



**A GUIDANCE NOTE ON THE
TECHNICAL, MANAGEMENT AND MONITORING
REQUIREMENTS
FOR
SPECIFIED PROCESS –
NON-FERROUS METALLURGICAL WORKS
(MELTING OF ZINC AND/OR ZINC ALLOY)**

BPM 29 (15)

Environmental Protection Department

Environmental Compliance Division/
Air Policy Division

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1. INTRODUCTION

- 1.1 This Note is one of a series issued by the Environmental Protection Department to guide the air pollution management of specified processes (SP), to which Part IV of the Air Pollution Control Ordinance (the Ordinance) applies, and the assessment of an application for SP licence. It applies to the process of melting zinc and zinc alloy under Non-ferrous Metallurgical Works, which is described as follows in Schedule 1 to the Ordinance -

“Non-ferrous Metallurgical Works are works in which the processing capacity exceeds 1 tonne per hour and in which melting of any non-ferrous metal, other than aluminium, copper, lead and zinc for galvanizing, is carried out”

The separation of non-ferrous metal from mixed scrap is not covered by this note. Also, this note only refers to processes where refining is carried out as a composite part of a melting and casting operation. Processes which are primarily refining operations, including the recovery of zinc from scrap metal, dross or slag, are not covered by this note. As regards specific requirements for non-ferrous metallurgical processes not covered by this note, please make enquiries at enquiry@epd.gov.hk.

- 1.2 Under section 12 of the Ordinance, the owner of any premises used for the conduct of an SP shall use the **best practicable means** (BPM) for preventing noxious or offensive emissions from their plants, preventing the discharge of such emissions into the atmosphere and rendering such emissions where discharged harmless and inoffensive. This Note sets out the minimum requirements for the provision and maintenance of the BPM for an individual plant. However, an applicant for an SP licence should recognize that fulfilment of the requirements in this Note does not necessarily lead to the granting of the licence because the decision will take into account the circumstances of an individual application. In addition, the Authority may impose specific requirements in the licence, if granted, on top of the requirements set out in this Note. The terms and conditions in the SP licence should be the statutory requirements for the environmental management of an SP.

(Note: “best practicable means”, where used with respect to the emission from a premises of an air pollutant, has referenced not only to the provision and the efficient maintenance of appliances adequate for preventing such emission, but also to the manner in which such appliances are used and to the proper supervision by the owner of the premises of any operation in which such an air pollutant is evolved.)

- 1.3 If an SP licence holder seeks to renew the licence of his existing SP that fails to meet the latest version of this Note at the time of the licence renewal application, he should provide full justifications for the failure and propose for the Authority’s consideration his plan to upgrade the emission control performance of his plant including the implementation timeframe.

2. EMISSION LIMITS

- 2.1 All emissions to air, other than steam or water vapour, shall be colourless, free from persistent mist or fume, free from persistent visible emissions, and free from droplets.
- 2.2 Emissions from non-fugitive fixed emission points in 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 Use of electric induction furnaces for melting metals is recommended. For furnace not powered by electricity, all fuels to be used shall comply with the Air Pollution Control (Fuel Restriction) Regulations.

4. CONTROL OF EMISSIONS

- 4.1 Emission of air pollutants shall be minimized to prevent:
- (a) harm to the environment, adverse effects to human health, or creation of any nuisances;
 - (b) threatening the attainment or maintenance of the relevant air quality objectives;
 - (c) giving rise to an objectionable odour noticeable outside the premises where the process is carried out; and
 - (d) imposing undue constraint on the existing and future development or land use.
- 4.2 To satisfy the emission limits set out in Section 2 of this Note, prevention or reduction of emissions at source is the choice. Where the emission cannot be prevented or reduced at source to a sufficient extent to meet these requirements, air pollution control equipment shall be provided to meet the emissions limits.
- 4.3 Clean energy sources and fuels which have been proven to reduce air pollution shall be used whenever possible in the relevant specified process and associated operations. The use of electricity or gaseous fuel for process heating is recommended.

- 4.4 Properly designed operation process shall be installed and operated to contain and treat process emissions including, but not be limited to, particulates, fumes and odour. Relevant emissions shall be adequately collected by local exhaust, and vented to a suitable abatement plant for treatment, meeting the specified emission limits set out in Section 2 of this Note, before being discharged to the atmosphere. Enclosed furnaces, casings, ductwork and ancillary equipment which are required to meet the emission standards should be maintained as gas tight as practicable.
- 4.5 Furnace(s) and process heat generation plant(s) shall be of adequate design for efficient energy application and transfer as well as minimizing releases to air. Combustion plant(s) shall be of low pollution design and equipped with advanced process control technology to ensure good combustion and reduce air emissions.

Design of chimney

- 4.6 Chimney includes structures and openings of any kind, including vents and process exhausts, from or through which air pollutants generated from combustion, melting and/or other manufacturing process may be emitted.
- 4.7 The design of a chimney is to be determined by mathematical or physical dispersion modelling techniques acceptable to the Authority. The aims are to ensure the objectives as listed in paragraph 4.1 are observed and followed through and that 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.
- 4.8 In any case, the design of a chimney shall at least satisfy the following conditions:
- (a) Chimney height
 - (i) For combustion process, the final chimney height shall be agreed with the Authority and in any case, it shall be at least 3 metres above the roof top of the building to which it is attached or 8 metres above ground level, whichever is the greater. In addition, suitable adjustment shall be made to take into account of local meteorology, local topography and background emissions.
 - (ii) For non-combustion process, the same guideline shall be observed as far as practicable and in any case, it shall be at least 3 metres 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. Where a wet method of arrestment is used, the linear velocity within the chimney shall not exceed 9 m/s to avoid entrainment of droplets from chimney surface into the gas stream.

(c) Exit temperature

For combustion process, the flue gas exit temperature shall not be less than the acid dew point, and in any case, not less than 80 °C.

(d) Mode of discharge

Releases to air from chimney shall be directed vertically upwards and not 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 shall, wherever possible, be insulated. The insulation materials shall be free of asbestos.

Other Emissions and Odour

- 4.9 For auxiliary operations including casting, finishing, milling, annealing, surface treatment and any other processes that may generate air pollutants, suitable control measures shall be provided to minimize the air pollutant emissions to air. In particular, for any process which would generate particulate emission, the particulates generated shall be collected and vented to an arrestment plant meeting the emission limits stipulated in Section 2 of this Note
- 4.10 Furnaces should be fitted with temperature controls to ensure that melting temperatures are kept as low as possible to minimize the emission of fume. Emissions from melting and holding furnaces should be adequately contained to prevent low level fugitive emissions.
- 4.11 All residues, including those produced by abatement plant, should be handled and stored in a manner which minimizes emissions to the air.
- 4.12 All emissions should be free from objectionable odour outside the site boundary.
- 4.13 A high standard of housekeeping should be maintained.

5. FUGITIVE EMISSION CONTROL

5.1 Engineering design/technical requirements

The Authority will prescribe the requirements in consideration of the circumstances of an individual SP plant. 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.

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

- (a) Dusty materials, or potentially dusty materials, for example, powder additives, shall be stored and handled in such a manner as to minimize resultant fugitive dust emission.
- (b) All residues produced, including those produced by arrestment plant, shall be handled and stored in a manner which could minimize emissions to air.
- (c) Air pollutant emissions from melting or holding furnaces and other process equipment shall be adequately contained to prevent fugitive emissions. The emissions shall be vented to suitable arrestment plant, where necessary, meeting the emission limits stipulated in Section 2 of this Note.

6. MATERIAL RESTRICTION

6.1 Metallic charge to melting furnace shall be clean, uncontaminated by grease or non-metallic matters unless the furnace is either designed or fitted with equipment for control of emission of pollutants to the satisfaction of the Authority.

7. OPERATION AND MAINTENANCE

7.1 Best Practicable Means requirements include the proper operation and maintenance of equipment, its supervision when in use and the training and supervision of qualified staff. Specific operation and maintenance requirements may be specified for individual equipment.

7.2 All control and monitoring equipment shall be operational and functioning properly when the plant or other associated processes are in operation.

7.3 Operating staff shall be properly trained in their duties relating to control of the process and emissions to air. Particular emphasis shall be given to training for start-up, shut down and abnormal conditions.

7.4 In case of abnormal emissions, malfunctioning and breakdown of the process or air pollution control equipment which would cause exceedance of the emission limits or breaches of other air pollution control requirements, the incident shall be reported to

the Authority without delay and in no case more than 3 working days. Moreover, all practicable means (including refraining from using the defective plant) shall be taken to minimize the abnormal emissions.

8. MONITORING REQUIREMENTS

8.1 Parameters and sampling frequency will be determined by the Authority. However, the following parameters should be monitored as specified below:

(a) Process Monitoring

Monthly total of raw material input, product output and material stock (by manual recording), and other essential operating parameter(s) which may significantly affect the emission of air pollutants.

(b) Ambient Monitoring

<p>At site boundary and/or any other locations acceptable to the Authority:</p>	<p>(i) Respirable suspended particulates (at least one 24-hour sample per 6 calendar days)</p> <p>(ii) Odour patrols along or beyond the site boundary (odour patrols to be conducted by the plant environmental personnel, who shall be free from any respiratory diseases, to detect any odour on weekly basis, two times a day in a week, one in the morning and one in the afternoon, or at frequency to be determined by the Authority.)</p>
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8.2 The following Boundary Ambient Standards set for triggering investigations by the licence holder

(i) Respirable suspended particulates : 100 µg/m³ (24 hour average)

(ii) Odour : Objectionable odour noticeable at the site boundary and/or outside the premises

Event and Action Plan

8.3 Should non-compliance with the boundary ambient standards be found, more

frequent monitoring is required and the licence holder shall take action according to the Event and Action Plan at Annex II.

- 8.4 Necessary monitoring equipment and techniques, agreeable to the Authority, shall be provided and used to demonstrate that the process is properly operated and the emissions can be minimized to meet the air pollution control requirements. The scope, manner and frequency of the monitoring shall be sufficient for this purpose and will be determined by the Authority. In general, visual and olfactory assessment on the operation of process equipment, air pollution control system(s) and air emissions shall be made frequently and at least once a day.
- 8.5 Monitoring results shall be recorded in a manner specified by the Authority. The record shall be retained at the premises for a minimum of two years, or any other period specified by the Authority, after the date of last entry and made available for examination as and when required by the Authority.
- 8.6 Indication of satisfactory performance of air pollution control equipment shall be provided. Continuous monitoring of essential operating parameter(s) that may significantly affect the emission of air pollutants, such as volumetric flow of extraction / air pollution control system(s) or essential operating parameter(s) of relevant abatement plant(s), shall be displayed.
- 8.7 Appropriate instrumentation shall be installed to monitor the performance of air pollution management system(s) including the emission extraction device and relevant abatement plant(s). It shall be fitted with audible and visual alarms with trigger levels for activation agreeable to the Authority. Emission events that lead to the alarms being activated shall be properly recorded in such manner and format agreed with the Authority. These instruments shall be checked regularly to ensure that they are functioning correctly in accordance with the manufacturer's instructions.

9. COMMISSIONING

- 9.1 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 NON-FERROUS METALLURGICAL WORKS - MELTING OF ZINC AND/OR ZINC ALLOY

I.1 The concentration limits stipulated in the tables below shall be applicable to all emissions from the subject specified process and associated processes covered by this Note during normal operations including load change. For smoke emission, the emission limits shall also be applicable to the start-up and shutdown periods. The introduction of dilution air to achieve the emission limits is not permitted.

(a) Metal melting process

The air pollutant concentration is expressed at reference conditions of 0°C temperature, 101.325 kPa pressure, and without correction for CO₂ and water content (except emission limit on smoke).

Air Pollutant	Concentration Limit
Particulates	20 mg/m ³
Cadmium and its compounds (as Cadmium)	1 mg/m ³
Nickel and its compounds (as Nickel)	5 mg/m ³
Lead and its compounds (as Lead)	2 mg/m ³
Copper and its compounds (as Copper)	5 mg/m ³
Chromium and its compounds (as Chromium)	Total emission in combination 1 mg/ m ³
Vanadium and its compounds (as Vanadium)	
Chloride (expressed as hydrogen chloride)	5 mg/m ³

(b) Other auxiliary operations

The air pollutant concentration is expressed at reference conditions of 0°C temperature, 101.325 kPa pressure, and without correction of water content.

Air Pollutant	Concentration Limit
Particulates	10 mg/m ³

ANNEX II EVENT AND ACTION PLAN

Event and Action Plan

Particulates (at least one 24-hour sample per 6 calendar days)	
Parameter	Action level
24 hr average RSP	100 µg/m ³ or below
Plant Environmental Personnel	Licensee
<ol style="list-style-type: none"> 1. Identify the source, investigate the causes and propose remedial measures. (<i>Exceedance of action level may be caused by malfunction of sampler and its operation, high level of background concentration, failure of air pollution control equipment, mishandling of materials, etc.</i>) 2. Discuss with the operator for remedial actions required. 3. Carry out corrective actions. 4. Check the effectiveness of actions. 5. Repeat measurement and increase monitoring frequency if necessary. 	<ol style="list-style-type: none"> 1. Notify the Authority for events with concentration equal or above 100 µg/m³. 2. Rectify any unacceptable practice. 3. Amend working methods if appropriate. 4. Report details of the findings (together with the daily inspection records in the past six days before the event) to the Authority.
Objectionable Odour (monitoring frequency and detecting method to be agreed with the Authority)	
Parameter	Action level
Objectionable odour	Objectionable odour noticeable at the site boundary and/or outside the premises
Plant Environmental Personnel	Licensee
<ol style="list-style-type: none"> 1. Identify the source, investigate the causes and propose remedial measures. (<i>A boundary check should be made at least two times per day/shift by the plant environmental personnel and operator when the plant is in operation. The time, location and result of these checks, along with weather conditions such as indicative wind direction and strength, should be recorded to help identify the source.</i>) 2. Discuss with the operator for remedial actions 	<ol style="list-style-type: none"> 1. Notify the Authority for events with emissions detected with objectionable odour. 2. Rectify any unacceptable practice. 3. Amend working methods if appropriate. 4. Report details of the findings to the Authority.

<p>required.</p> <ol style="list-style-type: none">3. Carry out corrective actions.4. Check the effectiveness of actions.5. Repeat odour patrols and increase patrol frequency if necessary.	
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