



**A GUIDANCE NOTE ON THE  
BEST PRACTICABLE MEANS**

**FOR**

**FRIT WORKS**

**BPM 16 (94)**

Environmental Protection Department  
Air Policy Group

September 2008

## **1. INTRODUCTION**

- 1.1 This Note is one of a series issued by the Environmental Protection Department to provide guidance on air pollution management for processes specified under Part IV of the Air Pollution Control Ordinance (the Ordinance). It also serves as a guide for the assessment of an application for Specified Process licence under the Ordinance.
- 1.2 It should be understood that this Note sets out the basic requirements for the applicant to provide and maintain the best practicable means for the prevention of emission of air pollutants. The applicant should recognize that whether a licence is granted or refused, and on what conditions, will depend on all the circumstances of an individual application besides the requirements set out in this Note. The Authority may devise specific requirements for individual facility carrying out the specified process.
- 1.3 This Note the specified process and associated processes in relation to the production of frit, described as "Frit Works" in Schedule 1 to the Ordinance. Frit Works are works in which the installed capacity exceeds 1 tonnes, and in which frit is made by fusion of materials and quenching.

## **2. EMISSION LIMITS**

- 2.1 All emissions to air, other than steam or water vapour, shall be colourless, free from persistent mist or fume, and free from droplets.
- 2.2 Emissions from the specified process and associated processes as covered by this Note shall not:
- (a) exceed the concentration limits set out in Annex I.
  - (b) appear to be as dark as or darker than Shade 1 on the Ringelmann Chart when compared in the appropriate manner with the Ringelmann Chart or an approved device.

## **3. FUEL RESTRICTION**

- 3.1 All fuels to be used shall comply with the Air Pollution Control (Fuel Restriction) Regulations in force.

## 4. CONTROL OF EMISSIONS

### 4.1 Design of chimney

Chimney includes structures and openings of any kind from or through which air pollutants, generated from combustion and/or any other manufacturing process of the plant, may be emitted.

4.2 The design of chimney is to be determined by mathematical or physical dispersion modelling techniques acceptable to the Authority. The aims are to ensure:

- (a) the relevant Air Quality Objectives (AQOs) will not be threatened;
- (b) the emission of non-AQO pollutants, in particular, heavy metals and carcinogenic organic compounds, will not cause any adverse effect to human health or environment; and
- (c) no undue constraint will be incurred to the existing and future development or land use.

4.3 In any case, the design of chimney shall at least satisfy the following conditions:

#### (a) Chimney height

- (i) For combustion processes, the final chimney height should be agreed with the Authority but as a general guideline, the chimney height, in a flat terrain situation, should as far as practicable be at least Building Height + 1.5 x Building Width or Building Height, whichever is the lesser. Suitable adjustment should be made to take into account local meteorological data, local topography and background air pollutant concentrations. In any case, the minimum chimney height shall be at least 8 metres above ground level or 3 metres above the roof top of the Building to which it is attached, whichever is the greater.
- (ii) For non-combustion processes, the same guideline should be observed as far as practicable and in any case, the chimney height shall be at least 3 meters above the roof top of the building to which it is attached.

#### (b) Efflux Velocity

The efflux velocity of the chimney shall not be less than 15 m/s at full load condition.

#### (c) Exit Temperature

For combustion process, the flue gas exit temperature shall not be less than the acid dew point.

(d) Mode of Discharge

Releases to air from chimney shall be directed vertically upwards and not be restricted or deflected by the use of, for example, plates, caps or cowls.

Where practicable, hot emissions should take place from the minimum number of chimneys and multiplicity of discharge points should be avoided, in order to obtain maximum thermal buoyancy.

Chimney for release of hot emissions should, wherever possible, be insulated. The insulation materials shall be free of asbestos.

- 4.4 Clean energy sources and fuels with proven benefits to air pollution reduction shall be used whenever possible in the relevant specified process and associated operations. The use of electricity or gaseous fuel for process heating or production of goods is always recommended..

## **5. FUGITIVE EMISSION CONTROL**

### 5.1 Boundary Ambient Standards

Total suspended particulates	260 ug/ m <sup>3</sup> (24-hour average)
Respirable suspended particulates	180 ug/m <sup>3</sup> (24-hour average)
Odour	2 odour units

*(Note: An odour unit is the measuring unit of odour level and analogous to pollutant concentration. In this context, the odour level is defined as the ratio of the volume which the sample would occupy when diluted with air to the odour threshold, to the volume of the sample. In other words, one odour unit is the concentration of the odorant which just induces an odour sensation.)*

### 5.2 Engineering Design / Technical Requirements

To be agreed with the Authority. As a general guideline, the loading, unloading, handling and storage of fuel, raw materials, products, wastes or by-products should be carried out in a manner acceptable to the Authority so as to prevent the release of:

- (a) visible dust emissions; and / or
- (b) emissions of organic vapours; and / or
- (c) other noxious or offensive emissions.

5.3 Without prejudice to the generality of the above general requirements, the following control measures shall be implemented:

- (a) Dusty materials shall be delivered to the works in a manner which prevents their escape into the external environment. Use of enclosed containers or sealed bags, with the contents suitably conditioned, are the preferred methods.
- (b) Powder form materials or products shall be stored in bags or silos. If silo is used, it shall be vented to air through suitable dust arrestment plant to meet the emission limits stipulated in Section 2 of this Note. All other dusty materials or products shall at least be stored in structure which is enclosed on top and three sides in order to prevent wind whipping.
- (c) The transport of dusty materials or products within the works shall be carried out by methods which do not give rise to dust emissions.
- (d) For conveying powder form materials or products, the conveyors shall be fully enclosed and vented to suitable dust arrestment plant to meet the emission limits stipulated in Section 2 of this Note.
- (e) For conveying other dusty materials or products, if external above ground conveyor is used, the conveyors shall be enclosed on top and two sides and fitted with bottom plate to protect against wind whipping. Transfer points between the conveyors shall be fully enclosed, and if necessary vented to a suitable dust arrestment plant to meet the emission limits stipulated in Section 2 of this Note.
- (f) Mills for the dry grinding of frit should be fully enclosed and exhaust gases extracted to suitable dust arrestment plant to meet the emission limits stipulated in Section 2 of this Note.
- (g) The fume and mist generated by the quenching process shall be adequately contained and vented to suitable arrestment plant to meet the emission limits stipulated in Section 2 of this Note.
- (h) All potential sources of dust emissions arisen from other processes not mentioned above (such as mixing, dry grinding and charging of raw materials, packing of finished products etc.) shall, where practicable, be fully enclosed and vented to suitable dust arrestment plant to meet the emission limits stipulated in Section 2 of this Note.
- (i) All practicable measures shall be taken to prevent or minimize the dust emission caused by vehicle movement. All access roads within the premises shall be paved.

- (j) Spillage and waste materials deposits shall be cleared as soon as possible and in the case of solid materials this shall be achieved by the use of vacuum cleaning or other appropriate methods. Dry sweeping of spillage and waste materials is not allowed.
- (k) The handling, transfer and disposal of fine dust from dry arrestment plant, should be carried out by methods which do not give rise to dust emissions.

#### 5.4 Other control requirements

- (a) Fluoride

The quantities of fluorides such as fluorspar and cryolite present in the feed should be kept at minimum in order to reduce the formation of gaseous fluorides.

- (b) Oxides of Nitrogen

To minimize the formation of oxides of nitrogen, the amount of nitrates added to enhance the oxidation of the melt shall be kept at the minimum requirement.

## **6. OPERATION AND MAINTENANCE**

- 6.1 Requirements include not only the provision of the appliances, but the proper operation and maintenance of equipment, its supervision and the training and supervision of properly qualified staff. Specific operation and maintenance requirements may be specified for individual equipment.
- 6.2 Malfunctioning and breakdown of the process equipment or air pollution control equipment which would cause exceedance of the emission limits or breach of other air pollution control requirements shall be reported to the Authority within 3 working days.

## **7. MONITORING REQUIREMENTS**

- 7.1 Parameters and sampling frequency will be determined by the Authority. In any case, sampling shall be performed at least annually to test the emission of particulates, heavy metals and fluorides emitted from the frit furnace.
- 7.2 In addition, the following parameters shall be monitored continuously as a minimum requirement:
  - (a) In-stack Monitoring

Particulate matter (measured by opacity) from the frit furnace.

(b) Process Monitoring

Production rate and other essential operating parameter(s) which may significantly affect the emission of air pollutants.

(c) Ambient Monitoring

At site boundary and / or any other locations acceptable to the Authority	Total suspended particulates and / or respirable suspended particulates (at least one 24-hour sample per 6 calendar days)
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## **8. COMMISSIONING**

8.1 Commissioning trials (to be witnessed by the Authority whenever appropriate) shall be conducted to demonstrate performance and capability of the air pollution control measures and a report of commissioning trial shall be submitted to the Authority within 1 month after completion of the trial.

**ANNEX I CONCENTRATION LIMIT FOR EMISSION FROM FRIT WORKS**

I.1 Air pollutant emissions from the subject specified process and associated processes covered in this Note shall not exceed the concentration limits specified below during normal operations.

<b>Air Pollutant</b>	<b>Concentration Limit</b>
Particulates	50 mg/m <sup>3</sup>
Heavy Metals and Their Compounds (expressed as metals)	
Lead and its compounds	5 mg/m <sup>3</sup>
Cadmium and its compounds	1 mg/m <sup>3</sup>
Total of Lead, Cadmium and their compounds	5 mg/ m <sup>3</sup>
Total of Nickel, Arsenic, Selenium, Antimony, Chromium, Copper and their compounds	1 mg/m <sup>3</sup>
Total of Manganese, Vanadium, Tin and their compounds	5 mg/m <sup>3</sup>
Fluorine and its compounds (expressed as Hydrogen Fluoride)	5 mg/m <sup>3</sup>

I.2 For combustion gases, the air pollutant concentration is expressed at dry, 0°C temperature, 101.325 kPa pressure and 8% oxygen content (v/v) conditions.

I.3 For non-combustion gases, the air pollutant concentration is expressed at 0°C temperature, 101.325 kPa pressure conditions, and without correction for water vapour or oxygen content. The introduction of dilution air to achieve the emission limits is not permitted.