

# Perspectives of compliance with environmental requirements arising from BAT conclusions for coke oven plants

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## Introduction

The environmental requirements for the years 2013÷2020 for coke oven plants are provided in the Environmental Protection Law [1], Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions [2], and Commission Implementing Decision of 28 February 2012 establishing the best available techniques (BAT) on industrial emissions for iron and steel production [3]. New coke manufacturing plants must comply with the environmental requirements as of 7 January 2013, while the compliance date for the existing plants is 8 March 2016 [2, 3].

In Poland in the years 2001 ÷ 2011 the coke oven plants have been upgraded in terms of technology and emissions [4]. Ten new coke oven batteries were constructed, in accordance with the current state of coke oven technology and environmental protection standards, and eleven decrepit coke oven batteries were shut down [5].

In view of the legal changes in the environmental requirements related to coke manufacturing and the technical and emission condition of the systems and facilities of the coke oven plant, it is important to perform the compliance analysis and determine the perspectives for adjusting coke oven plants to new technical and emission standards, arising from the BAT Conclusions [3, 5, 6].

## Technical and environmental requirements related to coke manufacturing

The technical and environmental requirements related to coke manufacturing are provided in chapter 1.4 of the BAT Conclusions [3]. The best available techniques and emission standards for the technological operations of manufacturing coke and coal derivatives are defined as follows:

### Charging coke oven chambers

"Smokeless" charging or sequential charging with double ascension pipes or jumper pipes are the preferred types. The duration associated with BAT of visible emissions from charging is < 30 seconds per charge.

### Coking

The percentage of visible emissions from all doors is < 5-10%.

The percentage of visible emissions from ceiling fixtures is < 1%.

### Coke oven battery underfiring

The BAT-associated emission levels (AEL), determined as daily mean values and relating to an oxygen content of 5 % are:

Sulphur oxides (SO<sub>x</sub>), expressed as sulphur dioxide (SO<sub>2</sub>) < 200 – 500 mg/Nm<sup>3</sup>

Sulphur oxides (SO<sub>x</sub>), expressed as sulphur dioxide (SO<sub>2</sub>):

- for new plants (less than 10 years old) < 305-500 mg/Nm<sup>3</sup>
- for older plants < 500-650 mg/Nm<sup>3</sup>

Dust < 1-20 mg/Nm<sup>3</sup>.

### Coke pushing

BAT-AEL:

Dust < 10 mg/Nm<sup>3</sup> for bag filters.

Dust < 20 mg/Nm<sup>3</sup> for other cases.

### Coke quenching:

Dust < 20 mg/Nm<sup>3</sup> for coke dry quenching (CDQ).

Dust < 25 g/t of coke in case of emission minimised conventional wet quenching.

Dust < 10 g/t in case of coke stabilisation quenching (CSQ).

### Gas desulphurisation:

BAT is to reduce the sulphur content of the coke oven gas (COG) by using one of the following techniques:

- Desulphurisation by absorption systems, maintaining the residual H<sub>2</sub>S concentrations < 300-1,000 mg/Nm<sup>3</sup>, with the higher values being associated with higher ambient temperature.
- Wet oxidative desulphurisation, with the associated residual H<sub>2</sub>S concentration < 10 mg/Nm<sup>3</sup>.

### Producing coal derivatives:

- minimising the number of flanges by welding piping connections wherever possible
- using appropriate sealings for flanges and valves
- using gas-tight pumps (e.g. magnetic pumps)
- avoiding emissions from pressure valves in storage tanks by connecting the valve outlet to the coke oven gas (COG) collecting main or collecting the gases and subsequent combustion.

### Managing coke gas

BAT is to use the extracted coke oven gas (COG) as a fuel or reducing agent or for the production of chemicals. Gas flares may burn the coke oven gas only in conditions other than normal operation of coke oven batteries – for safety reasons.

### Waste management

Production residues such as: tar residues, scrubbing oil polymers and excessive activated sludge should be recirculated into coal feed.

### Treatment of waste water from coking process:

BAT is to use biological waste water treatment with integrated denitrification/nitrification stages and reaching the following emission levels:

- chemical oxygen demand (COD) < 220 mg/l
- biological oxygen demand for 5 days (BOD<sub>5</sub>) < 20 mg/l
- sulphides < 0.1 mg/l
- thiocyanates < 4 mg/l
- cyanides < 0,1 mg/l
- polycyclic aromatic hydrocarbons (PAH) < 0.05 mg/l
- phenols < 0.5 mg/l
- total nitrogen < 15-50 mg/l.

## Analysis of compliance of the state of coking technology and emission levels in ArcelorMittal S.A. coke oven plant, in Zdzieszowice Unit with the environmental requirements provided in BAT Conclusions.

The analysis of compliance of coking technique and emission levels from the systems and devices of the coke oven plant with the requirements provided in BAT Conclusions was performed in three stages [6 ÷ 9]:

- first stage: division of systems and devices in the coke oven plant into technology nodes of coke and coal derivatives manufacturing, according to the classification of technological operations applied in BAT Conclusions
- second stage: preliminary assessment of compliance of technical and emission evaluation of specific technology nodes with the requirements set forth in BAT Conclusions. At this stage a list of technology nodes with high risk of non-compliance with BAT Conclusions was prepared
- third stage: technical evaluation and measurement of emission levels from the systems and devices in the technology nodes with high risk of non-compliance with BAT Conclusions. Based on the results of analysis and measurements critical points were identified in the coke oven plant technology nodes that require adjustment to the environmental requirements provided in BAT Conclusions.

The following critical points were identified in ArcelorMittal S.A. coke oven plant, Zdzieszowice Unit:

1. Underfiring coke oven batteries no. 3-6 and 7-12
  - too high NO<sub>x</sub> and SO<sub>x</sub> concentrations
2. Dedusting the coke side of batteries 3-6
  - too high dust emission levels
3. Quenching towers no. 2, 3, 4, 5, 6, 9 and 10
  - too high dust emission levels
4. Coke oven batteries no. 5 and 6
  - too high visible emission levels
5. Coal derivatives
  - no airtight sealing of tar and carbon oil storage
  - too high hydrogen sulphide concentration in cleaned coke gas
6. Coking waste water treatment plant.
  - too high refractive compounds concentration

#### Action plan for ensuring coke oven plant compliance with new environmental requirements related to coke manufacturing

In order to ensure the compliance of the coke oven plant with the environmental requirements arising from BAT Conclusions, the following actions have been undertaken:

1. In terms of measurement and evaluation of emission levels from coke oven plant systems and devices

Development and implementation of procedures for measuring emission levels from coke oven plant systems and devices:

- online measurement of fugitive emission from coke oven batteries – deadline: 7 January 2014
- measurement of emission levels from the technological operation – coke pushing – deadline: 7 January 2014
- online measurement of emission levels from the technological operation of coke oven batteries – underfiring batteries – deadline: 7 January 2014
- measurement of substance emission levels from coke quenching process – deadline: 8 March 2016 (update)
- evaluation of visible emission from the coke oven battery, using “yes or no” method – deadline: 7 January 2014 (update).

2. In terms of implementing new technical solutions for coke manufacturing and upgrading the existing coke oven plant systems and devices

- upgrade of dedusting installation on the coke side of coke oven batteries 3-6, expansion of dedusting installation for batteries no. 3 and 4 – deadline: 31 December 2015
- renovation and upgrade of quenching towers no. 2, 3 and 4 – deadline: 7 January 2014
- development of process design and implementation of new dedusting method for vapours from quenching towers no. 5, 6, 9 and 10 – deadline: 8 March 2016

- renovation of ceramic blocks of coke oven batteries no. 5 and 6 – deadline: renovation in stages until 31 December 2015
- design and implementation of new method of control for NO<sub>x</sub> and SO<sub>2</sub> emissions from underfiring coke oven batteries – deadline: 31 December 2015
- renovation and expansion of coal derivatives installations – deadline: 31 December 2015
- development of process design and implementation of eliminating refractive compounds from coke processing waste water – deadline: 31 December 2015.

#### Conclusions

The BAT Conclusions for coke oven plants specifies new technical requirements, emission standards and methodologies of monitoring substance emission levels.

The existing coke processing systems and devices should be adjusted to the environmental requirements arising from the BAT Conclusions by 8 March 2016.

The performed analysis of compliance of the coke oven plant systems and devices with new environmental requirements set forth in the BAT Conclusions revealed the need to take steps towards ensuring compliance in certain technology nodes in terms of coke processing technique and emission monitoring.

The action plan for the coke oven plant, developed and implemented for the period from 2015 to 2015, will ensure compliance with the environmental requirements arising from the BAT Conclusions by 8 March 2016.

#### Literature

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