Guidelines EN-G09: Iron and Steel Works – Foundries

PCFC- Entity (Business Unit) Name	:	Trakhees – Ports, Customs & Free Zone Corporation
Department Name	:	Environment Health and Safety (EHS)
Section Name	:	Environment Section
Document Reference Number	:	PCFC-TRK-EHS-ENV-G09
Revision Number	:	01
Revision Date	:	June 2023
Classification	:	Public

info@pcfc.ae P.O. Box 2001, Dubai, U.A.E. | ص.ب. 2001، دبي، الإمارات العربية المتحدة Call Center مركز الاتصال 800 990
@pcfc_dubai | www.pcfc.ae

Table of Contents

info@pcfc.ae P.O. Box 2001, Dubai, U.A.E. | ص.ب. 2001، دبي، الإمارات العربية المتحدة Call Center مركز الاتصال 800 990
@pcfc_dubai | www.pcfc.ae

1. Introduction

A foundry is a factory which produces metal castings from either ferrous or non-ferrous alloys. Metals are turned into parts by melting the metal into a liquid, pouring the metal in a mold, and then removing mold material or casting. Foundries produce steel castings by melting scrap, alloying, molding and finishing. The major processing operations of a typical steel foundry are raw materials handling, metal molting, mold and core production and casting and finishing.

These notes apply to works where iron and steel are melted, refined and cast, and they cover the associated processes. Melting is usually carried out in cupolas, electric arc furnaces, induction furnaces and similar small furnaces.

An accident in a foundry happened at Qinghe Special Steel Corporation on 18 April 2007. A ladle holding molten steel separated from the overhead iron rail, fell, tipped, and killed 32 workers, injuring another 6.

2. Sampling, Measurement of Emissions and Monitoring

2.1 As part of proper supervision, the owner shall make tests and inspections of the process. The frequency of testing shall normally be not less than once per year, but more frequent tests may be necessary in special circumstances. The results of all tests and inspection shall be recorded and made available to the Authority's representatives.

2.2 Visual inspections shall be made of fugitive emissions which cannot be measured.

3. Emission Limits and Controls

3.1 Cupola Furnaces

During normal operation and blow-down all the cupola gases shall be contained and burnt before discharge to air through a suitable dust arrestor. The final discharge to air shall be virtually invisible as judged by the naked eye and shall contain not more than 150 mg/m^3 of total particulate matter.

info@pcfc.ae P.O. Box 2001, Dubai, U.A.E. | ص.ب. 2001، دبي، الإمارات العربية المتحدة Call Center مركز الاتصال 800 990
@pcfc_dubai | www.pcfc.ae

3.2 Electric Arc Furnaces

a. Primary collection and arrestment are required on all new furnaces and the final emission to air shall contain not more than 150 mg/m^3 of particulate matter.

b. For large furnaces over 20 ton capacity, secondary collection shall be used to remove all fume from tapping, refining, charging, etc. and the emission from the arrestment plant shall contain not more than one hundred fifty (150) mg/m^3 of particulate matter.

c. Where associated processes five rise to particulate emissions, collection and arrestment are normally required and the concentration of particulate emissions to atmosphere shall not exceed one hundred fifty (150) mg/m^3.

d. The emission from any chimney or other final outlet shall be free from liquid droplets.

3.3 Induction Furnaces

a. Induction furnaces normally melt relatively clean scrap and discharge waste gases into the factory atmosphere and thence to air through roof ventilators. The final discharge shall not exceed one hundred fifty (150) mg/m^3.

b. When dirty and greasy scrap is being melted, it shall either be pre-cleaned, or the furnace shall be hooded and the waste gases must pass through suitable treatment plant to give an emission which is virtually invisible as judged with the naked eye.

3.4 General

a. Scrap metal usually contains small quantities of non-ferrous metals such as lead and zinc where this is so the limits for emissions of the non-ferrous metals industries apply, e.g. lead to be less than 0.005 g/m3 and iron 0.1 g/m^3. Total heavy metals concentration not to exceed five (5) mg/m^3.

info@pcfc.ae P.O. Box 2001, Dubai, U.A.E. | ص.ب. 2001، دبي، الإمارات العربية المتحدة Call Center مركز الاتصال 800 990
@pcfc_dubai | www.pcfc.ae

b. There are many processes associated with foundry work which give rise to particulate emissions and these shall be treated suitably to render them harmless and inoffensive. Where shot blasting is carried out, the process shall be extracted to a filter to give an invisible emission.

c. Fugitive dust emissions shall have no significant visible emission as judged by the naked eye.

d. Emissions from the raw materials handling operations are fugitive particulates generated from receiving, unloading, storing, and conveying all raw materials for the foundry. These emissions are controlled by enclosing the major emission points and routing the air from the enclosures through fabric filters.

e. Emissions from scrap preparation consist of hydrocarbons if solvent degreasing is used and consist of smoke, organics, and carbon monoxide (CO) if heating is used. Catalytic incinerators and afterburners of approximately 95 percent control efficiency for carbon monoxide and organics can be applied to these sources.

f. Emissions from melting furnaces are particulates, carbon monoxide, organics, sulfur dioxide, nitrogen oxides, and small quantities of chlorides and fluorides. The particulates, chlorides, and fluorides are generated by the flux. Scrap contains volatile organic compounds (VOCs) and dirt particles, along with oxidized phosphorus, silicon, and manganese. In addition, organics on the scrap and the carbon additives increase CO emissions. There are also trace constituents such as nickel, hexavalent chromium, lead, cadmium, and arsenic. The highest concentrations of furnace emissions occur when the furnace lids and doors are opened during charging, back charging, alloying, oxygen lancing, slag removal, and tapping operations. These emissions escape into the furnace building and are vented through roof vents. Controls for emissions during the melting and refining operations focus on venting the furnace gases and fumes directly to an emission collection duct and control system. Controls for fugitive furnace emissions involve either the use of building roof hoods or special hoods near the furnace doors, to collect emissions and route them to emission control systems. Emission control systems commonly used to control particulate emissions from electric arc and induction furnaces are bag filters, cyclones, and venturi scrubbers.

g. The major pollutant from mold and core production is particulates from sand reclaiming, sand preparation, sand mixing with binders and additives, and mold and core forming. Particulate, VOC, and CO emissions result from core baking and VOC emissions occur during mold drying. Bag filters and

info@pcfc.ae P.O. Box 2001, Dubai, U.A.E. | ص.ب. 2001، دبي، الإمارات العربية المتحدة Call Center 800 990 مركز الاتصال
@pcfc_dubai | www.pcfc.ae

scrubbers can be used to control particulates from mold and core production. Afterburners and catalytic incinerators can be used to control VOC and CO emissions.

h. Emissions from finishing operations consist of particulates resulting from the removal of burrs, risers, and gates and during shot blasting. Particulates from finishing operations can be controlled by cyclone separators.

4. Operational Controls

In general, finely divided materials associated with or arising from the process, shall be controlled in such a manner as to minimize emissions to atmosphere.

Stocks of fine materials (e.g. fluxes, additives, etc.) shall normally be delivered and stored under cover to prevent wind-whipping. Loading to and from stock shall be carried out so as to minimize airborne dust.

Storage silos for fine materials shall be enclosed and vented to air through a filter.

Slag shall be handled and disposed of in a manner which minimizes dust generation.

5. Chimneys

5.1 Waste cupola gases shall be vented to air from chimney heights based on the table below, but shall be not less than six (6) meters above the cupola structure or adjacent buildings.

CUPOLA CAPACITY *(TPH)*	CHIMNEY HEIGHT *(meters)*
7 or below	21
10	23
15	26
20	28
25	30

info@pcfc.ae P.O. Box 2001, Dubai, U.A.E. | ص.ب. 2001، دبي، الإمارات العربية المتحدة Call Center مركز الاتصال 800 990
@pcfc_dubai | www.pcfc.ae

5.2 The height of chimneys for emissions shall be decided by the Authority after discussions with works management taking into account local circumstances and nearby buildings. The minimum height shall not be less than three (3) meters above any tallest building to which it is attached or adjacent.

info@pcfc.ae P.O. Box 2001, Dubai, U.A.E. | ص.ب. 2001، دبي، الإمارات العربية المتحدة Call Center 800 990 مركز الاتصال
@pcfc_dubai | www.pcfc.ae