

**ENVIRONMENT AND HERITAGE SERVICE**

**GUIDANCE FOR PROCESSES PRESCRIBED FOR  
AIR POLLUTION CONTROL  
BY THE CHIEF INDUSTRIAL POLLUTION INSPECTOR**

**CHIEF INSPECTOR'S GUIDANCE  
TO INSPECTORS  
(PART B PROCESSES)**

**FERROUS FOUNDRY PROCESSES**

**B PROCESS GUIDANCE NOTE - GNB 2/1 VERSION 1**

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## **CONTENTS**

1. INTRODUCTION.
2. PROCESS DEFINITION.
3. GENERAL REQUIREMENTS
4. RELEASES INTO AIR
5. RELEASE ROUTES
6. TECHNIQUES FOR RELEASE MINIMISATION.
7. COMPLIANCE MONITORING PROGRAMME.

## 1. INTRODUCTION

This Note is issued by the Chief Industrial Pollution Inspector as one of a series providing guidance for processes prescribed for Air Pollution Control (APC) by the Chief Inspector in Regulations made under the Industrial Pollution Control (Northern Ireland) Order 1997.

A further series of Notes is produced by the Department of the Environment (NI) for those processes prescribed for air pollution control and subject to regulation by the District Councils.

This Note provides a guide on standards and techniques to Inspectors in their assessment of an application for, or variation of, an APC authorisation under the Order.

This Note will also be of interest to operators of such processes, however it should be understood that whether an authorisation is granted, and on what conditions, will depend on the particular circumstances of each application. Parameters such as individual process characteristics and site location may influence the nature of the conditions that are included in an authorisation.

A key objective of the legislation is to ensure that, in carrying on a prescribed process, the best available techniques not entailing excessive cost (BATNEEC) will be used -

- (i) for preventing the release of prescribed substances into the air or, where that is not practicable by means, for reducing the release of such substances to a minimum and for rendering harmless any such substances which are so released; and
- (ii) for rendering harmless any other substances which might cause harm if released into the air.

This Note comprises guidance in relation to new and existing processes and is based on an assessment of best available techniques as qualified by the requirement not to entail excessive cost. (The definition and meaning of BATNEEC is contained in the Industrial Pollution Control Part A and B processes “A Practical Guide”).

The guidance contained in this Note is based on the current state of knowledge and understanding of these processes, their potential impact on the environment, and the available control techniques at the time of publication. The guidance will be updated regularly, (as a minimum the Note will be reviewed at not more than four yearly intervals from the date of publication), to reflect changes in knowledge and understanding. It will not always be possible to revise the Notes quickly enough to keep in absolute step with rapid changes. It is therefore recommended that operators and their advisors check with the Inspectorate as to whether there have been any changes before relying on this Note for the purpose of making an application or taking other significant action under the Order.

## 2. **PROCESS DEFINITION**

2.1 This Note applies to processes using a cupola, crucible furnace, reverberatory furnace, rotary furnace, induction furnace or resistance furnace to make, melt or refine iron, steel or any ferrous alloy and foundry operations carried out in conjunction with these processes where the aggregated design holding capacity of molten metal is 5 tonnes or more as described in Schedule 1 - Section 2.1, Part B of the Industrial Pollution Control Order (Prescribed Processes and Substances) Regulations (Northern Ireland) 1998.

2.2 This Note covers any metal treatments carried out in the furnace or ladle, (for example, nodularisation of ferrous metal using magnesium). The Note also covers foundry operations including mould and core making, casting processes, knock out, quenching, shot blasting and metal removal, (for example, grinding and fettling). It

also relates to foundry sand reclamation operations which may involve screening, crushing, grinding, sieving, heating, drying and cooling of used foundry sand.

- 2.3 In the context of this Note “process” comprises the whole process including the treating, handling and storage of any materials used in the process as well as products and wastes produced by the process.

### 3. **GENERAL REQUIREMENTS**

- 3.1 New processes must comply with the standards contained in this Note immediately.

- 3.2 It should be the aim to bring processes up to current standards whenever the opportunity arises. Account should be taken of the plant’s technical characteristics; its rate of utilisation and the length of its remaining life; the nature and amount of polluting emissions from it and the desirability of not entailing excessive costs for the plant concerned.

- 3.3 As part of the first application for authorisation of existing processes, those areas of the process that require upgrading to achieve the standards of this Note should be identified and the possible techniques which are to be employed indicated. Under normal circumstances, a detailed programme for upgrading, including timetable, should be submitted with the application.

### 4. **RELEASES INTO AIR**

#### 4.1 **Reference Conditions**

All pollutant concentrations from contained releases should be expressed at reference conditions of temperature 273K (0°C) and pressure 101.3 kPa (1 atmosphere) without correction for water vapour content.

## 4.2 Emission Targets

4.2.1 All contained releases should comply with the following emission standards (where appropriate):-

<u>Pollutant</u>	<u>Concentration (mg/m<sup>3</sup>)</u>
Particulate	20
VOCs (as carbon)	20
HCl	20
HF	5
Cl <sub>2</sub>	5
H <sub>2</sub> S	5
Total Amines (as dimethylamine)	10
Lead and its compounds (as Pb)	2
Cadmium and its compounds (as Cd)	0.2
Copper and its compounds (as Cu)	5
Chromium and its compounds (as Cr)	2
Nickel and its compounds (as Ni)	2
Cobalt and its compounds (as Co)	2

4.2.2 All releases, other than steam or water vapour, should be colourless, free from persistent mist or fume and free from droplets.

4.2.3 The aim should be that all releases are free from offensive odour outside the process site boundary, as perceived by the Inspectorate.

4.2.4 Emissions in normal operations from combustion processes should be free from visible smoke and in any case should not exceed the equivalent of Ringlemann Shade 1 as described in British Standard BS 2742:1969.

4.2.5 The use of odour-masking agents and counteractants should not be permitted.

5. **RELEASE ROUTES**

Principal release routes to air are as follows:-

<u>Pollutants</u>	<u>Source</u>
VOCs (including partially oxidised hydrocarbons) and Odorous substances	Mould production, casting, cooling and knocking out operations
Particulate, Metals and Fume	Melting, refining, materials handling and finishing operations

6. **TECHNIQUES FOR RELEASE MINIMISATION**

6.1 **Introduction**

The techniques selected need to include releases from raw materials reception/storage, internal transportation, and from processing.

The process should be designed and operated in such a way that the substances released have the minimum impact on the environment. As a general principle the Inspectorate should be looking for evidence of the prevention, minimisation and rendering harmless of all releases of prescribed substances, and the rendering harmless of all other releases in the application, and requiring this in the authorisation.

Releases from the process may require a combination of several abatement techniques and the careful control of the process route taken in order to deal with the releases. The applicant should review all the options that are available and demonstrate that the combination of primary process and selected abatement equipment demonstrates BATNEEC.

## 6.2 **Techniques**

### 6.2.1 **Materials Handling**

- 6.2.1.1 Stocks of dusty, or potentially dusty materials, (including waste sand and sand awaiting reclamation), should be stored in such a manner as to minimise wind whipping, (for example, by covering, screening or dampening). Loading to and from stockpiles should be performed in a manner that minimises emissions to the air. All such materials should be stored in covered containers, purpose-built silos or under cover whenever practicable.
- 6.2.1.2 All new or reclaimed dry sand stored outside should be placed in purpose-built silos, sealed bags, or closed containers.
- 6.2.1.3 The transportation and handling of dusty materials and wastes should be carried out by methods which minimise emissions to the air. External above ground conveyors for dusty materials should be fitted with protection against wind whipping. Transfer points should be enclosed and ducted to suitable arrestment equipment where necessary to meet the emission requirements of par. 4.2.1.
- 6.2.1.4 Adequate provision should be made for the containment of liquid and solid spillages. All spillages should be cleared as soon as possible by the use of appropriate techniques. Dry sweeping of spillages should not be permitted in circumstances where it may result in the generation of airborne dust outside any building.

- 6.2.1.5 All processes likely to emit any particulate matter into the atmosphere, (for example oxy-fuel cutting, burning-off casting residues, casting and knocking out but excluding the storage and transfer of raw materials), should be undertaken in an enclosed area or building of suitable construction to minimise emissions to air and meet the emission requirements of par. 4.2.1.
- 6.2.1.6 Casting finishing processes, (for example, grinding, shot blasting, polishing and arc air cutting), should be undertaken in booths or areas with extraction of emissions or using equipment incorporating built-in extraction equipment. Any extraction should discharge via arrestment plant to meet the emission requirements of par. 4.2.1.
- 6.2.1.7 All emissions from foundry sand reclamation processes should be contained, captured and where necessary vented to suitable arrestment plant to meet the emission requirements of par. 4.2.1.
- 6.2.1.8 Silos should be vented to suitable arrestment plant. Arrestment plant fitted to silos should be of sufficient size, (and kept clean), to avoid over-pressurisation during delivery. This is particularly important where pressure relief valves are not fitted.

Visual assessment of emissions from arrestment plant on the silo should be undertaken periodically during bulk deliveries, particularly during the first and last five minutes. Storage silos should be equipped with audible or visual high-level alarms to warn of overfilling. The correct operation of such alarms should be checked regularly having regard to the frequency of delivery.

Sight glasses on the silo are an acceptable alternative to alarms where it can be established that sufficient capacity remains in the silos to contain the volume of each delivery, and that the delivery is continually attended.

- 6.2.1.9 The fitting of pressure relief valves will help to minimise damage to arrestment plant if the silo becomes pressurised due to the blinding of filters. Seating of pressure relief valves, where fitted to silos, should be checked at least once a week or before a delivery takes place, whichever is the longer interval. Immediately it appears that the valve may have become unseated, the delivery should cease and no further delivery should take place. The valve should be examined and resealed if necessary. Tanker drivers should be informed of the correct procedure to be followed.
- 6.2.1.10 Care should be taken during delivery from tankers to avoid venting of air to the silo at a rate that is likely to result in over-pressurisation of the silo. Particular problems may arise during the release of air from tankers at the end of deliveries and care should therefore also be taken to avoid over-pressurisation of silos when venting air from tankers at this stage. (It is envisaged that the only practicable means of venting at the end of deliveries will be through a silo.) These can be alleviated by the use of tankers with sufficient valvework to allow a gradual release to occur and by carefully controlled venting. In order that fugitive emissions are minimised during the charging of silos, care should be taken to ensure that the transfer lines are securely connected to the tanker discharge point and the silo delivery inlet point. Tanker drivers should be informed of the correct procedures to be followed.
- 6.2.1.11 The storage and handling of all chemicals should be carried out in a manner that spillages are contained and the potential for odours arising off-site is minimised.

## 6.2.2 **Fugitive Emissions**

- 6.2.2.1 The potential for fugitive releases should be considered in the design of the equipment, in the plant layout and in operating practices with the objective of eliminating the release of untreated emissions.

6.2.2.2 Good operational techniques should be employed to minimise fugitive releases particularly during the handling of molten metals and dusty materials, with capture techniques to collect any releases including containment and extraction at roof level as appropriate.

6.2.2.3 Where practicable all process areas should be maintained under negative pressure to ensure that fugitive releases that do arise pass through the appropriate gas cleaning plant.

### 6.2.3 **Nodularisation**

The aim should be that the emission of magnesium oxide fume from nodularisation process is minimised as much as possible by the use of close coupled extraction and effective hooding venting to a bag filter to meet the emission requirements of par. 4.2.1.

### 6.2.4 **Sand Mould and Core Making**

6.2.4.1 The use of resins, hardeners and catalysts should be minimised, consistent with the correct functioning of the binder system, in order to minimise emissions of volatile organic compounds (VOCs) and odourous substances.

6.2.4.2 Where ovens are used, the hot curing and/or baking of moulds and cores should be carried out in an oven designed for the purpose and should be fuelled by a low sulphur content fuel, (i.e., less than 1% sulphur).

6.2.4.3 Emissions from mould and core production, (including mixing operations), should be discharged through suitable arrestment plant where necessary to meet the requirements of par.s 4.2.1, 4.2.2 and 4.2.3.

6.2.4.4 Burners in mould and core making equipment should be regularly inspected and maintained, to minimise fuel leakage.

## 6.2.5 **Casting Process**

6.2.5.1 Emissions from casting processes should where necessary be captured and vented to suitable abatement plant to meet the emission requirements of par. 4.2.1. It is essential where chemically bonded materials are used that the level of abatement/dispersion is such that the requirements of par. 4.2.3 are met.

6.2.5.2 The emission of organic solvents from the use of die and mould dressing materials should be minimised, for example through the use of water-borne die lubricants and low-solvent mould and core coatings.

Emissions from the use of propanol based mould and core coatings should be minimised by igniting as soon as safely possible after coating.

## 6.2.6 **Thermal Sand Reclamation**

6.2.6.1 The temperature of the gases leaving the combustion chamber of the reclamation unit should be held at a minimum temperature of 850°C for at least 2 seconds. This temperature should be continuously recorded.

6.2.6.2 After cooling, the exhaust gases should vent to atmosphere through a suitable bag filter to meet the requirements of par.s 4.2.1 to 4.2.5.

6.2.6.3 It is essential that the sand reclamation unit should have adequate abatement/dispersion to meet the requirements of par. 4.2.3.

## 6.2.7 **General Operations**

6.2.7.1 Effective control of emissions requires the maintenance and proper use of equipment as well as prudent supervision of process operations. Effective preventive maintenance should be employed on all plant and the equipment concerned with the control of emissions to the air. Essential spares and consumables should be held or available at short notice.

6.2.7.2 Any malfunction or breakdown leading to abnormal emissions should be dealt with promptly and process operations adjusted until normal operations can be restored. The Inspectorate should be informed without delay. All such malfunctions should be recorded in a log book, retained by the operator for a minimum of 4 years and available for examination by the Inspectorate.

6.2.7.3 Staff at all levels should receive the necessary formal training and instruction in their duties relating to control of the process and emissions to air. Particular emphasis should be given to training for start-up, shut down and abnormal conditions.

6.2.7.4 A high standard of housekeeping should be maintained.

## 6.2.8 **Dispersion from Chimneys and Vents**

6.2.8.1 The applicants will need to satisfy the Inspectorate that an appropriate assessment of vent and chimney heights has been made to provide adequate dispersion of prescribed substances, and other substances that might cause harm, which cannot be prevented and may be released. Some guidance is given in Technical Guidance Note D1 (ISBN 0-11-752794-7).

6.2.8.2 It may be necessary for dispersion modelling to be carried out which takes into account local meteorological data, local structures and topography, as well as other local releases, (for example, sites with any large volume emission, significant non-

combustion sources or multiple release points and sites where there are sensitive receptors nearby).

- 6.2.8.3 Applicants should provide clear information on the parameters used and the assumptions made in their assessment, especially when using dispersion models. The assessment of background concentrations of pollutants will be particularly relevant. Statutory air quality standards and other recognised criteria should be taken into account.
- 6.2.8.4 Process upsets or equipment failure giving rise to abnormally high release levels over short periods should be assessed. Even if a very low probability of occurrence can be demonstrated by the applicant, a value for the chimney or vent height should nevertheless be set to avoid any serious damage to health in such circumstances.
- 6.2.8.5 The Operator should have procedures in place to reduce load or shut-down plant in the event of inadequate dispersion conditions.
- 6.2.8.6 Chimneys or process vents should be designed to provide efflux velocities that meet the requirements for stack aerodynamic downwash as described in Technical Guidance Note D1. Care should be taken to avoid generating positive pressure zones within the chimney unless the chimney wall is impervious or lined. Where a wet method of arrestment is used, the linear velocity within the arrestment equipment should not exceed 9 m/sec, to avoid entrainment of droplets.
- 6.2.8.7 Chimney flues, process vents and all ductwork should be leakproof. Chimney flues and ductwork leading to the chimney should be adequately insulated to minimise the cooling of waste gases and prevent liquid condensation on internal surfaces. Chimney flues and ductwork should be regularly cleaned to prevent accumulation of material.

- 6.2.8.8 Chimney or process vents should not be fitted with any restriction at the final opening, (for example, a plate, cap or cowl), where it is necessary to achieve dispersion of the residual pollutants except for a cone to meet the efflux velocity requirements of par. 6.2.8.6. The discharge should be vertically upwards.7.

## 7. **COMPLIANCE MONITORING PROGRAMME**

### 7.1 **General**

Conditions in the authorisation should require the results of all monitoring to be recorded. It should further distinguish between:

- compliance records;
- measurement or records for which regular formal returns to the Inspectorate are not normally required; and
- operational records made by the operator during the normal course of operating the process.

### 7.2 **Monitoring Requirements**

- 7.2.1 Particulate emissions should be continuously monitored and continuously recorded to indicate performance of abatement plant. (Continuously monitored means “monitoring to indicate the relative performance and/or process variation” and therefore does not provide data to demonstrate compliance with a numerical emission limit.) The instruments should be fitted with audible and visual alarms which should activate at a reference level agreed with the Inspectorate. Emission events which lead to the alarms being activated should be automatically recorded. These monitors should be checked to ensure that they are functioning correctly in accordance with the manufacturer’s instructions.

7.2.2 Where the emission standards in par. 4.2.1 apply, emissions should be tested at least once a year. If a justifiable compliant situation arises, the frequency may need to be increased.

7.2.3 Where arrestment plant includes wet scrubbing for amines or hydrogen sulphide the scrubber liquor should be continuously monitored for pH. The monitor should be fitted with audible and visual alarms which activate at a level which indicates that the emission limits for amines and hydrogen sulphide in par. 4.2.1 may be being exceeded.

Where a wet scrubber is used to abate emissions a visual inspection of the equipment should be made at least once a week to ensure correct functioning of the equipment including adequate liquor circulation. The results of the inspection should be recorded in the log book. Scrubber liquor flow should be continuously monitored, triggering an alarm or stand-by pump in the event of pump failure.

7.2.4 The results of all non-continuous emission testing should be forwarded to the Inspector within 8 weeks of the completion of the sampling.

A summary of continuous indicative particulate monitoring data should be submitted to the Inspectorate at least every 6 months, identifying the times, dates and duration of alarm events.

Where any emission measurement exceeds the specified emission standard specified in par. 4.2.1, the results should be forwarded to the Inspectorate. Where any emission exceeds twice the specified emission standard specified in par. 4.2.1, the Inspectorate should be advised immediately.

7.2.5 The Inspectorate should be advised at least 7 days in advance of any periodic monitoring exercise to determine compliance with emission limits, as well as the

provisional time and date of monitoring, pollutants to be tested and the methods to be used.

- 7.2.6 The sampling positions for all monitoring instruments should be agreed with the Inspectorate. Care is needed in the design and location of sampling systems to obtain representative samples.
- 7.2.7 The reference test method for particulate matter emissions in chimneys or ducts is that of British Standard BS 3405: 1983. Alternative methods of testing may be acceptable by agreement with the Inspectorate provided that it can be shown that comparable results are obtained.
- 7.2.8 The measurement of the concentration of other pollutants should be with test methods agreed with the Inspectorate.
- 7.2.9 The onus is on the operator, that the appropriate equipment, laboratory facilities, expertise and quality control procedures are provided to ensure accurate results.
- 7.2.10 **Environmental Monitoring**

The impact of the process on the environment will be affected by the size of the releases and the site's location. The need for environmental monitoring should be addressed in the application, where necessary, to demonstrate that the releases have been adequately rendered harmless by the application of BATNEEC.