ENVIRONMENTAL PROTECTION AGENCY

BATNEEC GUIDANCE NOTE

Classes 4.3

GLASS PRODUCTION

(Draft 1)

1. INTRODUCTION

This Guidance Note is one of a series issued by the Environmental Protection Agency and is designed to provide guidance to those applying for integrated pollution control licences under the EPA Act. It should also be read in conjunction with *Application Guidance Notes*, available under separate cover.

It should be noted at the outset, that noise is not included within the scope of this work and guidance on this parameter has been issued separately.

This Guidance Note is comprised of seven main sections and an appendix. Following this introduction, Section 2 contains a general note on the interpretation of BATNEEC. The industrial activity covered by the terms of this note is given in Section 3. In Section 4, the technologies to control emissions are tabulated and in Section 5 the specific emission limit values (ELVs) are given. Section 6 contains comments on compliance monitoring requirements, while the principal references are given in Section 7.

The Appendix gives the main sources of emissions, and the principal releases from such sources.

All applicants for Integrated Pollution Control licences, in the sector covered by this note, should carefully examine the information laid down in this Guidance Note, and should use this information to assist in the making of a satisfactory application for an Integrated Pollution Control licence to the Agency. It should be clearly understood that achieving the emission limit values does not, by itself, meet the overall requirements in relation to I.P.C. In addition to meeting such values the applicant will also be required to demonstrate that waste minimisation is a priority objective and to put in place particular abatement measures to reduce overall mass emissions and pollutant load where this is necessary to protect the ambient environment.

The technologies and the associated emission limit values (ELVs) identified in this Guidance Note are, at the time of writing, regarded as representing BATNEEC for new activities. BATNEEC is not a static quality and will change as technologies, environmental factors and costs alter with the passage of time. The Agency may amend or update the guidance contained in this note should such amendments seem appropriate. The information contained in this Guidance Note is intended to be used only as a tool to assist in determining the BATNEEC for an operation in this sector and should not be taken to be a definitive authority on the BATNEEC for this sector**.** This Note should not be considered as a legal document**.**

2. INTERPRETATION OF BATNEEC

BATNEEC means '*the best available technology not entailing excessive costs'.* The technology in question should be **Best** at preventing pollution and **Available** in the sense that it is procurable by the industry concerned. **Technology** itself is taken as the techniques and the use of the techniques, including training and maintenance etc. **NEEC** addresses the balance between environmental benefit and financial expense.

The objective of the Best Available Technology Not Entailing Excessive Costs (BATNEEC) Guidelines is to provide a list of technologies which will be used by the EPA to determine BATNEEC for a scheduled activity. The BATNEEC identified in this Guidance Note is used as a basis for setting emission limit values. It is intended to update these guidelines as required in order to incorporate technological advances as they occur.

In the identification of BATNEEC, emphasis is placed on pollution prevention techniques, including cleaner technologies and waste minimisation, rather than end-of-pipe treatment.

Technologies identified in the BATNEEC guidelines are considered to be current best practice for the purposes of setting emission limit values. These technologies are representative of a wide range of currently employed technologies appropriate to particular circumstances. However, the guidance issued in this note in respect of the use of any technology, technique or standard does not preclude the use of any other similar technology, technique or standard which may achieve the same emission. The entire range would not necessarily be appropriate in specific cases. The specific choice depends on a wide range of circumstances but the crucial factor is that the selected regime achieves BATNEEC. In applying BATNEEC, Environmental Quality Objectives (EQOs) must be respected where set. Measures such as in-plant changes, raw material substitution, process recycling and improved material handling and storage practices, may also be employed to effect reductions in emissions. As well as providing for the installation of equipment and the operation of procedures for the reduction of possible emissions, BATNEEC will also necessitate the adoption of an on-going programme of environmental management and control, which will focus on continuing improvements aimed at prevention, elimination and/or progressive reduction of emissions.

As described in the EPA Act of 1992, BATNEEC will be used to prevent, eliminate or, where that is not practicable, limit, abate, or reduce an emission from an activity which is listed in the first schedule to the Act. The use of BATNEEC is construed in the Act to mean the provision and proper maintenance, operation, use and supervision of facilities which are the most suitable for the purposes.

In determining BATNEEC for an activity, regard shall be had to :

- the current state of technical knowledge;

- the requirements of environmental protection;

- the application of measures for these purposes, which do not entail excessive costs, having regard to the risk of significant environmental pollution which, in the opinion of the agency, exists.

For existing facilities, additional regard shall be had to :

- the nature, extent and effect of the emission concerned;

- the nature and age of the existing facilities connected with the activity and the period during which the facilities are likely to be used or to continue in operation, and

- the costs which would be incurred in improving or replacing these existing facilities in relation to the economic situation of activities of the class concerned.

The technologies and the associated emission limit values (ELVs) identified in this Guidance Note are regarded as representing BATNEEC for a *new* activity. However, it is also generally envisaged that *existing* facilities will progress towards attainment of similar emission limit values, but the specific ELV requirements and associated time frames will be identified on a case by case basis when the licence application is being processed. Furthermore, for *all* facilities, additional and more stringent requirements may be specified on a site-specific basis whenever environmental protection so requires. Hence the BATNEEC guidelines are not the sole basis on which licence emission limit values are to be set, since information from other sources will also be considered, including site-specific environmental and technical data, plant financial data and other relevant information.

3. SECTOR COVERED BY THIS GUIDANCE NOTE

This Guidance Note covers SECTOR 4 of the activities specified in the First Schedule to the EPA Act, 1992. These are:

4.3 The production of glass (ordinary and special) in plants with a capacity exceeding 5,000 tonnes per year.

4. CONTROL TECHNOLOGIES

4.1 INTRODUCTION

As explained in Section 2, this Guidance Note identifies BATNEEC, but obviously does so in the absence of site-specific information. Accordingly it represents the requirements expected of any new activity covered by the Note, but does not exclude additional requirements which may form part of the granting of a licence for a specific site.

The approach to be used in selecting BATNEEC is based on the following hierarchy:

- Process design / redesign changes to **eliminate** emissions and wastes that might pose environmental problems.
- **Substitution** of materials / solvents etc. by environmentally less harmful ones.
- Demonstration of waste **minimisation** by means of process control, inventory control and end-of-pipe technologies etc.

The existing or possible measures for reducing and controlling emissions are described in this section. These range from relatively simple containment measures to sophisticated recovery and end-of-pipe technologies and include:

(i) Load Minimisation
(ii) Containment
(iii) Recovery/recycle
(iv) Emission reduction
(v) Waste treatment & disposal.

The technical feasibility of the measures listed below has been demonstrated by various sources. Used singly or in combination, the measures represent BATNEEC solutions when implemented in the appropriate circumstances. The circumstances depend on plant scale, materials used, nature of the products made, number of different products produced, etc. A summary of the treatments for various emissions is given at the end of the section.
Note that where flammable/ explosive vapours or dust are handled, safety procedures (acceptable to the Health & Safely Authority) should be adopted and nothing in this note should be construed as advise to the contrary.

4.2 TECHNOLOGIES FOR LOAD MINIMISATION

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and environmental site constraints).

- Use of cullet wherever possible for glass production.
- Inventory control.
- Optimisation of water usage.
- Dry equipment cleaning and dry vacuum systems, where feasible.
- Separation of cooling water, storm water and process effluents of different origin in order to permit appropriate treatment options.
- Where fossil fuels are used, oxygen enrichment or pure oxygen to be used for combustion (resulting in fuel saving and increased productivity) but this procedure will need optimisation to avoid increased NOx production (use of pure oxy/fuel mixtures can reduce NOx levels and exhaust gas volumes with reduced mass loads of particulates, though concentrations may increase).
- Use of natural gas as a fuel source from the furnace is preferred to fuel oil (where such an option exists); alternatively the use of electric furnaces is preferred.

4.3 CONTAINMENT OF EMISSIONS:

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and on site constraints).

- Bunding of all stored materials with separate bunding for incompatibles
- Low loss vacuum pumps, e.g., dry vacuum pumps.
- Overground pipelines and transfer lines.
- Totally enclosed belt conveyors.
- Enclosed forming chambers.
- Enclosure (of materials, storage, handling and transfer).
- Use of granular raw materials preferred to fine powders.
- No dry sweeping of spillages - vacuum cleaners to B.S. 6016 Type H to be available and used.
- Overfilling protection on bulk storage tanks.
- Prevention of rain ingress, wind entrainment etc. for stored materials.
- Heat recovery to be used where practicable.
- Storage of delivered materials pending detailed analysis.

4.4 TECHNOLOGIES FOR RECOVERY AND RECYCLE:

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and environmental site constraints).

- Waste glass recovery for use as cullet.

4.5 TECHNOLOGIES FOR TREATING EMISSIONS TO AIR:

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and environmental site constraints). (*Symbols refer to Table 4.1)*

- Wet scrubber (T1).
- Fabric filters (T2).

4.6 TECHNOLOGIES FOR TREATING WATER EMISSIONS

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and environmental site constraints). (*Symbols refer to Table 4.2)*

- pH correction/neutralisation (F1).
- Coagulation/flocculation/precipitation (F2).
- Sedimentation/filtration/floatation (F3).
- Centrifugation (F4).

4.7 TECHNOLOGIES FOR THE TREATMENT AND DISPOSAL OF WASTES:

(No priority ranking is intended, and the appropriate selection in a particular case will depend on the specifics of the process concerned and environmental site constraints).

- Sludge dewatering.
- Waste encapsulation.
- Engineered landfill of wastes.

Table 4. 1 - Summary of Technologies for Treating Air Emissions
(*Symbols refer to Section 4.5)*

Emission Type	Technology
Process dust emissions	T1
Ammonia	T1
Acid fluorides and sulphates	T1
Particulate raw materials (in silos)	T2
Release agents	-
Sulphur and compounds	Fuel and raw material selection
Nitrogen and compounds	Fuel, raw material selection and burner design

Table 4. 2 - Summary of Technologies for Treatment of Water Emissions
(*Symbols refer to Section 4.6)*

Emission Type	Technology
Particulates (e.g. raw materials, glass fines etc.)	F1, F2, F3, F4
Phenols, urea, formaldehyde, ammonia	F1, F2
Metals, fluorides and sulphates	F1, F2, F3

5. EMISSION LIMIT VALUES

5.1 REFERENCE CONDITIONS

The reference conditions for concentrations of substances in emissions to air from contained sources are:

For combustion gases: Temperature 273K, pressure 101.3 kPa, oxygen content: 8% v/v, no correction for water vapour.

For non-combustion gases: no correction for oxygen, water or water vapour content, temperature 273K, pressure 101.3 kPa.

These units and reference conditions may not be suitable for continuous monitoring methods and may, by agreement with the Agency, be converted for day-to-day control purposes into values more suitable for the available instrumentation.

5. 2 INTERPRETATION OF COMPLIANCE

5.2.1 Emissions to Air

For **continuously monitored** emissions, the following will be required for compliance with measurements based on 30 minute mean values (unless otherwise stated):

(i) 97% of all 30 minute mean measurements shall be below 1.2 times the emission limit.

(ii) No 30 minute mean measurement shall exceed 2.0 times the emission limit.

(iii) All daily mean values shall be less than the emission concentration limit.

Where **periodic monitoring** is used to check compliance, all samples should meet the consent conditions.

5.2.2 Emissions to waters

The limit values for discharges to water are based on 24 hour flow proportional composite samples taken over a representative production period.

5.3 EMISSIONS TO AIR

Emissions to air under normal operation, including start-up and shutdown, should be free from visible smoke and should not give rise to a nuisance odour detectable beyond the site boundary. Tables 5. 1 and 5. 2 contain the emission limit values.

Table 5. 1 - Emission Limit Values for Glass Production (Melting Processes)

Substance	**Mass Emission Threshold (kg/h)**	**Concentration Limit (mg/m^3)**
Particulate matter (total)	>0.5 <0.5	50 100
Sulphur oxides (expressed as sulphur dioxide) - gas fired - oil fired	 >5 >5	 750 1750
Nitrogen oxides (expressed as nitrogen dioxide)- where the raw materials contain significant quantities of nitrate	>5 >5	2700 5400
Fluorides (expressed as hydrogen fluoride) -where the raw materials contain significant quantities of fluorides:	>0.05 >0.05	5 20
Chlorides (expressed as hydrogen chloride)	>0.3	50
Total Lead and Cadmium	>0.025	5
Cadmium	>0.001	0.2
Total arsenic, nickel, selenium, antimony, chromium and copper	>0.005	1
Total manganese, vanadium and tin	>0.025	5
Hydrogen Sulphide	-	50

Note : Achievement of ELV concentration by the introduction of dilution air is not permitted

Table 5. 2 - Mass Emission Limits for Glass Production (Melting Processes)

Type of Glass Production	Furnace Emission Limit (g of total particulate /kg glass produced)	
	Gaseous Fuel	**Liquid Fuel**
Container glass	0.1	0.13
Pressed and blown glass		
(a) Borosilciate glass	0.5	0.65
(b) Soda-lime and lead	0.1	0.13
(c) Other glasses	0.25	0.325
Flat glass	0.225	0.225

Note : Achievement of ELV concentration by the introduction of dilution air is not permitted

5.4 RELEASES TO WATER

Effluent should be minimised by recycling and re-use wherever practicable. The use of lower quality water may be possible for some parts of the process rather than fresh water.

All releases to waters are subject to a licence from the Agency. However, any discharge to a sewer, will require the consent of the sanitary authority. BATNEEC to minimise the release of substances will generally include minimisation at source and either specific treatment of contaminated waste streams to remove particular substances or co-treatment of combined effluent streams or both. The Emission Limit Values for effluent discharges to waters are set out in Table 5.3

Table 5. 3 - Emission Limit Values for Discharges to Water*
(Cooling Water to be Discharged Separately)

Constituent Group or Parameter	Limit Value	Notes
pH	6 - 9	3
BOD (mg/1)	25	3
Suspended solids (mg/l as asbestos)	30	3
Number of Toxicity Units	1	1,3
Total Ammonia (mg/1 as N)	5	3
Oils, Fats & Grease (mg/1)	10	3
Phenols (mg/l)	1.0	3
Lead (mg/l)	0.5	3
Fish Tainting	No tainting	2
Arsenic (mg/l)	0.5	3
Fluoride (mg/l)**	50	3
EC. List 1	As per 76/464/EC and 86/280/EEC and amendments	

* All values refer to daily averages, except where otherwise stated to the contrary, and except for pH which refers to continuous values. Limits apply to effluent prior to dilution by uncontaminated streams, e.g. storm waters, cooling water etc.

** Not applicable to estuarine and marine discharges

Notes for Table 5. 3:

1. The toxicity of the effluent shall be determined on an appropriate aquatic species. The number of Toxicity Units (TU) = 100/96 hr LC50 in percentage vol/vol. so that higher TU values reflect greater levels of toxicity. For each TU at least 20 dilutions of the effluent volume must be available in the receiving system.

2. No substance shall be discharged in a manner which, or at a concentration which, following initial dilution causes tainting of fish or shellfish, interferes with normal patterns of fish migration or which accumulates in sediments or biological issues to the detriment of fish, wildlife or their predators.

3. Consent conditions for these parameters for discharge to municipal treatment plants can be established with the Licensing Authority, and different values may apply.

6. COMPLIANCE MONITORING

The methods proposed for monitoring the emissions from these sectors are set out below.

6.1 EMISSIONS TO AIR

6.1.1 Continuous monitoring on main emissions points for particulates and No_x.

6.1.2 Weekly maintenance inspections of all air handling plant (including pressure drop tests across filters).

6.1.3 Periodic stack sampling as required by licence, typically So_x and chloride once per annum and fluoride once per quarter.

6. 2 WASTE WATER DISCHARGES:

6.2.1 Establish existing conditions prior to start-up, of key emission constituents and salient flora and fauna.

6.2.2 Daily monitoring of flow and volume, continuous monitoring of pH. Monitoring of other relevant parameters as deemed by the Agency.

6.2.3 Monitoring of influent and effluent from the waste water treatment plant to establish an early warning of any difficulties in waste water treatment plant, or unusual loads.

6.2.4 Periodic fish tainting and toxicity tests where appropriate, taking account of the nature, magnitude and variability of the emission and the reliability of the controls.

6.2.5 Periodic biodegradability checks on effluents to municipal waste treatment plants, both prior to start-up and thereafter.

6. 3 SOLID WASTE MONITORING:

6.3.1 The recording in a register of the types, quantities, date and manner of disposal of all wastes.

6.3.2 Leachate testing of sludges and other material, as appropriate, being sent for landfilling.

7. PRINCIPAL REFERENCES

7.1 IRELAND

7.1.1 Environmental Protection Agency Act, 1992.

7.1.2 Local Government (Water Pollution) Acts 1977 and 1990.

7.1.3 Air Pollution Act 1987.

7. 2 U.K. H.M.I.P. CHIEF INSPECTORS GUIDANCE TO INSPECTORS

7.2.1 Industry Sector Guidance Note IPR 3/5.
(Glass Manufacture and Production; Glass Frit and Enamel Frit).

7.3 U.K. DEPARTMENT OF THE ENVIRONMENT

7.3.1 Secretary of State's Guidance PG 3/3(91) (Glass (excluding lead glass) Manufacturing Processes).

7.3.2 Secretary of State's Guidance PG 3/4(91) (Lead Glass Manufacturing Processes).

7. 4 GERMANY

7.4.1 T.A. Luft (1986)
(Sections 3.3.2. 8.1, 3.3.2.11.1 and 3.3.5.3.1).

7.5 US E.P.A.

7.5.1 Standards of Performance for Glass Manufacturing Plants
(40 CFR Ch.1, Part 60, Subpart CC, 1993).

Appendix 1

SOURCES AND EMISSIONS

1 INTRODUCTION:

In this section, the major sources of emissions to air and water are identified, as are the principal sources of waste from the sector. It should be borne in mind that the identified list of sources is not all encompassing, nor will every plant falling within an individual sector have every one of the emissions which are associated with the sector as a whole.

For each subsector, emissions to air and water are considered under two headings, the first covering fugitive and unscheduled emissions and the second specific process emissions. Some of the latter are considered to have little potential environmental significance and these are designated as minor (m) and are not assigned emission limit values. A summary of the constituents of each significant release is given at the end of the section.

2 SOURCES OF EMISSION TO AIR FROM:

2.1 Fugitive and Unscheduled Emissions:

- Emissions from empty bags, filter materials, etc..
- Bursting discs on enclosed silo storage etc.
- Particulates arising during delivery, transfer and storage of raw materials.
- VOCs and ammonia from resin delivery, transfer and storage.
- Vapour losses during storage, filling and emptying of bulk solvent tanks and bunds, including hose decoupling.
- Leakages from flanges, pumps seals, valve glands etc..
- Building losses, through windows, open doors, vents.
- Workplace losses through ventilation.

2.2 Process Emissions (*Symbols refer to Table A1)*

- Particulates arising during weighing and filling operations (S1).
- Furnace emissions (S2).
- Particulates from glass cutting, grinding and polishing (S3).
- Acid vapours from etching and cleaning (S4).
- Oven emissions (m).
- Forming line emissions (S5).

3 SOURCES OF EMISSIONS TO WATER FROM: (*SYMBOLS REFER TO TABLE A2)*

3.1 Spills and Diffuse Sources

- Bund drainage.
- Spillages.
- Leakages from flanges, pump seals, glands etc.
- Contamination of surface water through outdoor storage.
- Pipework leaks.

3.2 Processes Emissions

- Effluent from glass etching and cleaning (E1).
- Furnace cooling water (m).
- Effluent from wet scrubbers (E2).
- Effluent from cutting, grinding and polishing (E3).
- Production area washdown (E1).

4 SOURCES OF WASTE FROM: *(SYMBOLS REFER TO TABLE A3)*

- Dusts and sludges from abatement systems (W1).
- Sludge from effluent treatment (W2).
- Off-spec material (W1).
- Contaminated drums, packaging and protective clothing (W1 & W3).
- Spent acids (W3)

5 RELEASES

The substances most likely to be present in the release to the environment and of principal concern in the processes covered by this note are given below. A licence applicant should identify and quantify all environmentally significant emissions (including heat discharges) from the process.

Table A1 - Summary of Sources and Emissions to Air
(Symbols refer to Section 2 in Appendix)

Source	Emission
S1	Silica, alumina, magnesium oxide, calcium oxide, sodium and potassium oxides, cullet, lead, arsenic, potassium carbonate, borax.
S2	Sulphur and oxides Nitrogen and oxides
S3	Glass
S4	Acid fluorides and sulphates
S5	Release agents

Table A2 - Summary of Sources and Emissions to Water
(Symbols refer to section 3 in Appendix)

Source	Emission
E1	Sulphates, metals, (esp. lead) fluorides, glass fines
E2	Fluorides, sulphates
E3	Glass fines

Table A3 - Summary of Other Releases

(Symbols refer to Section 4 in Appendix)

Source	Emission
W1	Silica, alumina, magnesium oxide, calcium oxide, cullet, lead, arsenic, potassium carbonate, fluorides and chlorides, borax
W2	Fluorides, sulphides, metals, oxides, glass
W3	Fluorides, sulphates