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Department
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Process Guidance Note 6/35(13)

Statutory guidance for metal powder and other thermal spraying processes

Revised: July 2013

Llywodraeth Cymru
Welsh Government

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The Scottish
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Any enquiries regarding this document/publication should be sent to us at:

Atmosphere and Local Environment
Defra
Area 5F
Ergon House
Horseferry Road
London
SW1P 2AL

Email: Control.Pollution@defra.gsi.gov.uk

Defra would like to acknowledge the work of the Environment Agency's Local Authority Unit in the drafting of this guidance note.

Revision of the guidance

The electronic version of this publication is updated from time to time with new or amended guidance. **Table 0.1** is an index to the latest changes (minor amendments are generally not listed).

Table 0.1 - Revision of the guidance

Date of change	Section/ paragraph where change can be found	Nature of change - what paragraphs have been inserted, deleted or amended - what subject matter is covered by the change
July 2013	Throughout	Addition of colour coding to tables

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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 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 metal powder and other thermal spraying processes. It is published only in electronic form and can be found on the Defra website. It supersedes PG6/35(96) as amended by AQ01(06).

1.2 This guidance document is compliant with the Code of Practice on Guidance on Regulation page 6 of which contains 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 giving guidance on the Best Available Techniques (BAT). 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. Further guidance on the meaning of BAT can be found for England and Wales (in chapter 12 of the General Guidance Manual), Scotland, and Northern Ireland, (in chapter 9).

1.4 In general terms, what are BAT for one installation in a sector are 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 are 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.

1.6 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 this statutory 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 for whom this is statutory guidance;

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 constitute 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 another note rather than PG6/35

1.12 **PG6/45** covers the cleaning of products with organic solvents. The threshold to need a permit varies with the solvent used, but is either 1 or 2 tonnes a year.

1.13 **PG6/23** covers the use of masking paints and sealants if the organic solvent content consumed is 5 tonnes or more.

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 removed. Some have been amended. 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.

Table 2.1 - Compliance timetable

Guidance	Relevant paragraph/row in this note	Compliance date
There are no new provisions in this note likely of themselves to result in a need to vary existing permit conditions. For a full list of changes made by this note, excluding very minor ones, see **Table 6.1**.		

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.

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. Further guidance on permit reviews is contained in the appropriate Guidance Manual for England and Wales, Scotland, Practical guide section 10 and Northern Ireland Part B Guidance page 9, Northern Ireland Part C Guidance chapter 17. 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. Activity description

Regulations

3.1 This note applies to LAPPC installations for the metal powder and other thermal spraying processes. The activities for regulation are listed in **Table 3.1**.

Table 3.1 - Regulations listing activities

LAPPC	Activity	England and Wales	Scotland	Northern Ireland
		EPR Schedule 1 reference	PPC Schedule 1 reference	PPC Schedule 1 reference
Part A	Making lead powder	Section 2.2 Part A1	Section 2.2 Part A	Section 2.2 Part A
Part B	See description below	Section 6.4 Part B Section 2.2 Part B	Section 6.4, Part B Section 2.2, Part B	Section 6.4 Part B Section 2.2 Part B
Part C	See description below	n/a	n/a	Section 6.4 Part C Section 2.2 Part C
The links are to the original version of the Regulations. A consolidated version is not available on www.legislation.gov.uk.				

3.2 This guidance note covers the **thermal spraying of metal coatings** and metal compound coatings, when 20 or more tonnes are sprayed in any 12 months. The process is covered by Part B, or in NI Part C, of section 6.4 of the regulations in **Table 3.1**.

3.3 This guidance note also covers **spray forming** also known as spray casting or spray deposition, where metal is melted, then atomised and sprayed, either to make a billet or to form a near-net-shape component. The process is covered by Part B or C of section 2.2 of the regulations in **Table 3.1**. (In NI, Part C if the design holding capacity is under 0.5 tonnes of molten metal.)

3.4 This guidance note also covers **metal powder makers** who melt metal, atomise it and collect the powder. The process is covered by Part B of section 2.2 of the Regulations in Table 3.1. (In NI, Part C if the design holding capacity is under 0.5 tonnes of molten metal) However, making **lead powder** is not covered by this guidance note as the process is currently in Part A of the regulations in **Table 3.1**.

Thermal spraying coatings

3.5 In thermal spray coating, the coating material is fed into a spray gun, heated till molten and then sprayed onto the substrate.

3.6 There are various reasons for doing this, including: to rebuild worn components; to provide corrosion resistant or wear-resistant surfaces to metals or other substrates; and to provide a hard outer coating to a softer, lighter metal part.

3.7 **Sprayed coatings:** powder or wire: comprising metals, oxides or other materials.

3.8 **Heat** is produced electrically (an electric arc or plasma), or by the combustion of gas (for example, oxypropane or oxyacetylene), or by detonation.

3.9 Generally, electric arc guns are used for spraying wire; plasma guns are used for spraying powder; and gas heated guns are used for spraying either wire or powder.

3.10 **Particle size:** Where powder is utilised, the particle size of the resulting emission is largely governed by the particle size of the powder being used. Smaller particle size powders are more usually employed in plasma spraying than in spraying where the material is melted by the combustion of fuel gas.

3.11 However, where wire is used and the heat to render it molten is provided by an electric arc, due to the very high temperatures utilised, the emission is likely to contain a much higher proportion of fume (under 1 micron) and fine particles, and so it will be more difficult to arrest.

3.12 **Propulsion:** Where electric arc or fuel gas is used to provide the heat to melt the powder or wire, the molten metal is projected onto the substrate by compressed air. However, in plasma spraying, the very rapid expansion of gas which occurs in the gun is sufficient to carry the molten material, at very high velocities, onto the substrate, achieving a very hard, dense coating.

3.13 **Coatings metal composition:** There are a wide varieties of wires and powders sprayed and, of varying metallurgical compositions, (some alloys contain (for example) chromium, nickel and molybdenum in high percentages). So it is important to ensure that the particulate matter produced by the spraying is adequately extracted and arrested.

3.14 **Substrate preparation** is often carried out by abrasive blasting techniques.

Spray Forming

3.15 In spray forming the metal or alloy is melted, then atomised and propelled by centrifugal disk or gas jets, and the droplets then stick to the substrate while semi-solid.

3.16 Advantages include metallurgy options and fewer production steps. Disadvantages include complexity and loss of metal as overspray, splash and bounce, though the fine material can be re-injected as powder.

3.17 Atomization is often carried out under predominantly nitrogen or argon gas. Centrifugal atomization can also be carried out in vacuum

3.18 Single or double atomizing heads are usual for gas atomizers.

3.19 Particle size:

- centrifugal atomisers produce particles with a narrow size distribution within – 20-1000 micrometers; **and**
- gas atomiser produces particles with a wide distribution of particle sizes. Particles are generally larger than in metal powder production.

Metal Powder Manufacture

3.20 Molten metal is atomized by gas or water, or by centrifuge. Then cooled. The collected particles may need to be classified (sorted by size)

3.21 Some metals have minimal volatility at their melting point and produce little fume. If they are also precious metals, then recovery rates are high, emissions are minimal, and throughput may be low. Therefore, making metal powder from gold, silver, platinum and palladium are candidates for exemption from needing a permit as a 'trivial emitter', subject to the decision of the regulator.

3.22 Lead is volatile and hazardous, and making powder at a plant with a capacity for melting lead of over 4 tonnes per day is regulated by Part A of the Regulations, a higher level of control than this guidance provides.

3.23 This note covers metals with varying levels of hazard, from nickel (which from 31 December 2013 has an air quality target value of 20 nanograms per cubic metre, annual average) to aluminium. Other metals sprayed include chromium, cobalt, copper, manganese, iron and steel, or more usually, some of their many alloys.

4. Emission limits, monitoring and other provisions

4.1 Emissions of the substances listed in **Table 4.1** 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 4.1**.

The reference conditions for limits in **Section 4** are: 273.1K, 101.3kPa, without correction for water vapour content.

Table 4.1 should be considered in conjunction with the monitoring paragraphs found later in this section.

Table 4.1 - Emission limits, monitoring and other provisions					
Row	**Substance**	**Source**	**Emission limits/provisions**	**Type of monitoring**	**Monitoring frequency**
1	Total particulate matter	Contained spraying sources, and shotblasting	20 mg/m^3	Manual extractive testing	Annual
	of which the contribution of the following metals and their oxides, where present, should not exceed:				
	chromium		15 mg/m^3 expressed as metal	Manual extractive testing	Annual if chromium is sprayed
	nickel		15 mg/m^3 expressed as metal	Manual extractive testing	Annual if nickel is sprayed
	copper		7.5 mg/m^3 expressed as metal	Manual extractive testing	Annual if copper is sprayed
	cobalt		3 mg/m^3 expressed as metal	Manual extractive testing	Annual if cobalt is sprayed
	lead		5 mg/m^3 expressed as metal	Manual extractive testing	Annual if lead is sprayed

4.4 It is important to ascertain what metals are present in the powders or wires which are being sprayed at a particular processing location and in what proportion in a particular powder or wire the metals being considered are present, prior to deciding a monitoring programme.

4.5 Where more than one type of wire or powder containing the same metal is used, and that metal is assigned a specific emission concentration limit in **Table 4.1**, sampling should be undertaken when the wire or powder with the highest proportion of that metal is being sprayed, taking into account the particle sizes of the coatings being sprayed. Where the coating being sprayed is a powder, the particle size of the powder should also be taken into account. Where no powders or wires bearing the specific metals listed in **Table 4.1** are sprayed, it should be sufficient to demonstrate compliance with the emission limit for total particulate matter only.

4.6 Where the discharged volume from booth extraction or abrasive blasting equipment exceeds $50m^3$/minute from a single terminal, and arrestment is necessary to meet the emission limits in **Table 4.1**, a suitable parameter, to demonstrate that performance of the abatement plant is being maintained, (e.g. pressure drop), should be continuously indicatively monitored and recorded.

4.7 Where the discharged volume from booth extraction or abrasive blasting equipment from a single terminal where arrestment plant is necessary to meet the emission limits in **Table 4.1** is below $50m^3$/minute, continuous arrestment plant performance monitoring should not be required, but the arrestment plant should be designed to meet those emission limits.

4.8 In some cases it may be possible to recirculate the air extracted from spraybooths or abrasive blasting equipment rather than discharge it to the outside air, without contravening the requirements of the Health and Safety Executive in relation to workplace Occupational Exposure Limits for the materials being sprayed - for example, by the provision of suitable arrestment plant. In such cases, the emission monitoring requirements of **Table 4.1** should not be applied, provided that the recirculated air is discharged into the building in such a way as to minimise fugitive emissions - for example, not in close proximity to windows, doors or active or passive roof level ventilation.

4.9 Where such recirculation systems are being considered, operators are strongly advised to consult the Health and Safety Executive.

Monitoring, investigating and reporting

4.10 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. 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

4.11 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

4.12 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.

4.13 Emissions from combustion processes in normal operation should 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.

- 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 detected beyond the site boundary, the operator should investigate in order to find out which part of their operation(s) is the cause.

If this inspection does not lead to correction of the problem then the operator should inform the regulator who will 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 at least once per day/shift, by the operator, 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

4.14 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 as local meteorological conditions 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.

4.15 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 detected beyond the site boundary, the operator should investigate in order to find out which part of their operation(s) is the cause.

4.16 Whilst problems are ongoing, a boundary check should also be made at least once per day/shift, by the operator, 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

4.17 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.

Continuous monitoring

4.18 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 metre 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.

4.19 Continuous indicative monitoring is where a permanent device is fitted, for example, to detect leaks in a bag filter, but the output, whether expressed numerically 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.

4.20 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.

4.21 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

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

4.23 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.

4.24 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.

4.25 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.

4.26 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

4.27 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.

4.28 When determining "consistent compliance" the following are cases which might not qualify for a reduction in monitoring:

a) variability of results: cases where monitoring results vary widely and include results in the range 30-45mg/m^3 (when the emission limit is 50mg/m^3)

b) the margin between the results and the emission limit: cases where results over a period are 45mg/m^3 or more (when the emission limit is 50mg/m^3).

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

- three or more consecutive annual monitoring campaigns; **or**
- two or more consecutive annual monitoring campaigns 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.

4.29 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 that the arrestment equipment is functioning correctly.

Monitoring of unabated releases

4.30 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.

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.

Representative sampling

4.31 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 **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.

Table 5.1 - Summary of control techniques

Substance	Sources	Control techniques
Metal fume (under 1 micron) esp nickel chrome	Melting metal	Contain, Dry filter
Metal fume (under 1 micron) esp nickel chrome	Spraying	Contain Dry filter
Metal fume (under 1 micron) esp nickel chrome	Classifying	Contain Dry filter
Particulate matter	Abrasive surface preparation	Contain Dry filter (wet abatement for aluminium dusts)
Aluminium fume	Spraying / atomising	Contain Cyclone and wet abatement

Techniques to control emissions from contained sources

Less volatile metals

5.2 Spraying precious metals such as gold, silver, platinum and palladium may emit trivial amounts to air due to the high level of product recovery installed for commercial reasons, and due to the low vapour pressure of the metals at the melting point.

Lower hazard metals

5.3 Aluminium dust has a lower health hazard than many other metals. Aluminium dust is a fire and explosion hazard, which is a matter for health and safety regulation, but influences emission control decisions. For instance cyclone followed by wet abatement is preferred to avoid aluminium dust explosion hazards even though the aluminium in water generates an additional hydrogen hazard.

Higher hazard metals

5.4 Near a few plants in the UK, levels of nickel in the air have been higher than the nickel air target value which comes into effect at the end of 2012. Plants with a higher annual throughput (100s of tonnes of nickel) may well need more efficient abatement than plant with a lower throughput of perhaps 10s of tonnes of nickel.

5.5 Other metals with noted fume hazards include chromium, molybdenum, copper, manganese, and zinc.

5.6 For smaller emissions, wet abatement will reduce emissions by perhaps 90%.

5.7 For larger emissions, dry filters can provide a high level of reduction for particles at 0.5 micometres and above.

5.8 HEPA filters can provide further abatement, if needed.

Dust

5.9 Dust extraction from abrasive blasting equipment can, if not adequately arrested, give rise to very heavy emissions of particulate matter which can cause nuisance and can be very aggressive to painted surfaces.

5.10 All spray booths and shot blasting equipment should be provided with adequate extraction to minimise the escape of fugitive emissions from the building. Such extraction should be ducted to arrestment equipment where such equipment is necessary to meet the requirements of **Table 4.1**.

Air quality

Dispersion & dilution

5.11 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.

5.12 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

5.13 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."

Nickel air quality target value

5.14 The nickel air quality target value (20ng/m^3 calendar year average) should be met by 31.12. 2012 (England, Wales, Scotland, Northern Ireland). All necessary measures not entailing disproportionate costs must be taken to ensure that concentrations do not exceed this value.

HEPA filters can provide greater control at small particle sizes but at a cost for energy to drive the greater pressure loss across the finer filter

Stacks, vents and process exhausts

5.15 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 affect dispersion:

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

5.16 When dispersion of pollutants discharged from the stack (or vent) is necessary, the target exit velocity should be 15m/s 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.

5.17 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 9m/s.

5.18 To reduce the potential of droplet emissions a mist eliminator should be used. Where a linear velocity of 9m/s 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

5.19 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

5.20 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.

5.21 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. Regulators are urged to encourage operators to have an EMS for all their activities, 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

5.22 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 shutdown;
  - 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

5.23 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 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.

Table 6.1 - Summary of changes			
Section/ paragraph/ row	**Change**	**Reason**	**Comment**
Introduction			
	Simplification of text	Make Note clearer	And consolidate guidance note and amendment
	Addition of links	Change to electronic format	Removes need for extensive footnotes/references
Process description			
	Added spray forming	To clarify extent of regulation	Mostly aluminium alloys
	Added metal powder manufacture	To clarify extent of regulation	Powder manufacture is usually higher mass throughput than sprayed coatings
Air quality			
Para 5.15	Nickel air quality target added	UK and EU air quality legislation	Nickel target level comes into effect 31.12.2012
	HEPA filter option added, if air quality needs it.	To reflect options available	
	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. Regulators may be willing to provide assistance and ideas, although cannot be expected to act as unpaid consultants.

Health and safety

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

- requirements of a permit 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 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.