Code of Practice for the Manufacture of Coating Powder

Ref: E022, February 2010
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1  Introduction

1.1 This Code of Practice gives guidance on the conditions appropriate for the control of emissions into the air from manufacture of coating powder processes/ installations. It replaces the Process Guidance note PG6/9(96).

1.2 All members of the British Coatings Federation manufacturing coating powders must comply with the provisions of this Code.

1.3 The key emissions from these processes that are to be controlled following this Code are those consisting of particulate matter.

1.4 This Code is not applicable for processes using triglycidyl isocyanurate (TGIC), lead chromate materials or any other CMR (i.e. substance or preparation classified R45, R46, R49, R60 or R61 – or H350, H351, H340, H360D, H360F under the CPL Regulation).

1.5 This Code is based on the earlier Process Guidance Note PG6/9 (04), Secretary of State’s Guidance for the Manufacture of Coating Powder. The Sections and numbering are generally consistent with this Note in order to assist in the transfer from regulated to voluntary control.

2  Timetable
   This Code applies immediately the operator’s permit expires.

3  Process description

3.1 This note refers to the manufacture of coating powder.

3.2 In the context of this note, "process" or activity comprises the whole process from receipt of raw materials via production of intermediates to dispatch of finished products, including the treating, handling and storage of all materials and wastes relating to the process.

3.3 Coating powders are made from solid resin, pigments, and additives which are compounded together to form a coating powder.

3.4 Within this note there are three categories of coating powder:
   - Thermoset coatings: typically particle sizes are in the range 30 - 50 micrometres
   - Thermoplastic toners: commonly most particle sizes are in the range 5 – 20 micrometres
   - Thermoplastic coatings: for electrostatic grade many particles are around 100 microns and for fluidised bed grades they are significantly larger.

3.5 Some powders (especially some thermoplastic powders) have mostly large particles and have no potential to emit particulate matter to the air. Powders with more than 95% by weight above 75 microns may justify exemption from this Code.

Pre-mixing and dry blending

3.6 The first stage is to weigh accurately and to mix the dry powders together.
Compounding

3.7 The second stage is described as compounding, which is commonly undertaken with an extruder.

3.8 The pre-mix (i.e. the pre-blended raw materials) is fed in. Once inside the extruder, the pre-mix is compacted and heated until it melts. Then shear forces break down the pigment aggregates and form a homogenous dispersion. Finally, this homogenous melt is discharged from the extruder.

3.9 The next stage converts this hot melt into a cooled, hard and brittle strip by passing it through cooled rollers. Depending on the size of the extruder and its production rate, the extrudate may be further cooled on a cooling band. Toner powder is also pulverised down to between 50 to 250 micron. This is called kneaded toner.

3.10 The final operation in the cooling stage is to break the cold, brittle extrudate into small flakes around 5 to 15 millimetres (called kibble) using rotating hammers fitted at the end of the cooling stage.

3.11 The final stages of the manufacturing process are milling or grinding, and classification which convert the kibble or kneaded toner into a fine powder within a specified particle size range. The most widely used equipment for coatings is the micropulveriser. Toner processes use impact or jet milling. Some toner processes also mix additives to the finished product before sieving & packing.

3.12 Kibble or kneaded toner is transferred from a feed hopper into the mill by a screw feed. This screw further reduces the product size as it feeds the mill. The product is carried on an air-stream into the milling stage(s). Material enters a pulverising chamber where it is reduced to a fine powder by a rotating disc fitted with metal pins. Some toner powder processes use jet mills to achieve this fine powder. Jet mills feed the material into air streams which are either fired directly at ceramic collision plates, or multiple air streams are fired at each other. The milling or pulverising is caused by the product particles impacting with ceramic plates, each other or with the rotating pins depending upon the milling stage design.

3.13 The milled coating powder is transferred from the pulveriser / jet mill(s) on an airstream. This air-stream is designed so that oversized particles drop down and are returned to the milling chamber. So, by a combination of rate of feed, speed of rotating pin disc and air velocity, it is possible to produce a powder with a controlled particle size distribution. In toner applications either cyclonic or mechanical wheel separation is used to separate the oversize particles for further milling. In most toner manufacturing plants between two to four classification stages are used to get the final particle distribution needed. Powder transport between each classification stage is done by vacuum transfer. The transport air is separated from the powder using either cyclonic or mechanical wheel separation. The extracted air is filtered to remove any unwanted fine powder.

3.14 The milled / classified powder is then transferred to a collection chamber. This may be a cyclone where the powder falls to the bottom, while the air is exhausted from the top, filtered and exhausted to the atmosphere. The other method of collection is where the powder/air mix is passed into a chamber fitted with bag filters. In toner applications the powder is generally collected in a weighing vessel. This allows batch processing with other additives (such as silicates) required for the copy process. These additives are fed by separate screw feed system & the batches are mixed together mechanically then discharged to the packing stage.
3.15 Once the powder is in the required configuration it is generally sieved to remove any possible contaminants before being packed ready for sale or use.

![Diagram](image)

*Figure 3.1: Stages in the Manufacture of Powder Coatings*
4 Potential releases

4.1 The following parts of the process may give rise to particulate matter:

- Raw material and pre-mix weighing, handling and additive handling and mixing
- Grinding / milling and classification
- Boxing, bagging and loading into bulk containers
- Moving, cleaning and maintaining bag filters
- Handling and storing waste powders

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. (See Ref. (b) (M1) and Ref. (c) (M2))

The reference conditions for limits in Table 2 are:

- 273K, 101.3kPa, without correction for water vapour.

<table>
<thead>
<tr>
<th>Source</th>
<th>Substance</th>
<th>Emission Limit/Provisions</th>
<th>Type of Monitoring</th>
<th>Monitoring Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contained sources that vent externally</td>
<td>Total particulate not containing TGIC, lead chromate or CMR</td>
<td>Emission concentration limit 10mg/m³</td>
<td>Indicative monitoring, alarm and record - see 5.6 plus Manual extractive test - see 5.8</td>
<td>Annual</td>
</tr>
</tbody>
</table>

Table 2: Emission limits, monitoring and other provisions

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; and
- kept by the operator for at least two years

5.3 The monitoring results should include process conditions at the time of monitoring. The operator should keep a list of key arrestment plant and should have a written procedure for dealing with its failure, in order to minimise any adverse effects.

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

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.

Abnormal events
5.5 The operator should respond to problems which may have an adverse 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

Calibration and compliance monitoring
5.8 Calibration of quantitative instruments and compliance monitoring should meet the following provisions as appropriate:
No result should exceed the emission concentration limits specified, except where either:
(a) data is obtained over at least 5 sampling hours in increments of 15 minutes or less; or
(b) at least 20 results are obtained where sampling time increments of more than 15 minute are involved; AND in the case of (a) or (b)
(c) no daily mean of all 15-minute mean emission concentrations should exceed the specified emission concentration limits during normal operation (excluding start-up and shut-down); and
(d) no 15-minute mean emission concentration should exceed twice the specified emission concentration limits during normal operation (excluding start-up and shut-down).
Non-continuous emissions monitoring of particulate matter should be carried out according to the main procedural requirements of BS ISO 9096: 2003, with averages taken over operating periods, excluding start-up and shutdown.
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.

Varying monitoring frequency

The introduction of dilution air to achieve emission concentration limits should not be permitted.

5.10 Where non-continuous quantitative monitoring is required, the frequency may be varied.
Where there is consistent compliance with emission limits, operators 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 3 – 9 mg/m³, against an emission limit of 10 mg/m³ might not warrant a reduction in monitoring.
(b) the margin between the results and the emission limit, for example, results which range from 9 - 10 mg/m³ when the limit is 10 mg/m³ might not warrant a reduction in monitoring.
Consistent compliance should be demonstrated using the results from at least:
- two or more monitoring exercises within two years or;
- two or more monitoring exercises in one year supported by continuous monitoring.
Any significant process changes which might have affected the monitored emission should be taken into account. The nature of the material being monitored should also be taken into account.

5.11 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.

5.12 Care is needed in the design and location of sampling systems in order to obtain representative samples. For example, BS ISO 9096:2003 calls for sampling within a straight section of flue. The design for new sampling points is usually about 7 to 10 diameters in length.
The operator should ensure that adequate facilities for sampling are provided on vents or ducts.
Sampling points on new plant should be designed to comply with the British or equivalent standards.
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 in order to meet the emission limits and provisions in Section 5. Provided that an equivalent level of control will be achieved, then other techniques may be used.

<table>
<thead>
<tr>
<th>Release source</th>
<th>Substance</th>
<th>Control technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw material weighing and handling</td>
<td>Particulate matter</td>
<td>Contain and arrest</td>
</tr>
<tr>
<td>Production handling</td>
<td>Particulate matter</td>
<td>Contain and arrest</td>
</tr>
<tr>
<td>External process vents</td>
<td>Particulate matter</td>
<td>Arrest and monitor</td>
</tr>
<tr>
<td>Moving bag filters to cleaning station</td>
<td>Particulate matter</td>
<td>Contain</td>
</tr>
<tr>
<td>Dry cleaning of bag filters</td>
<td>Particulate matter</td>
<td>Contain and arrest</td>
</tr>
</tbody>
</table>

Summary of control techniques

Techniques to control emissions from contained sources

Particulate matter

6.2 Emissions of particulate matter should be arrested if necessary to meet the emission limit.

Techniques to control fugitive emissions

6.3 Closed containers prevent wind whipping of dusty, dry waste materials.

Dusty wastes should be stored in closed containers and handled in a manner that avoids emissions.

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, nor should dust be blown with compressed air.

A high standard of housekeeping should be maintained.

Management

Management techniques

6.4 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

6.5 Effective management is central to environmental performance; 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 such as Coatings Care. Operators may also find that an EMS will help identify business savings.

**Training**

6.6 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 startup, 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; in particular, how to deal with conditions likely to give rise to dust emissions, such as the event of spillage, and emptying and cleaning of arrestment plant
  - 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.

**Maintenance**

6.7 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 kept with respect to pollution control equipment.

**7 Summary of Changes**

Removed all references to the regulator and permits.

Removed the requirement for continuous monitoring.

**8 Further information**

**Health and safety**

Operators of processes and installations must protect people at work as well as the environment.

- Where emission limits quoted in this guidance conflict with health and safety limits, the tighter limit should prevail because 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](http://www.envirowise.gov.uk) and [www.energy-efficiency.gov.uk](http://www.energy-efficiency.gov.uk) and Environment and Energy Helpline freephone 0800 585794
- ISO 14001 [www.bsi.org.uk](http://www.bsi.org.uk) or telephone BSI information centre (020 8966 7022)
- EU Eco Management and Audit Scheme (EMAS) [www.emas.co.uk](http://www.emas.co.uk) or telephone the Institute of Environmental Management and Assessment (01522 540069)
- Coatings Care Code and Guidance I3 Environmental Management (Pollution Prevention/Waste Management)
References
(b) M1 Sampling requirements for monitoring stack emissions to air from industrial installations,
Environment Agency July 2002 (EA website)
(c) M2 Monitoring of stack emissions to air. Environment Agency May 2003 (EA website)
(d) The Chemical (Hazard Information and Packaging of Supply) Regulations 2002 SI 3247

Web addresses
EA guidance [www.defra.gov.uk/environment/index.htm](http://www.defra.gov.uk/environment/index.htm)
Local Authority Unit of the Environment Agency for England and Wales
[www.environmentagency.gov.uk/business/lapc](http://www.environmentagency.gov.uk/business/lapc)
Scottish Environment Protection Agency (SEPA) [www.sepa.org.uk](http://www.sepa.org.uk)
Energy saving and environmental management measures can increase industry profits.
Envirowise (formerly ETBPP) show how at [www.envirowise.gov.uk](http://www.envirowise.gov.uk) (or freephone 0800 585794).