Process Guidance Note 1/03 (12)

Statutory Guidance for Boilers and Furnaces 20-50MW thermal input

June 2012

Revision of the Guidance

The electronic version of this publication is updated from time to time with new or amended guidance. The table below is an index to the latest changes (minor amendments are generally not listed).

Revision of the guidance		

Contents

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 boilers and furnaces from 20 MW net rated thermal input to 50MW rated thermal input. It is published only in electronic form and can be found on the Defra website. It supersedes PG1/03 (95) as amended by AQ23(04).

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 the mandatory requirements are contained in the Sulphur Content of Liquid Fuels Regulations for England and Wales, Northern Ireland and Scotland.

[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 statutory guidance in Northern Ireland and as guidance in Scotland.
[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

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.

1.8 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

1.9 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

1.10 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 another note rather than 1/03

1.11 For combined heat and power schemes (CHP) a gas turbine may be associated with a supplementary boiler. For a CHP scheme where the supplementary firing is at a net rate between 20 - 50MW, the guidance in **PG1/4** - Gas turbines should be applied.

For information, a CHP process description is in PG1/4, section 3

1.12 This note is for the combustion of materials that are not wastes.

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 Table 2.1, 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.

Compliance timetable		
Guidance	**Relevant paragraph/ row in this note**	**Compliance date**
New emission limits for biomass combustion	Table 3.1	For new plant, from publication of this note Existing plant continue to use the limits in their permit
Tighter smoke limits for start up, shut down, soot blowing, and for start up plant	Paragraph 4.8	Within 12 months of the publication of this note

Table 2.1

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 the 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 boilers and furnaces 20-50MW. The activities are listed for regulation as follows.

Regulations listing activities				
LAPPC	**Activity**	**England and Wales**	**Scotland**	**Northern Ireland**
Part A	50MW or more rated thermal input, on one site	**Section 1.1 Part A**	**Section 1.1 Part A**	**Section 1.1 Part A**
Part B	20MW or more net rated thermal input, in one appliance, but site is less than Part A	**Section 1.1 Part B**	**Section 1.1 Part B**	n/a
Part C	20MW or more net rated thermal input, in one appliance, but site is less than Part A	n/a	n/a	**Section 1.1 Part C**

Table 3.1:

3.2 This Note refers to the burning of any fuel in a boiler or furnace with a net rated thermal input of 20 MW or more, but less than 50 MW rated thermal input.

- The figure of 20 MW net rated thermal refers to the individual rating of a single boiler or furnace; it is not aggregated; it is net rated thermal input
- The figure of 50 MW rated thermal refers to the aggregate rating of one or more appliances on the same site; it is aggregated; it is rated thermal input.

3.3 For the purpose of this Note, a boiler or furnace is defined as a combustion appliance designed for the production of energy, where the products of combustion are used indirectly to heat any fluid. For example, this Note would not apply to any appliance where the products of combustion are used for the direct heating, drying, melting or treatment of any object or material.

3.4 "Net rated thermal input" should be taken as the rate at which fuel can be burned, at maximum continuous rating, multiplied by the net calorific value of the fuel and expressed as megawatts thermal (MWth). If the combustion appliance has been derated by physical modification which prevents fuel consumption taking place at the previous rate without further modification, then the maximum continuous rating may be taken

as being that rating which can be achieved by the appliance in its derated form.

Solid biomass

3.5 Compared to solid fossil fuels, solid biofuels have a simpler chemical composition, but much wider variation

3.6 Variations in the biomass: occur as it grows, and after it dies. There is natural detritus on the biomass. There are components introduced during and after plant collection.

3.7 As the ash is significantly different from solid fossil fuels, combustion and slagging characteristics are also significantly different

3.8 Biomass groups covered by this note are:

- woody,
- herbaceous,
- aquatic
- and mixtures of them.

3.9 Biomass groups not covered in this note are:

- animal biomass (including meat and bone meal, chicken litter various manures.)
- nor industrial biomass (including municipal solid waste, demolition wood, sewage sludge, paper-pulp sludge, waste papers)

Liquid biofuels

3.10 **Pyrolysis oil** is a liquid bio-fuel, produced by distillation from solid biomass. It can be produced from a range of bio-solids, and the oil has a range of constituents depending on the bio-solids, the distillation, how long it has been stored and how it has been processed after distillation. Compared to fossil oils, it is likely to be lower in sulphur, and higher in oxygen. AEA have produced a report for Defra “Air Quality impacts of the use of pyrolysis liquid fuels” which gives further information.

3.11 There has been a growing interest in burning pyrolysis oil, but there is insufficient evidence at present to provide any guidance on standards. Any local authority faced with an application or potential application for a 20-50MW pyrolysis oil burning plant should consult Defra or the Local Authority Unit of the Environment Agency.

3.12 **Tall oil** is a liquid bio-fuel, produced as a by-product from the Kraft process for producing wood pulp (mostly cellulose fibres) from wood. It is odorous, and higher in sulphur than pyrolysis oil..

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, dry gas, and 6% oxygen for solid fuel firing, and 3% oxygen for liquid and gas fuels.

Table 3 should be considered in conjunction with the monitoring paragraphs found later in this section

Emission limits, monitoring and other provisions					
Row	Substance	Emission limits/provisions		Type of monitoring	Monitoring frequency
		Plant new since 1 September 1995 mg/m^3	Plant in operation before 1 September 1995 mg/m^3		
Coal firing					
	Sulphur dioxide (indigenous coal)	3000	3000	Calculated from sulphur content of coal	On change of supply
	Sulphur dioxide (non-indigenous coal)	2000	2000		
	Nitrogen oxides expressed as NO2 - stoker firing	450	500	Quantitative	annual
	Nitrogen oxides expressed as NO2 - other firing methods	650	650	Quantitative	annual
	Carbon monoxide*	150	150	Quantitative	annual
	Total particulate matter	300	300	Indicative + Quantitative	Continuous + annual
	Oxygen	n/a	n/a	Quantitative	continuous

Solid biomass firing				
	Sulphur dioxide	200	Calculated from sulphur content of fuel Or quantitative	On change of supply Annual
	Nitrogen oxides expressed as NO2	250 (except for stepped grates 300 see para 5.2)	Quantitative	Annual
	Carbon monoxide	150 (see note 2)	Quantitative	continuous
	Total particulate matter	50	Indicative + quantitative	Continuous + annual
	Oxygen	n/a	quantitative	continuous
Note 1: the choice of biomass sulphur monitoring should be left to the operator Note 2: this CO limit is given mainly as an indication for operators of what should be achievable. It is anticipated that regulators will not normally include this limit in any permit, because operators themselves will want to maximise energy generation efficiency for commercial reasons, which as a consequence will result in CO levels being kept low.				

Liquid fuel firing BS 2869:1998 classes E,F,G and H – residual fuels; for example, heavy fuel oil					
	Sulphur oxides this emission concentration is equivalent to a mass content of 1% sulphur in fuel	1700	1700	Sulphur content of liquid fuel is regulated by other arms of government	
	Nitrogen oxides expressed as NO_2	450	600	Quantitative	Annual
	Carbon monoxide*	150	150	Quantitative	continuous
	Total particulate matter	150	150	indicative	continuous
	Oxygen	n/a	n/a	Quantitative	continuous
Boiler replacement to meet the carbon monoxide limit should not be required.					

Liquid fuel BS 2869:1998 class D – middle distillate fuels; for example gas oil					
	Nitrogen oxides expressed as NO2	200	300	Quantitative	Annual
	Carbon monoxide*	150	150	Quantitative	Annual
	Total particulate matter	100	150	Indicative Quantitative	Continuous annual
	Gas oil must have a sulphur content not exceeding 0.1% by mass.			Sulphur content of liquid fuel is regulated by other arms of government	
	Oxygen	n/a	n/a	Quantitative	continuous
Boiler replacement to meet the carbon monoxide limit should not be required.					

Natural gas					
	Sulphur oxide	35	35	On commissioning or by specification on change of supplier.	
	Nitrogen oxides expressed as NO2	140	140	Quantitative	Annual
	Carbon monoxide*	100	100	Quantitative	Annual
	Total particulate matter	5	5	Quantitative	Annual
	Oxygen	n/a	n/a	Quantitative	continuous
*Boiler replacement to meet a carbon monoxide limit should not be required					

Particulate from non-combustion, contained sources (eg fuel and ash handling)				
	Particulate matter	50	Design to meet limit	visual monitoring

Table 4.1

4.4 Where a boiler or furnace is fired simultaneously with two or more fuels (co-firing), the following formula should be used to calculate the emission limits that will apply when the boiler or furnace is being fired in this way:

Emission Limit (EL) = MWth (fuel a) x EL (fuel a) + MWth (fuel b) x EL (fuel b) etc / Total thermal input from all fuels

Monitoring, investigating and reporting

4.5 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

4.6 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.
- A summary of the results of continuous emission monitoring for oxygen, should be forwarded to the local enforcing authority at least once every 6 months. This information should include monthly averages, monthly maximum emission concentrations and the daily 95 percentile of the 15-minute mean emission concentrations (that emission concentration exceeded for 5% of each day).
- 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

4.7 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.

- 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.

4.8 Emissions from combustion processes should in normal operation be free from visible smoke.

- During start up and shut down combustion 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 (including emissions from materials handling operations), should be free from persistent visible emissions.
- All emissions to air should be free from droplets.

4.9 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.

4.10 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.

4.11 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 and where appropriate the regulator may want to vary the permit in order to add a condition requiring the particular measure(s) to be undertaken.

Emissions of Odour

4.12 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 arising from the receipt, handling and storage of liquid fuel 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 and where appropriate the regulator may want to vary the permit in order to add a condition requiring the particular measure(s) to be undertaken.

Abnormal Events

4.13 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

4.14 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.

- The number of start-ups and shut downs should be kept to the minimum that is reasonably practicable.
- All appropriate precautions must be taken to minimise emissions during start-up and shutdown.

Continuous Monitoring

4.15 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/m3). 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.

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.

4.16 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 continuous monitor 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.

4.17 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.

4.18 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.

4.19 No results obtained from non-continuous monitoring should exceed the specified emission concentration limits, except where:

a. data is obtained over at least 5 sampling hours in increments of 15 minutes or less, or

b. at least 20 results are obtained where sampling time increments of more than 15 minutes are involved.

In these circumstances, no more than 5% of all 15-minute mean emission concentrations should exceed the specified emission concentration limits and no 15-minute mean emission concentration should exceed twice the specified emission concentration limits.

4.20 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.

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. This is achieved by correcting measured levels to reference oxygen conditions.

Varying of monitoring frequency

4.21 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.

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

a. the variability of monitoring results, for example, results which range from 15 - 45 mg/m3, against an emission limit of 50 mg/m3 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 - 50 mg/m3 when the limit is 50 mg/m3 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.

4.23 A reduction in monitoring frequency should not be permitted where continuous quantitative or indicative monitoring is required. These types of monitoring are needed to demonstrate at all times when the plant is operating, that either the emission limits are being complied with or the arrestment equipment is functioning correctly.

Monitoring of unabated releases

4.24 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.

Sampling provisions

4.25 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.

4.26 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.

4.27 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 earlier paragraph).
- 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 Table 5.1 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.

Summary of control techniques	
Sources	**Control techniques**
Sources of NOx	
Biomass Combustor design	Fluidised bed combustion or travelling grate preferred to stepped grate
Sources of sulphur dioxide	
Combustion of fuel containing sulphur	Choice of lower sulphur fuel
Sources of dust	
Combustion fly ash	Good combustion and abatement
Silos	Dust arrestment bag filters cartridge filters
fuel stockpiles	Wind dynamics management use of fencing, bunding, profiling etc Reduced drop heights Suppression water and/or suppressants well positioned spray guns sufficient coverage by sprays Covering below ground or covered stock bins dust covers housing

Conveyors, conveyor transfer points	Containment wind boards Reduced drop heights Appropriate siting away from site boundary especially if near residential or other sensitive receptors
Roadways including haulage roads	Suppression site and process design
External operations conveyors stockpiles roadways	Appropriate siting away from site boundary especially if near residential or other sensitive receptors Wind dynamics management use of fencing, bunding, profiling etc.
Vehicles - bodies and wheels	Wheel-wash and under-body vehicle wash Exhausts that do not point vertically down
Sources of smoke and organic carbon	
Flue gases	Good combustion

Table 5.1

Consideration will be given within two years from the publication of this note as to whether SCR (selective catalytic reduction) is BAT forcontrolling NOx emissions from new and/or existing 20-50MW combustion plant.

Control techniques

Parameters for choosing a biomass combustor:

Fluidised bed, travelling grate v stepped grate

5.2 Fluidised bed combustion and travelling grates can meet a tighter limit for NOx than stepped grate boilers, and fluidised bed or travelling grate should be preferred to stepped grate boilers. If the fuel is not suitable for fluidised bed combustion or a travelling grate, then a stepped grate boiler can be allowed.

5.3 Other parameters which lead to the choice of biomass combustor, and its design include:

- Purpose: energy generation, variation of load, CHP,
- Fuel: %biomass, high N Cl, slagging characteristics,
- Form:

- EN 14961-1 Table 1 lists: briquettes, pellets, wood chips, hog fuel, wood logs, sawdust, shavings, bark, bales, energy grain, olive residues, fruit seed, others

- and as an example, the specification for pellets includes : origin, dimensions, moisture, bulk density, fines, additives, net calorific value as received, mechanical durability; and in certain cases, sulphur, chlorine, nitrogen content)

- Aquatic biomass, blends and mixtures

- Fuel indexes:

5.4 The effect of the parameters can include:

- High moisture content can be limiting by effect on heat balance

- Difficult ash behaviour – slagging in the fire bed, and fouling on furnace and boiler surfaces

- Difficult physical properties – bale handling equipment, metering and feeding materials to combustor

- Deposit build-up on boiler tubes requires removal for thermal and corrosion reasons

5.5 Techniques to predict fuel behaviour from bio-fuel analysis are still being developed.

5.6 Bio-mass combustor designs are actively being developed: control techniques include fuel and air staging, flue gas recirculation, fuel bed cooling.

- Further information might be found at, for example, IEA Bio-energy Task 32 and 19th Biomass European Conference and Exhibition

Techniques to control emissions from contained sources and fugitive sources

Delivering, moving and removing materials

5.7 Loading to and from stock piles should be carried out so as to prevent emissions to the air.

5.8 The transport and handling of dusty materials within the site should be carried out by methods which prevent emissions to the air. External above - ground conveyors carrying dusty materials should be fitted with protection against wind whipping. Transfer point extraction should be ducted to suitable arrestment equipment to meet the limit values in section 4 above.

5.9 All vehicles transporting dry, dusty materials to or from site should be totally enclosed or adequately sheeted to prevent escape of particulate matter to the air.

Storing solid fuel and ash

5.10 All dusty materials should be stored in covered containers, purpose-built silos or undercover whenever practicable.

5.11 Stockpiles of dusty, or potentially dusty, materials should be stored so as to prevent wind whipping e.g., by covering, screening or dampening

5.12 Bulk fuel storage tanks and silos should be fitted with a high-level alarm or volume indicator to warn of and thereby prevent overfilling. For example for chipped fuels

- The high-level alarm should be electrically interlocked with the fuel delivery system in order to prevent overfilling.
- Deliveries of chipped fuels should be supervised at all times

5.13 Silos for the storage of solid fuels should be vented to air through suitable arrestment equipment, to meet the emission concentration limits specified in section 4 above.

5.14 All arisings of ash and other dusty materials should be stored in closed containers or buildings or stored in a wet state pending removal from site.

Storing liquid fuels

5.15 Bulk storage tanks for liquid fuels should wherever practicable be back vented to the delivery tank during filling. Where this is impracticable, displaced air vents should be sited in such a way as to prevent the arising of offensive odour, as perceived by the local enforcing authority Inspector at or beyond the site boundary.

5.16 Above-ground fuel storage tanks should be completely contained by bunding which is impervious and resistant to the fuels in storage and capable of holding 110% of the capacity of all storage tanks within the bund.

Fuel processing

5.17 All on-site fuel processing activities such as chipping, shredding, pulverising or screening should be conducted so as to minimise releases of dust to air. Such activities should take place inside a building.

Spills

5.18 Adequate provision should be made for the containment of liquid and solid spillages. All spillages should be cleared as soon as possible and in the case of solid materials this should be achieved by the use of vacuum cleaning, wet methods, or other appropriate techniques. Dry sweeping should not be permitted.

Air Quality

Dispersion & Dilution

5.19 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 (Dispersion) 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.

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.

Where offensive odour is likely outside the process site boundary the assessment of stack or vent height should take into account the need to render harmless residual offensive odour.

Ambient air quality management.

5.20 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."

Stacks, vents and process exhausts

5.21 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.

5.22 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.

5.23 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

5.24 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, so that plant breakdowns can be rectified rapidly. 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

5.25 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.

5.26 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

5.27 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

5.28 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 6.1. Minor changes that will not impact on the permit conditions e.g. slight alterations to the Process Description have not been recorded.

Summary of changes			
Section/ paragraph/ row	**Change**	**Reason**	**Comment**
Introduction			
	Simplification of text	Make Note clearer	
	Addition of links	Change to electronic format	Removes need for extensive footnotes/references
Emission limits, monitoring and other provisions			
Table 4.1	Addition of limits for biomass	To regulate coal and biomass separately	Biomass limits are consistent with RHI
	For solid biomass: preference for fluidised bed combustion (fbc) or travelling grate over stepped grates	To equal RHI requirements when using fbc or travelling grate, but not to require NOx abatement if fuel is unsuitable for fbc or travelling grate	Stepped grates can meet 300 without secondary NOx abatement. Fluidised bed combustion and travelling grate can meet 250 without secondary NOx abatement
	Sulphur dioxide limits removed for oil	To avoid double regulation	Already controlled by other Regs. Permit need only name which type of oil is allowed; eg gas oil or heavy fuel oil
	Smoke emission tightened from Ringelmann 2 to Ringelmann 1: during start-up and shut-down, during soot blowing, and for stand-by plant	BAT	Better combustion controls now available
Control techniques			

Table 5.1	Future review of applicability of SCR	BAT	Review within 2 years of publication of this revision of PG1/03
Air Quality			
	Clarification of exhaust velocity requirements		

Table 6.1

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 or those who may be harmed by the work activity;
- 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 measure