Process Guidance Note 3/6 (04)

Secretary of State's Guidance for Polishing or Etching Glass or Glass Products using Hydrofluoric Acid

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Environment Agency

Contents

1 Introduction 1

2 Timetable for compliance and reviews 4

Existing processes or activities 4

New processes or activities 4

Substantially changed processes or activities 4

Permit reviews 5

3 Process description 6

4 Potential releases 8

5 Emission limits, monitoring and other provisions 9

6 Control techniques 13

Techniques to control emissions from contained sources 13

Techniques to control fugitive emissions 14

Air quality 15

Management 16

7 Summary of changes 18

8 Definitions and further information 19

Health and safety 20

EMS additional information 20

References 21

Web addresses 21

Appendix 1:Extract from Pollution Prevention and Control (England and Wales) Regulations 2000 SI 1973 22

Appendix 2:International Ambient Air Quality Guideline Values for Fluorides 23

List of Tables

Table 1: Compliance timetable 4

Table 2: Emission limits, monitoring and other provisions 9

Table 3: Summary of control techniques 13

Table 4: Summary of changes 18

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 installations/ processes[1] for the polishing or etching of glass or glass products using hydrofluoric acid. It supersedes guidance note PG3/6(95) published in August 1995.

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 processes and 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 or 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 purposes of this guidance note, the two concepts are regarded as having essentially the same effect.
3. In accordance the Pollution Prevention & Control (England and Wales) (Amendment) Regulations 2002, SI 2002/275, processes for the Polishing or Etching of Glass or Glass Products Using Hydrofluoric Acid transfer from regulation under the 1990 Act to the 1999 Act from 1 April 2005. The relevant date in Scotland under Part 2 of schedule 3 to SSI 2000/323 is 31 December 2002.
4. In Scotland section 24 of 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 the polishing or etching of glass or glass products using hydrofluoric acid
- 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**.

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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 October 1999. 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
Particulate matter 20mg/m^3 for agitated acid dipping processes	**Table 2** Row 2	Within 12 months of the publication of this note
Total fluoride (expressed as hydrogen fluoride) - new limit for agitated acid dipping processes of 2mg/m^3	**Table 2** Row 3	Within 12 months of the publication of this note
Total fluoride (expressed as hydrogen fluoride) - new parameter for etching and still acid dipping processes of 5mg/m^3	**Table 2** Row 4	Within 12 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 processes.

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 charge from the first day of operation.

Permit reviews

Reviewing permits

2.7 Under LAPC the provision 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 the “General Guidance Manual on Policy and Procedures for A2 and B Installations” (Ref 2) available from **www.defra.gov.uk/environment/ppc/index.htm** to be referred to in this document as 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 the polishing or etching of glass or glass products using hydrofluoric acid are prescribed for:

- **LAPC**, under section 3.5 of Schedule 1 to the Environmental Protection (Prescribed Processes and Substances) Regulations 1991, SI 472 (as amended).
- **LAPPC**, under section 3.3 Part B (d) of Schedule 1 of the Pollution Prevention and Control (England and Wales) Regulations 2000 SI 1973.[6]

3.2 This note refers to processes for the polishing or etching of glass or glass products where either hydrofluoric acid is used or there is a potential for atmospheric emissions of hydrogen fluoride.

3.3 Separate notes have been produced which relate to other Part B prescribed glass processes. These are PG3/3(95), glass (excluding lead glass) manufacturing processes, and PG3/4(04) lead glass, glass frit and enamel frit manufacturing processes.

3.4 Processes covered under this note include the use of hydrofluoric acid to polish lead crystal glassware and to etch the surface of cathode ray tubes prior to coating.

3.5 The glass polishing process is as follows:

Unpolished glassware may be prepared by cutting before being loaded into containers, usually of polypropylene because of the corrosive nature of the etching/ polishing agent.

The polishing process includes an alkaline wash, and dipping in baths of hydrofluoric and sulphuric acids and rinse water. This part of the process releases hydrogen fluoride and other fluoride compounds to air, which must be extracted and passed through a scrubbing system. The polishing baths may be 'agitated' or 'still'.

In larger operations, the acid bath process involves agitation of either the glass container or the bath fluid using injected air, for example the Achtal/Neutra and Salzle processes. Automation may be introduced to time the dipping process, and a fully automated plant will perform a series of dipping and rinsing operations.

Agitation of the polishing bath generates significant hydrogen fluoride fume and recent measurement techniques have revealed that there can also be significant quantities of silicon tetrafluoride in the exhaust. The optimum scrubbing conditions for hydrogen fluoride removal may not satisfactorily abate the emission of silicon tetrafluoride, leading to the need for multiple stage scrubbing. This leads to a greater reduction of total fluoride emission and a tighter fluoride limit is appropriate.

In smaller operations, the baths are 'still' i.e. not agitated, and a manual process is used to lower the containers into a bath containing a mixture of hydrofluoric and sulphuric acids. Single stage scrubbers may be adequate to abate the hydrogen fluoride.

In both types of polishing, the acid dissolves part of the surface of the glass to reduce its roughness, giving a highly polished surface. Acidic sludge produced must be periodically removed from the bath and may be neutralised with powdered lime, for example.

Polished objects are rinsed in water and dried before being packed and dispatched.

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

3.6 The etching of cathode ray tubes uses a different process:

Cathode ray tubes are etched prior to coating with phosphorescence and/or graphite. The etching process is a multi-stage one and may include:

- etching by impingement or spraying of dilute or concentrated nitric and hydrofluoric acids
- spraying with sulphamic acid or ammonium bifluoride in solution
- intermediate rinsing processes using de-ionised and townswater, followed by drying

The process generates fume containing hydrogen fluoride and ammonia, which is extracted to scrubbing systems.

4 Potential releases

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, hydrogen fluoride, silicon tetrafluoride, hexafluorosilicates and ammonia.

4.2 The following parts of the process may give rise to hydrogen fluoride and silicon tetrafluoride emissions to air, as well as particulate matter in the form of mist:

- acid dipping baths
- cathode ray tube screen preparation, washing and etching

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

- cathode ray tube screen washing may result in the release of ammonia
- acid dipping bath emissions may also consist of hexafluorosilicates

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.

- The reference conditions for pollutant concentrations 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	Substance	Source	Emission limits / provisions	Type of monitoring	Monitoring frequency (subject to paragraph 5.11)
1	Total particulate matter	Material handling activities	Emission concentration limit of 20mg/m^3	Manual extractive	Annual
2		Activities which include agitated acid dipping lines			
3	Total fluoride emissions expressed as hydrogen fluoride, having regard to paragraph 5.8.	Activities which include agitated acid dipping lines	Emission concentration limit of 2mg/m^3	Conductivity testing of the scrubber liquor in each tower plus manual extractive	Continuous plus every 6 months
4		Activities where only etching of cathode ray tubes or similar etching processes or still bath dipping is carried out	Emission concentration limit of 5mg/m^3	Indicative testing plus manual extractive	Weekly plus every 6 months
5	Ammonia	Cathode ray tube and similar etching process	Emission concentration limit of 18mg/m^3	Indicative testing plus manual extractive	Weekly plus every 6 months

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.
- Where continuous measurement of the scrubbing liquor conductivity is carried out then such measurements should be continuously recorded.

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 process 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 emissions

5.4 Visible emissions should be limited and monitored as follows. Abnormal emissions require action as described in paragraph **5.5**.

- 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.
- 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.

Abnormal events

5.5 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 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 scrubber units; or
  - in the event of failure of continuous monitoring or recording equipment

Continuous monitoring

5.6 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 pollutant, the output level varies with the instrument. It should be noted that not all monitors provide a linear response to an increase in the pollutant being measured. 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 alarms. 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.

- In the case of water based arrestment systems continuous monitoring and recording of the conductivity of the scrubbing liquor in the arrestment systems can be used as a surrogate for total fluoride (expressed as HF) emissions which are released to the atmosphere. Such measurements can be used as a valuable management tool in providing a continuous estimate of total fluoride (expressed as HF) emissions which are released to the atmosphere from the process. Continuous monitoring can also be used to identify 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 where there is a sudden increase in emissions, for example, if arrestment plant fails.

5.7 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. All continuous monitoring equipment should be fitted with audible and visual alarms to warn of occasions when excursion conditions occur.
- 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

5.8 Calibration and compliance monitoring should meet the following provisions as appropriate:

- No result should exceed the emission concentration limits specified. However, regulators should allow some discretion initially with regard to total fluoride emissions pending confirmation that CEN methodology allows achievement of the limits which will be reviewed in the light of practical experience with the CEN methodology.
- Where required, results of conductivity measurements should be continuously recorded and displayed to the operator. They should be referenced when six monthly extractive monitoring is carried out. This applies to processes using agitated dipping processes.
- Where continuous conductivity measurements of the scrubbing liquor are undertaken the instrumentation shall be calibrated on a quarterly basis.

- Non-continuous emissions monitoring of particulate should be carried out according to the main procedural requirements of BS ISO 9096:2003, with averages taken over the production cycle.
- Emissions monitoring of fluoride should be carried out in accordance with the relevant CEN standard where available, or otherwise an equivalent methodology agreed with the regulator.

5.9 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

5.10 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.

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.

- Where emission limit values are consistently met without the use of arrestment equipment, the annual monitoring provision for those pollutants should be dispensed with, subject to the caveats of this paragraph.

Ambient monitoring

5.12 Where complaint is attributable to the operation of the process and is, in the opinion of the regulator justified, then an appropriate ambient monitoring programme should be undertaken, the nature of which has been agreed with the regulator. **Appendix 2** includes some current international guideline values for fluorides.

Sampling provisions

5.13 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. e.g. BS ISO 9096: 2003, 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 or installation 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
Displaced air emissions on loading acid bulk storage tanks	Hydrogen fluoride	Arrestment plant e.g. scrubber or bag filter or back venting to the delivery vehicle. High level alarms. Interlock system to prevent overfilling.
Process chemicals e.g. lime for neutralisation	Particulate	Good house keeping and operator training
Displaced air emissions on loading bulk storage tanks and silos	Particulate	Arrestment plant e.g. scrubber or bag filter or back venting to the delivery vehicle. High level alarms. Interlock system to prevent overfilling.
Storage drums	Particulate, fume or vapour	Avoid use of drums where practicable. Keep partly used or nominally empty drums tightly closed. Store in a dedicated, well ventilated area.
Agitated acid polishing baths	Particulate mist	Arrestment - mist eliminators
Agitated acid polishing baths	Fluorides	Local extraction ducted to arrestment plant - multi-stage scrubber
Cathode ray tube screen and similar etching processes and still acid dipping baths	Fluorides	Local extraction ducted to arrestment plant - minimum of single stage scrubber

Techniques to control emissions from contained sources

Particulate

6.2 Emissions of particulate matter should be filtered if necessary to meet the emission limit. The use of a mist eliminator is expected to reduce particulate matter emissions to below the emission limit in **Section 5**.

Fluoride

6.3 Depending upon the intensity of the emission, different scrubber systems may be required to achieve the emission limit for total fluorides. For glass screen etching and still acid bath operations, a single tower scrubber where the scrubbing solution is repeatedly replaced with uncontaminated liquor may suffice. For acid dipping processes where agitation is used, multi tower scrubbing systems are likely to be required. At least the first stage of scrubbing may well consist of dilute hydrofluoric acid which removes some of the fluoride component in the emission. In order to achieve optimum control of the arrestment of total fluoride emissions, continuous monitoring and recording of the scrubbing liquor conductivity in the arrestment towers should be undertaken. Automatic replenishment of the scrubbing liquor should take place in response to preset threshold values being reached. In all cases good maintenance and management is required to ensure the scrubber is operating to the required standard.

- All baths, process vessels and tanks should be provided with local extraction and ducted to arrestment equipment where necessary to meet the provisions of **Table 2** and paragraph **5.4** above.

Techniques to control fugitive emissions

6.4 Storage and delivery of chemicals has the potential to give rise to fugitive emissions as well as transfer of chemicals on site. Storage vessels should be carefully sited, and the transfer of acids needs to be strictly controlled to avoid spillages.

- Wherever practicable, in relation to quantities of materials used, all materials should be stored in either bulk storage tanks or silos.
- Substances displaced from bulk storage tanks and silos should be ducted to suitable arrestment equipment - for example a scrubber or bag filter or back vented to the delivery vehicle, in order to meet the provisions of **Table 2** and paragraph **5.4** above.
- Arrestment equipment serving silos for bulk storage of dry materials should be sited at ground level to facilitate maintenance and visual monitoring of emissions, wherever practical in relation to process characteristics.
- Chemical storage tanks and silos should be fitted with a high level alarm that sounds when, for example, 80% of the tank or silo capacity is reached. This should be connected to an interlock system which isolates the delivery system, thereby preventing overfilling.
- Where drum storage is unavoidable, drums should be stored in a dedicated, well ventilated area and all drums, including partly used or nominally empty drums, should be kept sealed or tightly closed. Drums should not be pressurised to effect delivery from them unless they are designed to be used in this way.
- Where storage of dry materials in sacks, bags or other containers is unavoidable, all handling operations, especially the addition of dry materials to the process, should be done in such a way as to minimise emission of particulate matter.
- Above ground bulk chemical storage tanks and above ground bulk fuel storage tanks should be completely contained by bunding.
- Bunding should :
  - completely contain above ground bulk fuel storage tanks;
  - be impervious and resistant to the chemicals in storage; and
  - be capable of holding 110% of the capacity of the largest storage tank
- Adequate provision to contain liquid and solid spillage is needed - for example, by provision of spillage containment kerbs to drummed material storage areas. 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

6.5 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 from stack

6.6 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. Best available scientific knowledge suggests that vegetation is more sensitive to ambient fluoride exposure than materials and public health. If ambient fluoride concentrations are at a level which protect vegetation then other environmental receptors are expected to be protected as a consequence. Dispersion modelling is required to be undertaken to calculate the stack height and efflux velocity which is required to render emissions harmless with respect to vegetation. (**Appendix 2** includes reference to internationally used guidelines set to protect vegetation). In the case of etching or still dipping processes a straightforward D1 calculation should be sufficient to calculate stack height. Where agitated acid dipping processes occur an alternative more detailed dispersion model may be required, subject to the agreement of the regulator. The dispersion modelling which is used to calculate stack height and efflux velocity should take into account local meteorological data, local topography, nearby emissions and the influence of nearby buildings and plant structure. Existing stack heights and efflux velocities should be recalculated where , in the opinion of the enforcing authority, there is evidence of justified public complaint or environmental impact 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 efflux 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

6.7 Liquid condensation on internal surfaces of stack flues 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.

6.8 Unacceptable emissions of droplets could possibly occur from wet arrestment plant where the linear velocity within the associated ductwork exceeds 9 m/s. The use of mist eliminators reduces the potential for droplet emissions.

- Where a linear velocity of 9 m/s is exceeded in the ductwork of existing wet arrestment plant, it should be reduced, subject to health and safety considerations, to ensure that droplet fallout does not occur.
- Stack flues and ductwork should be cleaned to prevent accumulation of materials, as part of the routine maintenance programme.
- 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

6.9 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 local suppliers, so that plant breakdowns can be rectified rapidly.

Appropriate management systems

6.10 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/LAPPC permit to require an EMS for purposes other than LAPC/LAPPC compliance. For further information/advice on EMS refer to EMS Additional Information in **Section 8**.

Training

6.11 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

6.12 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 / Paragrpah / Row	Change	Reason	Comment
Emission limits, monitoring and other provisions			
Table 2, Row 1 and 2	Particulate matter 20mg/m^3.	Achievable using BAT.	Limit was 50mg/m^3.
Table 2, Row 3	Total fluoride (expressed as hydrogen fluoride) - new limit for agitated acid dipping processes of 2mg/m^3.	Already complied with by all known processes.	Limit was 5mg/m^3. Some discretion may be required as the CEN methodology may not have been previously used. It is not known for sure that this methodology will allow limit to be met and the position will be reviewed in the light of practical experience with the CEN methodology.
Table 2, Row 4	Total fluoride (expressed as hydrogen fluoride) - new parameter for etching and still acid dipping processes of 5mg/m^3.	Emission includes other fluorides.	Same limit, but previously it only applied to hydrogen fluoride. Some discretion may be required as the CEN methodology may not have been previously used. It is not known for sure that this methodology will allow limit to be met and the position will be reviewed in the light of practical experience with the CEN methodology.
Paragraph **5.8**	Use of BS 3405 for monitoring particulate matter emissions replaced by BS ISO 9096:2003. Sampling points on new plant should be designed to comply with BS ISO 9096:2003 requirements.	BS ISO 9096:2003 designed to measure concentrations below those for which BS 3405 was written.	The main procedures of BS ISO 9096:2003 should be followed and any points of diversion from the standard noted. The effect of the results of any deviation from the standard should be estimated and reported.
Paragraph **5.12**	Ambient air monitoring.	To recognise a potential need to investigate source of nuisance.	Measurable effect of HF on the environment.
Control techniques			
Paragraph **6.3**	Scrubber plant.	Considered to be BAT.	

8 Definitions and further information

This guidance	Process Guidance Note 3/6 (04).
Previous guidance	Process Guidance Note 3/6 (95) which in its turn replaced PG 3/6 (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 Environmental Protection Act 1990 relate to the concentration of pollutant released into the air from prescribed processes
- 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 2000 SI 928
- The Air Quality (Wales) Regulations 2000 SI 1940
- The Air Quality (Scotland) Regulations 2000 SI 97

(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)**

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]

(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 3.3 - Manufacturing Glass and Glass Fibre

Part A(1)

(a) Manufacturing glass fibre.

(b) Manufacturing glass frit or enamel frit and its use in any activity where that activity is related to its manufacture and the aggregate quantity of such substances manufactured in any period of 12 months is likely to be 100 tonnes or more.

Part A(2)

(a) Manufacturing glass, unless falling within Part A(1) of this Section, where the melting capacity of the plant is more than 20 tonnes per day.

Part B

Unless falling within Part A(1) or A(2) of this Section -

(a) Manufacturing glass at any location where the person concerned has the capacity to make 5,000 tonnes or more of glass in any period of 12 months, and any activity involving the use of glass which is carried out at any such location in conjunction with its manufacture.

(b) Manufacturing glass where the use of lead or any lead compound is involved.

(c) Manufacturing any glass product where lead or any lead compound has been used in the manufacture of the glass except -

(i) making products from lead glass blanks; or

(ii) melting, or mixing with another substance, glass manufactured elsewhere to produce articles such as ornaments or road paint.

(d) Polishing or etching glass or glass products in the course of any manufacturing activity if -

(i) hydrofluoric acid is used; or

(ii) hydrogen fluoride may be released into the air.

(e) Manufacturing glass frit or enamel frit and its use in any activity where that activity is related to its manufacture.

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.

Appendix 2: International Ambient Air Quality Guideline Values for Fluorides

98 percentile of 1 hourly values = 3ug/m^3 (German TA Luft Standard)

99 percentile of 1 hourly values = 2ug/m^3 (Danish C value)

24 hour average value = 1.1 ug/m^3 (Canadian Environmental Services)

Annual arithmetic mean = 0.2ug/m^3 (World Health Organisation)