



**A GUIDANCE NOTE ON  
BEST PRACTICABLE MEANS**

**FOR**

**ZINC GALVANISING WORKS**

**(HOT DIP GALVANISING)**

**BPM 27 (94)**

Environmental Protection Department  
Air Policy Group

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## **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 covers the specified process and associated processes in relation to the galvanizing of products with zinc, described as "Zinc Galvanising Works" in Schedule 1 to the Ordinance. Zinc Galvanising Works are works in which the installed capacity exceeds 5,000 tonnes per annum (expressed as galvanized product), and in which zinc galvanizing is carried out.

## **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 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, drying and/or 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 process, 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 chimney height shall not be less than 8 metres above ground level and shall not be less than 3 metres above the building roof top.
- (ii) For non-combustion process, the same guideline should be observed as far as practicable and in any case, the chimney height shall be at least 3 metres above the roof top of the building to which it is attached.

#### (b) Efflux velocity

The efflux velocity, whenever practicable, should be at least 1.5 times of the wind speed at the chimney top. In any case, it shall not be less than 15 m/s at full load operation.

#### (c) Exit temperature

For combustion process, the exhaust 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 material 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 $\mu\text{g}/\text{m}^3$
Respirable suspended particulates	180 $\mu\text{g}/\text{m}^3$
Odour	2 odour units

*(Note: An odour unit is the measuring unit of odour level and is 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 sample. In other words, one odour unit is the concentration of 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 shall 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 requirements, the following control measures shall be implemented:

- (a) Material handling - Dusty materials, or potentially dusty materials, for example, ash and flux, shall be handled in properly enclosed system. Purpose-built silo shall be used for the storage of dusty materials whenever practicable.
- (b) Degreasing operations involving organic solvents shall be carried out in specially designed plant to prevent, or where not practicable, to minimize the emission of volatile organic compounds. The volatile organic compounds generated, if any, shall be collected and vented to suitable gas treatment system to meet the emission limits stipulated in Section 2 of this Note.
- (c) Abrasive blasting shall be carried out in a specially designed enclosure. The dust generated from the blasting shall be collected and vented to suitable dust arrestment plant to meet the emission limits stipulated in Section 2 of this Note.
- (d) Unless the operator can demonstrate that the acidic gases emitted from the acid baths for acid pickling will meet the emission limits stipulated in Section 2 of this Note as well as the minimum requirement for protection of the health of the workers, the emissions from acid baths shall be adequately contained by the use of local exhaust ventilation vented to suitable gas treatment system to meet the emission limits.
- (e) The use of solid flux shall be prevented or reduced by prefluxing with liquid zinc ammonium chloride where practicable in relation to the process characteristics.
- (f) When preflux solutions are used, fume may be created if hot metal is immersed. In these circumstances it is necessary to control the fume emissions by local exhaust ventilation and fume arrestment systems to meet the emission limits stipulated in Section 2 of this Note.
- (g) Emissions from flux application and galvanising process shall be adequately contained by effective capture of emissions by local exhaust ventilation vented to suitable arrestment systems to meet the emission limits stipulated in Section 2 of this Note.
- (h) Post galvanising treatment - Where chromate and/or phosphate coatings are applied to work after galvanising, emissions shall be contained and vented to suitable arrestment systems to meet the limits stipulated in Section 2 of this Note.

- (i) Housekeeping - A high standard of housekeeping shall be maintained. Adequate provision shall be made for the containment of liquid and solid spillages. All spillage 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 method. Dry sweeping of spillage shall not be allowed.

## **6. OPERATION AND MAINTENANCE**

- 6.1 Requirements include not only the provisions 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 Malfunction and breakdown of the process equipment or air pollution control equipment that 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, emissions from galvanising baths shall be tested annually for particulates and chloride.
- 7.2 Arrestment plant shall be fitted with indicative continuous monitors and audible alarms to warn of malfunction or failure. For arrestment plant including a scrubber, the liquid flow and the liquor pH shall be continuously monitored. For arrestment plant including bag filters, the emission of particulates shall be continuously and indicatively monitored to guard against bag failure or malfunction.

## **8 COMMISSIONING**

- 8.1 Commissioning trials, to be witnessed by the Authority whenever appropriate, shall be conducted to demonstrate performance 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 ZINC GALVANIZING WORKS

I.1 Air pollutant emissions from the subject specified process and associated processes covered by this Note shall not exceed the concentration limits specified in the table below during normal operations. The air pollutant concentration is expressed at reference conditions of 0°C temperature, 101.325 kPa pressure, and without correction for water content. The introduction of dilution air to achieve the emission limits is not permitted.

Air Pollutant	Concentration Limit
Particulates	15 mg/m <sup>3</sup> (for emissions solely or partly from galvanising baths)
	50 mg/m <sup>3</sup> (for emissions from all processes including handling of raw materials and products but excluding galvanising baths)
Chlorides (as hydrogen chloride excluding particulates)	30 mg/m <sup>3</sup>
Lead and its compounds (as lead)	2 mg/m <sup>3</sup>
Volatile organic compounds from degreasing operations involving organic solvents (as total carbon excluding particulates)	50 mg/m <sup>3</sup>
Ammonia	18 mg/m <sup>3</sup>