Process Guidance Note 2/6a (04)

Secretary of State's Guidance for Processes Melting and Producing Aluminium and its Alloys

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

Environment Agency

Contents

List of Figures

List of Tables

1 Introduction

1.1 This note is issued by the Secretary of State, the Welsh Assemby Government (WAG) and the Scottish Ministers ("the Government") to give guidance on the conditions appropriate for the control of emissions into the air from processes/ installations[1] for melting and producing aluminium and its alloys. it supersedes guidance note PG2/6(96) published in March 1996.

1.2 This is one of a series of notes giving guidance on Best Available Techniques (BAT) and Best Available Techniques Not Entailing Excessive Cost (BATNEEC)[2]. The notes are all aimed at providing a strong framework for consistent and transparent regulation of installations.

1.3 This note is for use under both Local Air Pollution Control (LAPC) established by Part I of the Environmental Protection Act 1990, and Local Air Pollution Prevention and Control (LAPPC) established by the Pollution Prevention and Control Act 1999[3]. It constitutes statutory guidance to regulators under regulation 37 of The Pollution Prevention and Control (England and Wales) Regulations 2000, SI 1973[4]. To the extent it provides guidance on techniques, it also constitutes statutory guidance to regulators under section 7(11) of the 1990 Act, and in any event regulators are expected to have regard to it. The note will be treated as one of the material considerations when determining any appeals made against a decision under either the 1990 or 1999 Acts.

1.4 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 Directions from the Government.

Site specific BAT/ BATNEEC

1.5 All processes are subject to BAT/ BATNEEC. In general terms, what is BAT/ BATNEEC for one process in a sector is likely to be BAT/ BATNEEC for a comparable process; but in each case it is, in practice, for regulators (subject to appeal) to decide what is BAT/ BATNEEC for the individual process and the regulator should take into account variable factors (such as configuration, size and other individual characteristics of the process) and the locality (such as proximity of particularly sensitive receptors[5]). Ultimately, therefore, what constitutes BAT/ BATNEEC is site specific but this guidance note comprises guidance for the generality of processes in the sector and careful regard should be had to it, in order to maximise consistency of permits as appropriate.

Who is affected

1.6 This guidance is for:

- regulators: who must have regard to the guidance when determining applications and reviewing extant authorisations and permits
- operators: who are best advised also to have regard to it when making applications, and in the subsequent operation of their process
- 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 processes in this particular industry sector

1. the term "process(es)" is used in the remainder of the note to mean both "processes" under the Environmental Protection Act 1990 and "installations" under the Pollution Prevention and Control Act 1999.
2. BATNEEC is the formulation used in the Environmental Protection Act 1990 and BAT is used in the Pollution Prevention and Control Act 1999. For the purpose of this guidance note, the two concepts are regarded as having essentially the same effect.
3. In accordance with the Pollution Prevention & Control (England and Wales) (Amendment) Regulations 2002, SI 2002/275, Part B aluminium and aluminium alloy processes transfer from regulation under the 1990 Act to the 1999 Act from 1 April 2004.
4. In Scotland The Pollution Prevention and Control (Scotland) Regulations 2000
5. Guidance on the relationship between BAT/BATNEEC and air quality objectives is contained in the General Guidance Manual on policy and procedures for A2 and B installations.

1.7 The guidance is based on the state of knowledge and understanding at the time of writing of:

- processes for melting and producing aluminium and its alloys
- their potential impact on the environment and
- what constitutes BAT/ BATNEEC for preventing and reducing air emissions

1.8 The note may be amended from time to time in order to keep abreast with developments in BAT/BATNEEC including improvements in techniques and new understanding of environmental impacts and risks. Such changes may be issued in a complete revision of this document, or in separate additional guidance notes which address specific issues. (It may not always be possible to issue amending guidance quickly enough to keep in absolute step with rapid changes, which is another circumstance where paragraph **1.5** above might apply.)

1.9 Steps will be taken to ensure that those who need to know about changes are informed. Operators (and their advisers) are, however, strongly advised to check with the regulator whether there have been any changes before relying on this note for the purposes of making an application under the 1990 or 1999 Acts or making any other decisions where BAT/ BATNEEC may be a consideration.

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 interested organisations.

Publication

1.11 This and the other published guidance in this series is available, free of charge, via Defra at **www.defra.gov.uk**. There are links to this site from the following web sites:

- Scottish Executive at **www.scotland.gov.uk**.
- Environment Agency at **www.environment-agency.gov.uk**.
- Scottish Environment Protection Agency at **www.sepa.org.uk**.

Printed copies of this and other PG notes are available from Defra Publications. They are priced separately and can be purchased in the following ways:

By writing to Defra Publications, Admail 6000, London, SW1A 2XX.

Cheques or postal orders to cover the cost of priced items must be enclosed with your order, and should be made payable to 'Defra Publications'. See also the Defra Publications order form available from **www.defra.gov.uk/corporate/publications/orderform.htm**.

Or by telephoning 08459 556000 (calls charged at local rate) or +44 20 8957 5242 from outside the UK.

Debit and credit cards are accepted.

When ordering, always quote the title in full and the order code (PB XXXX) given. Further information on ordering can be found on the Defra website at **www.defra.gov.uk/corporate/publications/ordering.htm**

1.12 General guidance explaining LAPPC and setting out the policy and procedures, is contained in the “General Guidance Manual on Policy and Procedures for A2 and B Installations” available from **www.defra.gov.uk/environment/ppc/index.htm**, referred to in this document as the "General Guidance Manual.” This is designed for operators and members of the public, as well as for local authority regulators. In Scotland there is the SEPA Practical Guide for Part B activities available from **www.sepa.org.uk/ppc/guidance/practicalguidepartbactivities.pdf**

1.13 In addition to the General Guidance Manual referred to above, explanation or clarification of certain terms used in this guidance note may be found in a general guidance note issued under Part I of the Environmental Protection Act 1991: 'Interpretation of terms used in process guidance notes', known as General Guidance Note 4 - GG4 - published by HMSO in 1991. Where there is any conflict between GG4 and the guidance issued in this note or in the General Guidance Manual, the latter two documents should prevail, as should any subsequent guidance issued in relation to LAPPC.

2 Timetable for compliance and reviews

Existing processes or activities

2.1 The previous guidance advised that upgrading to that standard should usually have been completed by 1 April 1996. Requirements still outstanding from any existing upgrading programme should be completed.

Upgrading for this note

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

Table 1: Compliance timetable

Provision	Relevant Paragraph / Row in this note	Compliance Date
Emission limit for particulate matter of 20 mg/m^3	**Table 2** Row 1	Within 24 months of the publication of this note
A dioxin emission limit and a requirement for dioxin monitoring depending upon operating conditions. (see paragraph **5.5**)	**Table 2** Row 5 **5.5**	Within 24 months of the publication of this note
All other provisions	-	To be complied with as soon as practicable, which in most cases should be within 12 months of the publication of this note.

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

Relaxation of conditions

2.4 Where provisions in the preceding guidance note have been deleted or relaxed, authorisations should be varied as necessary as soon as reasonably practicable. **Section 7** provides a summary of all changes.

New processes or activities

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

Substantially changed processes or activities

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

Permit reviews

Reviewing permits

2.7 Under LAPC the requirement is to review conditions in authorisations at least every four years. (Section 6(6) Environmental Protection Act 1990).

2.8 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 six years ought normally to be sufficient for the purposes of Regulation 15(1) Pollution Prevention and Control Regulations 2000.

More frequent review may be necessary in individual cases for the reasons given in Regulation 15(2). Further guidance on permit reviews is contained in chapter 26 of the General Guidance Manual. Regulators should use any opportunities to determine the variations to authorisations/permits necessitated by paragraph **2.2** above in conjunction with these reviews.

2.9 Under both LAPC and LAPPC, conditions should be reviewed where complaint is attributable to the operation of the process and is, in the opinion of the regulator, justified.

3 Process description

Regulations

3.1 Processes for melting and producing aluminium and its alloys are prescribed for:

- **Local air pollution control, LAPC**, under section 2.2 of Schedule 1 to the Environmental Protection (Prescribed Processes and Substances) Regulations 1991, SI 472 (as amended).
- **Local air pollution prevention and control, LAPPC**, under section 2.2 Part A2 or Part B of Schedule 1 of the Pollution Prevention and Control (England and Wales) Regulations 2000 SI 1973[6]. The dates on which existing LAPC part B prescribed processes transfer to LAPPC are set out in part 2 of schedule 3, which lists the prescribed dates for installations. Regulation 9 (1) requires that no person shall operate an installation after the prescribed date except under and to the extent authorised by a permit granted by the regulator. The date for section 2.2 Part B processes is 1 April 2003. (See Schedule 3 paragraph 9 (3) regarding applications being deemed to have been made for existing Part B processes).

Process or activity

3.2 This note refers to existing processes for:

- the melting of aluminium or an aluminium alloy in any furnace, bath or other holding vessel with a design holding capacity of less than 5 tonnes, or
- the melting of aluminium or an aluminium alloy in any furnace, bath or other holding vessel, in conjunction with a die casting process regardless of furnace design holding capacity.

3.3 For new or substantially changed processes, and for all processes after the prescribed date, this note refers to processes melting aluminium or aluminium alloys, in plant with a melting capacity of 20 tonnes or less per day, in accordance with section 2.2 Part B (a).

3.4 For new or substantially changed processes, and for all processes after the prescribed date, this note refers to melting aluminium or aluminium alloys in conjunction with a die-casting activity at a rate of 20 tonnes or less per day, in accordance with section 2.2 Part B (d).

3.5 Where a plant has a melting capacity of more than 20 tonnes per day, it will be a Part A activity under section 2.2 of Schedule 1 of the Pollution Prevention and Control (England and Wales) Regulations 2000 SI 1973. This is of relevance to new or substantially changed processes, and for all processes after the prescribed date. Part A processes are not covered by this guidance note.

3.6 This note covers the processing of the metal until it enters the mould. Auxiliary foundry operations are the subject of PG note 2/4. The cleaning of crucibles for aluminium processes should be subject to the standards in this note, since it occurs on-line.

3.7 This note does not relate to the extraction or recovery by thermal means of aluminium, copper or zinc from mixed scrap (for example using a sloping hearth furnace) - such processes are the subject of PG 2/1.

3.8 This note to relates to the melting of ingot metal and clean returned or scrap material and the concurrent refining operations carried out. During melting of ingot it is often necessary to carry out a limited form of refining operation.

3.9 The processes covered by this note include any related process for the refining of aluminium or their alloys. These activities are sometimes described by process operators as metal treatment operations.

6. In Scotland, section 6.3 Part B of Schedule I of the Pollution Prevention and Control (Scotland) Regulations 2000 (SSI 2000/323).

3.10 For the purpose of this note, refining is defined as "to cleanse, reduce or remove deleterious elements, oxides or other gangue material, for example by means of the addition of salt flux or the injection of gases to the molten metal". There are three main metal treatment (or refining) operations carried out in aluminium melting processes and these are as follows:

(a) grain modification - for aluminium alloys this usually involves the addition of small amounts of metal, for example sodium or strontium, to the melt to enhance casting characteristics.

(b) fluxing - this usually involves the addition of solid fluoride based fluxes to the melt to remove solid contaminants.

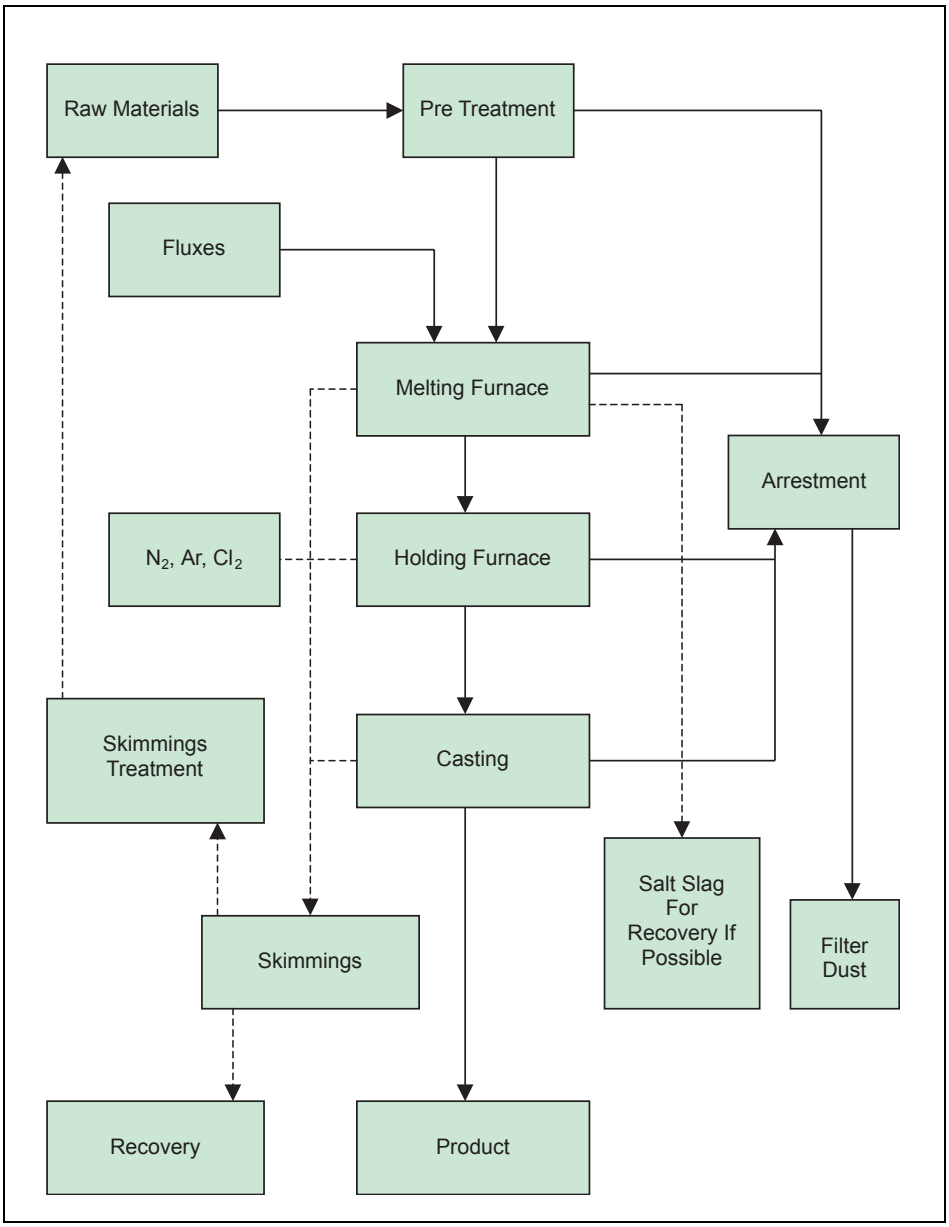
(c) degassing - this involves the removal of hydrogen gas from the melt, traditionally by the addition of solid degassing agents, for example hexachloroethane. The main uses of HCE in aluminium foundries were due to be phased out by the end of 1992 in accordance with PARCOM Decision 92/4. All uses of HCE in aluminium foundries were due to be phased out by the end of 1996. The UK was among the countries which adopted this decision in 1992. A more recent variation involves flux injection where the solid degassing agent is carried into the furnace within a stream of either nitrogen or argon gas.

3.11 This note only refers to processes where refining is carried out as a composite part of a melting and casting operation. Processes which are primarily refining operations, for example to recover aluminium from dross or slag, are subject to national regulatory control and the subject of separate guidance.

3.12 There may be some cases where processes covered by this note operate combustion units which burn waste or recovered oils. Process Guidance Note PG1/2 provides guidance on appliances which burn waste or recovered oil which have a net rated thermal input of under 3MW. In addition, it contains guidance on waste/recovered oil-burning appliances, irrespective of size, where they form part of another Part B process.

3.13 Where processes covered by this note burn waste or recovered oil, regard should therefore also be had to the guidance in PG 1/2. In the event of a conflict between the guidance contained in this note and that in PG 1/2, the former should take precedence.

Figure 3.1: Secondary aluminium generic process



4 Potential releases

Pollutants and sources

4.1 The key emissions from these processes that constitute pollution for the purposes of Part I of the Environmental Protection Act 1990 or the Pollution Prevention and Control Regulations 2000 and therefore warrant control are those consisting of particulate matter, chlorine, chloride and fluoride.

4.2 The following parts of the process may give rise to particulate matter in the form of metal oxide fume and dust:

- charging of the furnace
- melting processes
- pouring of molten metals
- transfer of potentially dusty materials such as powdered fluxes, dross and ash, including discharge into skips or hoppers and handling of green sand

4.3 The following parts of the process may give rise to other pollutants:

- use of chlorine for degassing gives rise to chlorine emissions
- use of fluoride fluxes gives rise to fluoride emissions
- use of chloride fluxes gives rise to chloride emissions

4.4 Dioxins may be produced if the conditions that give rise to such pollutants are present. These are:

- presence of chloride ions - these can arise from contaminated scrap, from use of coal, coke, fuel oil and from certain fluxes
- presence of organic carbon - this may arise from contaminated scrap and from coal, coke or oil used as a fuel
- temperature conditions between 200^{o}C and 650^{o}C

5 Emission limits, monitoring and other provisions

5.1 The emission limit values and provisions described in this section are achievable using the best available techniques described in **Section 6**. Monitoring of emissions should be carried out according to the method specified in this section or by an equivalent method agreed by the regulator. (See Ref. **(e)** (M1) and Ref. **(f)** (M2))

- The reference conditions for limits in **Table 2** are:
  - 273K, 101.3kPa, the oxygen and water references should be that which corresponds to the normal operating conditions in the process concerned.

Table 2: Emission limits, monitoring and other provisions

Row	Source	Substance	Emission limits / provisions	Type of monitoring	Monitoring frequency (subject to paragraph 5.11)
1	Furnace - charging, fluxing, melting, pouring.	Total particulate matter	20 mg/m^3	Indicative monitoring with recording	Continuous
				PLUS	PLUS
				Monitoring to comply with BS ISO 12141:2002 or BS EN 13284:Part 1	Annual

Row	Source	Substance	Emission limits / provisions	Type of monitoring	Monitoring frequency (subject to paragraph 5.11)
2	Degassing	Chlorine	5 mg/m^3	Manual extractive test	Annual

Row	Source	Substance	Emission limits / provisions	Type of monitoring	Monitoring frequency (subject to paragraph 5.11)
3	Fluxing	Fluoride (expressed as hydrogen fluoride)	5 mg/m^3	Manual extractive test	Annual

Row	Source	Substance	Emission limits / provisions	Type of monitoring	Monitoring frequency (subject to paragraph 5.11)
4	Fluxing	Chloride (expressed as hydrogen chloride)	5 mg/m^3	Manual extractive test	Annual

Row	Source	Substance	Emission limits / provisions	Type of monitoring	Monitoring frequency (subject to paragraph 5.11)
5	Processes likely to emit dioxins (see paragraph 5.5)	Dioxins	1 ng/m^3 (I-TEQ)	Manual extractive test BS EN 1948:1997:Part 1, 2 and 3	Annual

Note: The provisions of **Table 2** should not apply to furnaces where all three of the following apply:

(a) only ingots and clean returned sprues, runners and risers and castings are melted; and

(b) no products of combustion are in contact with the molten metal; and

(c) there are no refining operations as identified in paragraph **3.10** (other than degassing using only nitrogen or argon gas).

Monitoring, investigations and recording

5.2 The need for and scope of testing, and the frequency and time of sampling depend on local circumstances, operational practice and the scale of operation. As part of proper supervision the operator will monitor emissions, make tests and inspections of the process and keep records, in particular:

- 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

Information required by the regulator

5.3 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 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.
- 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 the 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/received. The operator should:
  - identify the cause and take corrective action
  - record as much detail as possible regarding the cause and extent of the problem, and the action taken by the operator to rectify the situation
  - re-test to demonstrate compliance as soon as possible; and
  - notify the regulator

Visible and odorous emissions

5.4 Visible and odorous emissions should be limited and monitored as follows. Abnormal emissions require action as described in paragraph **5.6** All reasonably practicable steps should be taken to minimise the duration and visibility of visible emissions during start-up and shut down, and changes of fuel or combustion load.

- Emissions from combustion processes should in normal operation be free from visible smoke and in any case should not exceed the equivalent of Ringelmann Shade 1 as described in British Standard BS 2742:1969.
- All releases to air, other than condensed water vapour, should be free from persistent visible emissions.
- All emissions to air should be free from droplets.
- There should be no offensive odour beyond the installation site boundary, as perceived by the regulator.

- Where an emission point is not fitted with a continuous indicative monitor and alarm in accordance with paragraph **5.8**, visual assessments of emissions should be made frequently and at least once each day whilst the process is in operation. The time, location and result of these assessments should be recorded.

Dioxins

5.5 The following provision is intended to ensure minimisation of dioxin emissions:

Where chloride containing feedstocks are melted i.e. contaminated scrap or where chloride containing fluxes are used, then:

(1) Is secondary chamber (afterburner) interlocked with primary chamber such that the primary chamber cannot be used until the afterburner is up to temperature?

(2) Is the temperature in the secondary chamber continuously monitored?

(3) Is the temperature in the secondary chamber maintained at >850 ^{o}C?

(4) Is the secondary chamber designed to achieve a residence time of at least two seconds?

(5) Is the secondary chamber designed to achieve an oxygen level within the combustion chamber of >6%?

(6) Is there a continuous indicative monitor for particulate matter?

(7) Is the particulate matter concentration maintained at less than 20mg/m^3?

If the answer is NO to any of the above questions (1-7) then there is an annual monitoring requirement for dioxins and a limit of 1.0 ng/m^3.

Furthermore, where gases from the secondary chamber are filtered or scrubbed prior to emission in order to achieve the emission limit for particulate matter of 20 mg/m^3, then the gases should be cooled quickly (quick quench within about two seconds) through the *de novo* synthesis temperature zone of 250 - 650 ^{o}C.

If monitoring results show that the process complies with the dioxin emission limit then further monitoring may not be necessary, provided there is no significant change to the process operating conditions.

Abnormal events

5.6 The regulator needs to be notified about certain events, whether or not there is related monitoring showing an adverse result, and 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:
  - 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.

Continuous monitoring

5.7 Continuous indicative monitoring can be used as a management tool. In conjunction with continuous recording it identifies any trends in emissions; for example, that emissions are gradually increasing, which may indicate a need for maintenance. It can also be used with or without continuous recording to trigger an alarm when there is a sudden increase in emissions; for example, if arrestment plant fails. For a given concentration of particulate the output level varies with the instrument. It should be noted that not all monitors provide a linear response to an increase in particulate matter. The monitor should be set up to provide a baseline output when the plant is known to be operating under the best possible conditions; i.e. such that emissions are fully compliant with the provisions. The instrument manufacturer should be able to set an output level which corresponds to around 75% of the emission limit, to trigger the alarms. Thus the alarms are activated in response to this significant increase in particulate loading above the baseline, so that warning of the changed state is given before an unacceptable emission occurs.

5.8 All new continuous monitoring equipment should be designed for less than 5% downtime over any 3-month period. 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 accordance with the manufacturers' instructions, which should be made available for inspection by the regulator. The relevant maintenance and calibration (or referencing) should be recorded.
- Purchasers of new or replacement monitoring equipment should specify the requirement for less than 5% downtime over any 3-month period, on ordering.

Calibration and compliance monitoring

5.9 In general, non-continuous monitoring should be carried out at least once a year. However, where the operator can demonstrate that a number of individual furnaces carry out similar processes which lead to emissions of the same nature and volume, a sampling programme involving monitoring less frequently than once a year may be appropriate. In any case, each stack should be tested at least once every 4 years, and at least 25% of all stacks should be tested each year. Calibration and compliance monitoring should meet the following provisions as appropriate:

- No result should exceed the emission concentration limits specified in **Table 2**.
- Non-continuous emissions monitoring of particulate matter should be carried out according to the main procedural requirements of BS ISO 12141:2002 or BS EN 13284:Part 1, with averages taken over operating periods, excluding start-up and shutdown.

5.10 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.

Varying monitoring frequency

5.11 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. When determining "consistent compliance" factors to consider include:

(a) the variability of monitoring results, for example, results which range from 5 - 19 mg/m^3 , against an emission limit of 20 mg/m^3 might not qualify for a reduction in monitoring.

(b) the margin between the results and the emission limit, for example, results which range from 18 - 20 mg/m^3 when the limit is 20 mg/m^3 might not qualify for a reduction in monitoring.

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

- three or more monitoring exercises carried out over a period of at least two years or
- two or more monitoring exercises supported by continuous monitoring.

Any significant process changes which might have affected the monitored emission should be taken into account.

5.12 The continuous indicative monitoring that is required is to demonstrate correct functioning of the arrestment equipment. In this context it is not appropriate that reduced monitoring be applied.

5.13 The frequency of testing should be increased, for example, as part of the commissioning of new or substantially changed processes, or where emission levels are near to or approach the emission concentration limits.

Sampling provisions

5.14 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 appropriate British or equivalent standards. e.g. BS EN 13284-1or BS ISO 12141:2002 for sampling particulate matter in stacks.
- The operator should ensure that adequate facilities for sampling are provided on stacks or ducts.
- 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.

6 Control techniques

Summary of best available techniques

6.1 The following table provides a summary of the best available techniques that can be used to control the process in order to meet the emission limits and provisions in **Section 5**. 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 3: Summary of control techniques

Release source	Substance	Control techniques
Melting and holding furnaces	Metal oxide fume and particulate flux emissions	Use clean feedstock, otherwise: Contain emissions - by enclosed furnace for example Extract emissions Abate emissions where necessary to meet the provisions
If the feedstock includes scrap contaminated with oil or paint	PAH, dioxins and products of incomplete combustion	Set up afterburner to ensure complete combustion of waste gases (see paragraph **5.5**)
Melting and holding furnaces	Particulate flux emissions (chloride / fluoride)	Minimise the addition of fluxes Use particle arrestment where necessary to meet the provisions

Techniques to control emissions from contained sources

Particulate matter

6.2 Best available techniques are required to control emissions from melting processes. The main principles for preventing emissions are the use of clean feedstock, operational controls to minimise emissions, then containment and arrestment of emissions. Filtered particulate emissions can be expected to be below 10 mg/m^3 if modern plant designed for the purpose is used.

- The use of grain modifiers, oxidation control materials, fluxes and degassing agents should be reduced to a minimum consistent with good operating practice.
- Emissions from charging and pouring operations should be adequately contained - for example, by the use of local exhaust ventilation - and, where necessary to meet the provisions of this note, vented to suitable arrestment plant.
- Furnaces should be fitted with temperature controls adequate to prevent the emission of substances prescribed for air into the air, for example high magnesium content aluminium alloys should normally be maintained at less than 1053k (780^{o}C) to avoid the generation of magnesium oxide fume.
- Care should be taken in the selection of material and its introduction to the furnace in order to prevent the emission of substances prescribed for air into the air. Where contaminated materials (for example, runners and rises contaminated with lubricants, oily or painted scrap) are melted, emissions should be exhausted to suitable arrestment plant (for example after burner) as necessary to meet the provisions of this note.
- Where air emissions are vented to an afterburner chamber, the furnace should only be charged when the afterburner exhaust temperature exceeds1123k (850^{o}C). Where the furnace includes a door, the door should be interlocked to prevent introduction of material into the furnace unless the afterburner temperature exceeds

1123k (850^{o}C). The afterburner temperature should be maintained at not less than 1123k (850^{o}C) at all times during operation of the furnace. This temperature should be continuously monitored and continuously recorded and an audible and visual alarm should be fitted to activate when the temperature falls below 1123K (850^{o}C). The residence time, air supply and turbulence should be sufficient to ensure complete combustion of waste gases to meet the provisions of this note.

Dioxins

6.3 Feedstock control, good combustion and low particulate emissions minimise the potential for the emission of dioxins (polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans). Where foundries only use clean ingot there is no likelihood of dioxin emissions.

Techniques to control fugitive emissions

Fugitive emissions

6.4 Emissions from melting and holding furnaces should be adequately contained - for example, by the use of extract hoods and exhaust ventilation - to prevent fugitive emissions from the building. Where necessary to meet the provisions of this note, emissions should be vented to suitable arrestment plant.

- All process buildings should be cleaned regularly to minimise the risk of fugitive emissions and made as dust tight as is necessary to prevent visible emissions.
- Stocks of dusty, or potentially dusty, materials for example, fluxing powders should be stored in such a manner as to minimise wind whipping.
- Loading to and from stockpiles should be carried out in a manner which will minimise emissions to the air.
- All potentially dusty materials should be stored in covered containers or undercover.

6.5 Adequate provision to contain liquid and solid spillage is needed. Closed containers prevent wind whipping of dusty waste materials such as particles collected by arrestment plant.

- Dusty wastes, including those from dross pans and the bag filters, should be stored in closed containers and handled in a manner that avoids emissions.
- Dross or ash should be handled and stored under dry conditions.
- All spillages should be cleared as soon as possible; solids by vacuum cleaning, wet methods, or other appropriate techniques. Dry sweeping of dusty spillages should not be permitted.
- A high standard of housekeeping should be maintained.

Air quality

Ambient air quality management

6.6 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 Part B process itself is a significant contributor to the problem, it may be necessary to impose tighter emission limits. If the air quality 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 Part B 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. More guidance on this is provided in paragraph 360 of the Air Quality Strategy which gives the following advice:

"The approach from local authorities to tackling air quality should be an integrated one, involving all strands of local authority activity which impact on air quality and underpinned by a series of principles in which local authorities should aim to secure improvements in the most cost-effective manner, with regard to local environmental

needs while avoiding unnecessary regulation. Their approach should seek an appropriate balance between controls on emissions from domestic, industrial and transport sources and draw on a combination and interaction of public, private and voluntary effort."

Dispersion and dilution

6.7 Pollutants that are emitted via a stack require sufficient dispersion and dilution in the atmosphere to ensure that they ground at concentrations that are harmless. This is the basis upon which stack heights are calculated using HMIP Technical Guidance Note D1 (D1). The stack height so obtained is adjusted to take into account local meteorological data, local topography, nearby emissions and the influence of plant structure. It is necessary that the assessment also take into account the relevant air quality standards that apply for the emitted pollutants.

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. D1 relies upon the unimpeded vertical emission of the pollutant. A cap or other restriction over the stack impedes the vertical emission and hinders dispersion. For this reason where dispersion is required such flow impeders should not be used. A cone may sometimes be useful to increase the exit velocity and achieve greater dispersion.

Revised stack height calculations should not be required unless it is considered necessary because of a breach or serious risk of breach of an EC Directive limit value and because it is clear from the detailed review and assessment work that the Part B process itself is a significant contributor to the problem.

An operator may choose to meet tighter emission limits in order to reduce the required stack height.

Stacks, vents and process exhausts

6.8 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. Stacks and ductwork should be leakproof.

6.9 The dispersion from all stacks and vents can be impaired by low exit velocity at the point of discharge, or deflection of the discharge. Unacceptable emissions of droplets could possibly occur from wet arrestment plant where the linear velocity within the associated ductwork exceeds 9 m/sec. The use of mist eliminators reduces the potential for droplet emissions.

- Where a linear velocity of 9 m/sec is exceeded in the ductwork of existing wet arrestment plant, it should be reduced to the extent that is practicable to ensure that droplet fallout does not occur.
- Flues and ductwork should be cleaned to prevent accumulation of materials, as part of the routine maintenance programme.
- Exhaust gases discharged through a stack or vent should achieve an exit velocity which is normally greater than 15 m/sec during normal operating conditions to achieve adequate dispersion. A lower velocity may be acceptable provided it achieves adequate dispersion and dilution in accordance with paragraph **6.7** above.
- Stacks or vents should not be fitted with any restriction at the final opening such as a plate, cap or cowl, with the exception of a cone which may be necessary to increase the exit velocity of the emissions.

Management

Management techniques

6.10 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
- it is good practice to ensure that spares and consumables are available at short notice in order to rectify breakdowns 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.

- Spares and consumables - in particular, those subject to continual wear - should be held on site, or should be available at short notice from guaranteed suppliers, so that plant break-downs can be rectified rapidly.

Appropriate management systems

6.11 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 processes 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.

Regulators should use their discretion, in consultation with individual operators, in agreeing the appropriate level of environmental management. Simple systems which ensure that LAPC considerations are taken account of in the day-to-day running of a process may well suffice, especially for small and medium-sized enterprises. While authorities may wish to encourage wider adoption of EMS, it is outside the legal scope of an LAPC authorisation/LA-PPC permit to require an EMS for purposes other than LAPC/LA-PPC compliance. For further information/advice on EMS refer to EMS Additional Information in **Section 8**.

Training

6.12 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.

- Training of all staff with responsibility for operating the process should include:
  - awareness of their responsibilities under the permit
  - minimising emissions on start up and shut down
  - action to minimise emissions during abnormal conditions
- The operator should maintain a statement of training requirements for each operational post and keep a record of the training received by each person whose actions may have an impact on the environment. These documents should be made available to the regulator on request.

Maintenance

6.13 Effective preventative maintenance should be employed on all aspects of the process including all plant, buildings and the equipment concerned with the control of emissions to air. In particular:

- A written maintenance programme should be provided to the regulator with respect to pollution control equipment; and
- A record of such maintenance should be made available for inspection.

7 Summary of changes

Reasons for the main changes are summarised below.

Table 4: Summary of changes

Section and paragraph	Change	Reason	Comment
Emission limits, monitoring and other provisions			
Table 2 Row 1	Emission limit for particulate matter of 20 mg/m^3	Good melting techniques in combination with a bag filter where necessary (or similar) achieves this limit.	Limit was 50 mg/m^3 in PG 2/6 (96)
5.5	A dioxin emission limit and a requirement for dioxin monitoring depending upon operating conditions.	To minimise emission of dioxins	
5.9 and **5.14**	Use of BS 3405 for monitoring particulate matter emissions replaced by BS ISO 12141:2002 or BS EN 13284:Part 1 Sampling points on new plant should be designed to comply with BS ISO 12141:2002 or BS EN 13284:Part 1 requirements	BS ISO 12141:2002 or BS EN 13284:Part 1 designed to measure concentrations below those for which BS 3405 was written	The main procedures of BS ISO 12141:2002 or BS EN 13284:Part 1 should be followed and any points of diversion from the standard noted. The effect on the results of any deviation from the standard should be estimated and reported
Control techniques			
6.5	Dusty wastes should be stored in closed containers	Considered to be BAT	
6.12	The operator should maintain a statement of training requirements for each operational post and keep a record of the training received by each person whose actions may have an impact on the environment. These documents should be made available to the regulator on request	Good management practice	
6.13	A written maintenance programme should be provided to the regulator with respect to pollution control equipment	Good management practice which should ensure preventative maintenance is properly considered and planned. Preventative maintenance protects against incidents due to plant failure	

8 Definitions and further information

This guidance	Process Guidance Note 2/6a(04)
Previous guidance	Process Guidance Note 2/6(96) which in its turn replaced PG2/6(91)
LAPC	explained in the Introduction of this guidance
LAPPC	explained in the Introduction of this guidance
Permit	the written permission to operate an installation prescribed for LAPPC – (the replacement for authorisation under LAPC)
Authorisation	the written authority to operate a process prescribed for LAPC - (will be replaced by permit under LAPPC)
Local enforcing authority	is replaced by the word 'regulator' in LAPPC
Regulator	replaces the phrase 'local enforcing authority' from LAPC
Existing process	should be taken to have the following meaning (which is based on paragraph 14 of Schedule 3 to SI 1991 /472): • a process which was being carried on at some time in the 12 months immediately preceding the first day of the month following publication of this guidance note • a process which is to be carried on at a works, plant or factory or by means of mobile plant which was under construction or in the course of manufacture or in the course of commission on the first day of the month following publication of this guidance note, or the construction or supply of which was the subject of a contract entered into before that date
New process	not an existing process.
Authorised person	under section 108 of the Environment Act 1995, "authorised person" has replaced the term "inspector"
Installation	should be interpreted in accordance with the guidance contained in the the General Guidance Manual on Policy and Procedures for A2 and B Installations. www.defra.gov.uk/environment/ppc/manual/index.htm
Process	the term "process has been used in this guidance note to refer to both "processes" under the Environmental Protection Act 1990 and "installations" under the Pollution Prevention and Control Act 1999

Health and safety

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

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

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

- emission limits under the Environment Protection Act 1990 or Pollution Prevention and Control Act 1999 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

EMS additional information

Further information/advice on EMS may be found from the following:

- Envirowise at **www.envirowise.gov.uk** and **www.energy-efficiency.gov.uk** and Environment and Energy Helpline freephone 0800 585794
- ISO 14001 **www.bsi.org.uk** or telephone BSI information centre (020 8966 7022)
- EU Eco Management and Audit Scheme (EMAS) **www.emas.co.uk** or telephone the Institute of Environmental Management and Assessment (01522 540069)

Regulators and process operators may also like to be aware of:

BS 8555: a new standard to help SMEs implement an EMS, by offering a five-phase approach, is contained in BS 8555 which was published in 2003 following on from work undertaken by the Acorn Trust. The Institute of Environmental Management and Assessment, which has taken over the Trust's activities, is developing a scheme of accredited recognition for companies achieving different phases of BS 8555. BS 8555 can be used to achieve ISO 14001 and registration to the higher standard, EMAS.

Some of the **High Street banks**, such as NatWest and the Coop, now offer preferential loan rates to organisations that can demonstrate they are committed to improving their environmental performance. The NatWest also produce a self help guide for SMEs, 'The Better Business Pack', focusing on waste, utilities, transport and supply chain issues. It gives tools, guidance and examples. Contact: WWF-UK on 01483 426444.

References

(a) Secretary of State's Guidance (England and Wales): General Guidance Manual on Policy and Procedures for A2 and B Installations , March 2003 - available from the Defra web-site and, in hard copy, from the Defra Publications line 08459 556000 **www.defra.gov.uk/environment/ppc/index.htm**

(b) DOE/WO Additional Guidance AQ17(94), issued to local authorities by the Air and Environment Quality Division of DEFRA and by the Welsh Office, provides further advice on the assessment of odour. The Scottish equivalent of AQ17(94) is SN 11(94).

(c) Current air quality objectives are specified in:
- The Air Quality (England) Regulations 2002 SI 3043
- The Air Quality (Wales) Regulations 2002 WSI 3182 (W.298)
- The Air Quality (Scotland) Regulations 2002 SSI 297

(d) HMIP Technical Guidance Note D1: "Guidelines on Discharge Stack Heights for Polluting Emissions", published by The Stationery Office, ISBN 0-11-752794-7.

(e) M1 Sampling requirements for monitoring stack emissions to air from industrial installations, Environment Agency July 2002 **(EA website)**

(f) M2 Monitoring of stack emissions to air. Environment Agency May 2003 **(EA website)**

(g) BS 2742:1969: "Notes on the use of Ringelmann and miniature smoke charts".

(h) BS ISO 12141:2002: “Stationary source emissions - Determination of mass concentration of particulate matter (dust) at low concentrations - Manual gravimetric method

(i) BS EN 13284-1:2002: “Stationary source emissions - Determination of low range mass concentration of dust - Part 1: Manual gravimetric method

Web addresses

The final consultation drafts and final published versions of all guidance notes in this series can be found on **www.defra.gov.uk/environment/index.htm**.

Welsh Assembly Government web-site **www.wales.gov.uk**.

Local Authority Unit of the Environment Agency for England and Wales. **www.environment-agency.gov.uk**.

Scottish Environment Protection Agency (SEPA) **www.sepa.org.uk**.

Energy saving and environmental management measures can increase industry profits. Envirowise (formerly ETBPP) show how at **www.envirowise.gov.uk** (or freephone 0800 585794).

Appendix 1: Extract from Pollution Prevention and Control (England and Wales)[7] Regulations 2000 SI 1973[8]

DEFINITION OF NON-FERROUS METAL PROCESSES IN SCHEDULE 1.

(The processes for local air pollution prevention and control are listed under "Part B". The "Part A1" processes are for national regulatory control. The "Part A2" processes are subject to local authority integrated pollution prevention and control.)

Section 2.2 - Non-Ferrous Metals

Part A(1)

(a) Unless falling within Part A(2) of this Section, producing non-ferrous metals from ore, concentrates or secondary raw materials by metallurgical, chemical or electrolytic activities.

(b) Melting, including making alloys, of non-ferrous metals, including recovered products (refining, foundry casting etc.) where -

  (i) the plant has a melting capacity of more than 4 tonnes per day for lead or cadmium or 20 tonnes per day for all other metals; and

  (ii) any furnace, bath or other holding vessel used in the plant for the melting has a design holding capacity of 5 tonnes or more.

(c) Refining any non-ferrous metal or alloy, other than the electrolytic refining of copper, except where the activity is related to an activity described in paragraph (a) of Part A(2), or paragraph (a), (d), or (e) of Part B, of this Section.

(d) Producing, melting or recovering by chemicals means or by the use of heat, lead or any lead alloy, if -

  (i) the activity may result in the release into the air of lead; and

  (ii) in the case of lead alloy, the percentage by weight of lead in the alloy in molten form is more than 23 per cent if the alloy contains copper and 2 per cent in other cases.

(e) Recovering any of the following elements if the activity may result in their release into the air: gallium; indium; palladium; tellurium; thallium.

(f) Producing, melting or recovering (whether by chemical means or by electrolysis or by the use of heat) cadmium or mercury or any alloy containing more than 0.05 per cent by weight of either of those metals or, in aggregate, of both.

(g) Mining zinc or tin bearing ores where the activity may result in the release into water of cadmium or any compound of cadmium in a concentration which is greater than the background concentration.

(h) Manufacturing or repairing involving the use of beryllium or selenium or an alloy containing one or both of those metals if the activity may result in the release into the air of any of the substances listed in paragraph 12 of Part 2 to this Schedule; but an activity does not fall within this paragraph by reason of it involving an alloy that contains beryllium if that alloy in molten form contains less than 0.1 per cent by weight of beryllium and the activity falls within paragraph (a) or (d) of Part B of this Section.

7. For activities carried out in Scotland the PPC (Scotland) Regulations should be referred to. For activities carried out in Ireland the PPC (Ireland) Regulations should be referred to.
8. Every effort has been taken to ensure that this Appendix is correct at the date of publication, but readers should note that the Regulations are likely to be subject to periodic amendment, and this Appendix should not therefore be relied upon as representing the up-to-date position after the publication date.

(i) Pelletising, calcining, roasting or sintering any non-ferrous metal ore or any mixture of such ore and other materials.

Interpretation of Part A(1)

In paragraph (g), "background concentration" means any concentration of cadmium or any compound of cadmium which would be present in the release irrespective of any effect the activity may have had on the composition of the release and, without prejudice to the generality of the foregoing, includes such concentration of those substances as is present in -

(i) water supplied to the site where the activity is carried out;

(ii) water abstracted for use in the activity; and

(iii)precipitation onto the site on which the activity is carried out.

Part A(2)

(a) Melting, including making alloys, of non-ferrous metals, including recovered products (refining, foundry casting, etc.) where -

(i) the plant has a melting capacity of more than 4 tonnes per day for lead or cadmium or 20 tonnes per day for all other metals; and

(ii) no furnace, bath or other holding vessel used in the plant for the melting has a design holding capacity of 5 tonnes or more.

Part B

(a) Melting, including making alloys, of non-ferrous metals (other than tin or any alloy which in molten form contains 50 per cent or more by weight of tin), including recovered products (refining, foundry casting, etc.) in plant with a melting capacity of 4 tonnes or less per day for lead or cadmium or 20 tonnes or less per day for all other metals.

(b) The heating in a furnace or any other appliance of any non-ferrous metal or non-ferrous metal alloy for the purpose of removing grease, oil or any other non-metallic contaminant, including such operations as the removal by heat of plastic or rubber covering from scrap cable, if not related to another activity described in this Part of this Section; but an activity does not fall within this paragraph if -

(i) it involves the use of one or more furnaces or other appliances the primary combustion chambers of which have in aggregate a net rated thermal input of less than 0.2 megawatts; and

(ii) it does not involve the removal by heat of plastic or rubber covering from scrap cable or of any asbestos contaminant.

(c) Melting zinc or a zinc alloy in conjunction with a galvanising activity at a rate of 20 tonnes or less per day.

(d) Melting zinc, aluminium or magnesium or an alloy of one or more of these metals in conjunction with a die-casting activity at a rate of 20 tonnes or less per day.

(e) Unless falling within Part A(1) or A(2) of this Section, the separation of copper, aluminium, magnesium or zinc from mixed scrap by differential melting.

Interpretation of Part B

In this Part "net rated thermal input" is the rate at which fuel can be burned at the maximum continuous rating of the appliance multiplied by the net calorific value of the fuel and expressed as megawatts thermal.

Interpretation of Section 2.2

(1) In this Section "non-ferrous metal alloy" means an alloy which is not a ferrous alloy, as defined in Section 2.1.

(2) Nothing in paragraphs (c) to (h) of Part A(1) or in Part B of this Section shall be taken to refer to the activities of hand soldering, flow soldering or wave soldering.