wet material from spillages should be dried before being burnt.

- All ductwork and piping used to deliver fuel to the storage system and combustion plant should be leakproof to prevent the emission of particulate matter.
- A high standard of housekeeping should be maintained.

Silos and supply hoppers

- Silos and supply hoppers to baling, shredding or combustion plant should be fitted with a high level alarm or volume indicator to warn of overfilling.
- The delivery system should be provided with an interlock to prevent the silo or supply hopper being overfilled. The interlock mechanism should cause the material to be discharged to an alternative storage container, where necessary vented to suitable arrestment plant.

Air Quality

Dispersion & Dilution

5.25 Pollutants that are emitted via a stack require sufficient dispersion and dilution in the atmosphere to ensure that they ground at concentrations that are deemed harmless. This is the basis upon which stack heights are calculated using HMIP Technical Guidance Note D1 **(D1).** The stack height so obtained is adjusted to take into account local meteorological data, local topography, nearby emissions and the influence of plant structure.

The calculation procedure of D1 is usually used to calculate the required stack height but alternative dispersion models may be used in agreement with the regulator. An operator may choose to meet tighter emission limits in order to reduce the required stack height.

5.26 Where an emission consists purely of air and particulate matter, (i.e. no products of combustion or any other gaseous pollutants are emitted) the above provisions relating to stack height calculation for the purpose of dispersion and dilution should not normally be applied. Revised stack height calculations should not be required as a result of publication of this revision of the PG note, unless it is considered necessary because of a breach or serious risk of breach of an EC Directive limit value or because it is clear from the detailed review and assessment work that the permitted process itself is a significant contributor to the problem.

Ambient air quality management

5.27 In areas where air quality standards or objectives are being breached or are in serious risk of breach and it is clear from the detailed review and assessment work under Local Air Quality Management that the permitted process itself is a significant contributor to the problem, it may be necessary to impose tighter emission limits. If the standard that is in danger of being exceeded is not an EC Directive requirement, then industry is not expected to go beyond BAT to meet it. Decisions should be taken in the context of a local authority's Local Air Quality Management action plan. For example, where a permitted process is only responsible to a very small extent for an air quality problem, the authority should not unduly penalise the operator of the process by requiring disproportionate emissions reductions. Paragraph 59 of the Air Quality Strategy 2007 [Volume 1] gives the following advice:

"...In drawing up action plans, local authority environmental health/pollution teams are expected to engage local authority officers across different departments, particularly, land-use and transport planners to ensure the actions are supported by all parts of the authority. In addition, engagement with the wider panorama of relevant stakeholders, including the public, is required to ensure action plans are fit-for-purpose in addressing air quality issues. It is vital that all those organisations, groups and individuals that have an impact upon local air quality, buy-in and work towards objectives of an adopted action plan."

5.28 In the context of this note (PG1/12) there may be cases where, for air quality reasons, ceramic filters, electrostatic precipitators (ESP) or techniques which achieve a similar level of PM and NOx abatement, are considered, in a particular location, to amount to BAT.

Stacks, vents and process exhausts

5.29 Liquid condensation on internal surfaces of stacks and exhaust ducts might lead to corrosion and ductwork failure or to droplet emission. Adequate insulation will minimise the cooling of waste gases and prevent liquid condensation by keeping the temperature of the exhaust gases above the dewpoint. A leak in a stack/vent and the associated ductwork, or a build up of material on the internal surfaces may effect dispersion:

- Flues and ductwork should be cleaned to prevent accumulation of materials, as part of the routine maintenance programme.

5.30 When dispersion of pollutants discharged from the stack (or vent) is necessary, the target exit velocity should be 15m/sec under normal operating conditions, (but see paragraph below regarding wet plumes).

In order to ensure dispersion is not impaired by either low exit velocity at the point of discharge, or deflection of the discharge, a cap, or other restriction, should not be used at the stack exit. However, a cone may sometimes be useful to increase the exit velocity to achieve greater dispersion.

5.31 An exception to the above is where wet arrestment is used as the abatement. Unacceptable emissions of droplets could occur from such plant where the linear velocity in the stack exceeds 9 m/sec.

To reduce the potential of droplet emissions a mist eliminator should be used. Where a linear velocity of 9m/sec is exceeded in existing plant, consideration should be given to reducing this velocity as far as practicable to ensure such droplet entrainment and fall-out does not happen.

Management

Management techniques

5.32 Important elements for effective control of emissions include:

- proper management, supervision and training for process operations;
- proper use of equipment;
- effective preventative maintenance on all plant and equipment concerned with the control of emissions to the air; **and**
- ensuring that spares and consumables (in particular, those subject to continual wear) are held on site, or available at short notice from guaranteed local suppliers to enable rapid rectification of plant breakdowns. This is important with respect to arrestment plant and other necessary environmental controls. It is useful to have an audited list of essential items.

Appropriate management systems

5.33 Effective management is central to environmental performance; It is an important component of BAT and of achieving compliance with permit conditions. It requires a commitment to establishing objectives, setting targets, measuring progress and revising the objectives according to results. This includes managing risks under normal operating conditions and in accidents and emergencies.

It is therefore desirable that installations put in place some form of structured environmental management approach, whether by adopting published standards (ISO 14001 or the EU Eco Management and Audit Scheme [EMAS]) or by setting up an environmental management system (EMS) tailored to the nature and size of the particular process. Operators may also find that an EMS will help identify business savings.

5.34 Regulators should use their discretion, in consultation with individual operators, in agreeing the appropriate level of environmental management. Simple systems which ensure that LAPPC considerations are taken account of in the day-to-day running of a process may well suffice, especially for small and medium-sized enterprises. Authorities are urged to encourage wider adoption of EMS by operators, but it is outside the legal scope of an LAPPC permit to require an EMS for purposes other than LAPPC compliance. For further information/advice on EMS refer to the appropriate chapter of the appropriate Guidance Manual for England and Wales, Scotland and Northern Ireland.

Training

5.35 Staff at all levels need the necessary training and instruction in their duties relating to control of the process and emissions to air. In order to minimise risk of emissions, particular emphasis should be given to control procedures during start-up, shut down and abnormal conditions. Training may often sensibly be addressed in the EMS referred to above.

- All staff whose functions could impact on air emissions from the activity should receive appropriate training on those functions. This should include:
  - awareness of their responsibilities under the permit
  - steps that are necessary to minimise emissions during start up and shut down
  - actions to take when there are abnormal conditions, or accidents or spillages that could, if not controlled, result in emissions.
- The operator should maintain a statement of training requirements for each post with the above mentioned functions and keep a record of the training received by each person. These documents should be made available to the regulator on request.

Maintenance

5.36 Effective preventative maintenance plays a key part in achieving compliance with emission limits and other provisions. All aspects of the process including all plant, buildings and the equipment concerned with the control of emissions to air should be properly maintained. In particular:

- The operator should have the following available for inspection by the regulator:
  - A written maintenance programme for all pollution control equipment; and
  - A record of maintenance that has been undertaken

6. Summary of changes

The main changes to this note, with the reasons for the change, are summarised below in **Table 5**. Minor changes that will not impact on the permit conditions e.g. slight alterations to the Process Description have not been recorded.

Table 5 - Summary of changes

Section / Paragraph / Row	Change	Reason	Comment
Note title	Combustion of Waste Wood – changed from "Solid Fuel manufactured from Waste"	All other fuels considered as waste would fall under WID*	
	Statutory Guidance – changed from Secretary of State's guidance	Accommodation of the devolved administrations	
Introduction	Simplification of text	Make Note clearer	
	Addition of hyperlinks	Change to electronic format	Removes need for extensive footnotes/ references
Section 3 - Activity description	Removal of references to paper and card, poultry and other animal litter	These fuel types are waste and fall under WID	
Section 4 – Emission Limits and other provisions			
Table 3	Total particulate matter ELV - tightened from 200mg/m^3 to 150mg/m^3	Improved environmental impact	
	Carbon monoxide - new ELV introduced for pre-1995 combustion plant - tightened ELV for new plant less than 1MW	Improved environmental impact	
	Carbon monoxide - new plant – period of disregard from cold start is 15 minutes, reduced from 30 minutes	Improved environmental impact	
	Removal of chlorine ELV	Fuels containing chlorine are waste and fall under WID	
	Ban on idling	Minimises CO and encourages good combustion techniques	
	New plant – period of disregard for cold start reduced to 15mins	Minimises pollutants and encourages good combustion techniques	
Section 5 – Control techniques			
Para 5.6	New plant above 1MW – automatic de-ashing systems should be used	Minimises fugitive emissions	
Para 5.13	Ban on idling	Minimises CO and encourages good combustion techniques	
Air Quality	Clarification of exhaust velocity requirements		

7 Further information

Sustainable consumption and production (SCP)

Both business and the environment can benefit from adopting sustainable consumption and production practices.

Estimates of potential business savings include:

- £6.4 billion a year UK business savings from resource efficiency measures that cost little or nothing
- 2% of annual profit lost through inefficient management of energy, water and waste
- 4% of turnover is spent on waste.

When making arrangement to comply with permit conditions, operators are strongly advised to use the opportunity to look into what other steps they may be able to take. Local authority regulators may be wiling to provide assistance and ideas, although cannot be expected to act as unpaid consultants.

Health and safety

Operators of processes and installations must protect people at work as well as the environment:

- requirements of a permit or authorisation should not put at risk the health, safety or welfare of people at work
- equally, the permit or authorisation must not contain conditions whose only purpose is to secure the health of people at work. That is the job of the health and safety enforcing authorities

Where emission limits quoted in this guidance conflict with health and safety limits, the tighter limit should prevail because:

- emission limits under the relevant environmental legislation relate to the concentration of pollutant released into the air from prescribed activities
- exposure limits under health and safety legislation relate to the concentration of pollutant in the air breathed by workers
- these limits may differ since they are set according to different criteria. It will normally be quite appropriate to have different standards for the same pollutant, but in some cases they may be in conflict (for example, where air discharged from a process is breathed by workers). In such cases, the tighter limit should be applied to prevent a relaxation of control.

Further advice on responding to incidents

The UK Environment Agencies have published guidance on producing an incident response plan to deal with environmental incidents. Only those aspects relating to air emissions can be subject to regulation via a Part B (Part C in NI) permit, but regulators may nonetheless wish to informally draw the attention of all appropriate operators to the guidance.

It is not envisaged that regulators will often want to include conditions, in addition to those advised in this PG note, specifying particular incident response arrangements aimed at minimising air emissions. Regulators should decide this on a case-by-case basis. In accordance with BAT, any such conditions should be proportionate to the risk, including the potential for harm from air emissions if an incident were to occur. Account should therefore be taken of matters such as the amount and type of materials held on site which might be affected by an incident, the likelihood of an incident occurring, the sensitivity of the location of the installation, and the cost of producing any plans and taking any additional measures.