

## FUGITIVE EMISSIONS ZENICA'S COKE PLANT

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### ABSTRACT

*In this work are given information about estimates of emission of volatile organic carbon and the particulate matter with uncontrolled source plants in the coke plant Arcelor Mittal Zenica (fugitive emission) and comparison with the emission at the coke plants presented in the BAT (Best Available Techniques Reference Document on the Production of Iron and Steel, December 2001). Estimates indicate that the emission of listed pollutants with Zenica's coke plant much greater than emission from the coke plants presented in the BAT. Application of certain technical technological measures can significantly reduce uncontrolled emission from the Zenica's coke plant. The paper referred to the BAT recommendations, and other technological solutions that will be applied to the Zenica's coke plant to reduce fugitive emissions and reducing them to the limit values that apply in Bosnia.*

**Key words:** fugitive emission, estimate of emission, particulate matter, volatile organic carbon, BAT.

### 1. INTRODUCTION

Coke plant consists of the following production-technological plants:

- a) plant preparing of coal,
- b) plant of coking,
- c) plant of by-products (refinement of coke oven gas).

Uncontrolled emissions into the air is particularly expressed in the plant of coking. It plant has silos of coal, coke battery, a tower for the quenching of coke with a funnel and facilities separations coke. Estimate emission particulate matter (PM) and volatile organic carbon (VOC) with uncontrolled sources plant of coking is performed on the basis of the Technical Project for the reduction of pollution in Zenica Steel Plants and Action Plan with Measures and Deadlines for the Gradual Reduction of Emissions and Pollution and for armonization with the Best Available Technique for the Department "Coke Plant" Arcelor Mittal Steel Zenica [1, 3].

### 2. ESTIMATE EMISSION OF VOC AND PM WITH COKE PLANT

Uncontrolled sources of emission at coke plant are all places where the emission occurs, and that are:

- coal charging,
- ascension pipes,
- doors,
- coke pushing,
- coke quenching.

Uncontrolled source of emission divided into an active source of emission (source at the time of filling and emptying) and the inactive source emissions (which are closed but which may also represent a source of uncontrolled emission).

## 2.1. Estimate emission of VOC with uncontrolled source of coke plant

Uncontrolled source of emission VOC on plant of coking is smoke that appears on the emissive places listed under point 2. In Table 1. gives factors VOC emissions before and after preventive measures.

Table 1. Comparison of VOC emission Zenica's coke plant with emission from BAT's coke plants[2,3]

Plant	COKING			
	Pollutant	Unit emission (kg/t coke)		
	VOC	Emission before preventive measures	Emission after preventive measures	BAT
Places forming of emission	Coal charging	0,325	0,026	$6,8 \cdot 10^{-5} - 0,104$
	Doors	0,976	0,117	0,00534-0,095
	Coke pushing	0,13	-	-

The data in Table 1 indicate that the VOC emission can be significantly reduced, considering the preventive measures, such as:

- selection of quality raw materials,
- reviewing directive for plant operation,
- training workers for maintenance facilities,
- training workers of the conduct of technological processes,
- training workers of visible emissions monitoring,
- continuous application technological regulations.

The data in Table 1 are not relevant indicator comparisons VOC emission from the coke plant in Zenica with emission from BAT's coke plants. The reason for this is that in the BAT not give information on VOC emission in any area specified in the Table 1, but data on individual shows only two pollutants to CH<sub>4</sub> and aliphatic HC.

## 2.2. Estimate emission of PM with uncontrolled source of coke plant

Compare particulate matter emission into the air with Zenica's coke plant with emission particulate matter given in the best available technologies (BAT) is shown in Table 2.

The data in Table 2 (identical as in Table 1) indicate that the PM emission can be significantly reduced, considering the preventive measures. Compared of PM emission from Zenica's coke plant with emission from BAT's coke plants, abiding by preventive measures, exceeding emission is evident in all the places shown in the Table 2. At all locations where emission PM exceed the limit values from the BAT technology, within the framework of an Action Plan with Measures and Deadlines for the Gradual Reduction of Emissions and Pollution and for Harmonization with the Best Available Technique for the Department "Coke Plant" Arcelor Mittal Steel Zenica, proposed the modification and improvement of technical-technological equipment in order that a greater reduction in emissions of the above. At issue are the BAT recommendations, and other technological solutions.

Tabela 2. Comparison of PM emission Zenica's coke plant with emission from BAT's coke plants[3]

Plant	COKING			
	Pollutant	Unit emission (kg/t coke)		
	PM	Emission before preventive measures	Emission after preventive measures	BAT
Places forming of emission	Coal charging	0,143	0,013	0,0003-0,01
	Doors	0,3385	0,013	0,0003-0,006
	Coke pushing	0,3125	0,3125	>0,21
	Coke quenching	0,1693	0,1693	do 0,134
	Ascension pipes	0,039	0,013	<0,00021

### 3. PROPOSED MEASURES FOR REDUCTION FUGITIVE EMISSIONS

#### 3.1. Proposed BAT recommendations for reducing emissions

##### 3.1.1. Proposed BAT recommendations for reducing emissions of coke pushing

###### Description of possible technological solutions

Several systems have been developed to minimise coke side particulate matter emissions from coke pushing [2]:

1. Coke side sheds, including evacuation and de-dusting. The particulate matter is evacuated by means of a coke side shed and de-dusted in a fabric filter.
2. Draught-hood-system. Operates on the wet scrubber principle and utilises the thermal draft of the dust-laden gases, while keeping the coke dry and thus avoiding hydrogen sulphide formation.
3. Container car. The coke is pressed directly from the coke oven chamber in a container car. The coke does not get into contact with oxygen and only small amounts of particulate matter are generated. Usually applied in combination with coke dry quenching.
4. Coke transfer machine with (integrated) hood and mobile de-dusting device. The particulate matter is evacuated by means of integrated hoods on the coke transfer machine.
5. Coke transfer machine with (integrated) hood, stationary duct and stationary gas cleaning, preferably by fabric filtration (Figure 1), so-called "Minister Stein System". During the whole pushing process the quenching car shall be positioned in the catchment area of the de-dusting collection system (use of one-point quenching car with (integrated) hoods on the coke transfer machine). Stated solution is proposed as a measure to reduce emission of coke pushing on Zenica's coke plant.

###### Applicability

Coke side de-dusting is applicable both at new and existing plants. At existing plants, a tailor-made solution frequently has to be engineered. Sometimes lack of space at the plant is a constraint.

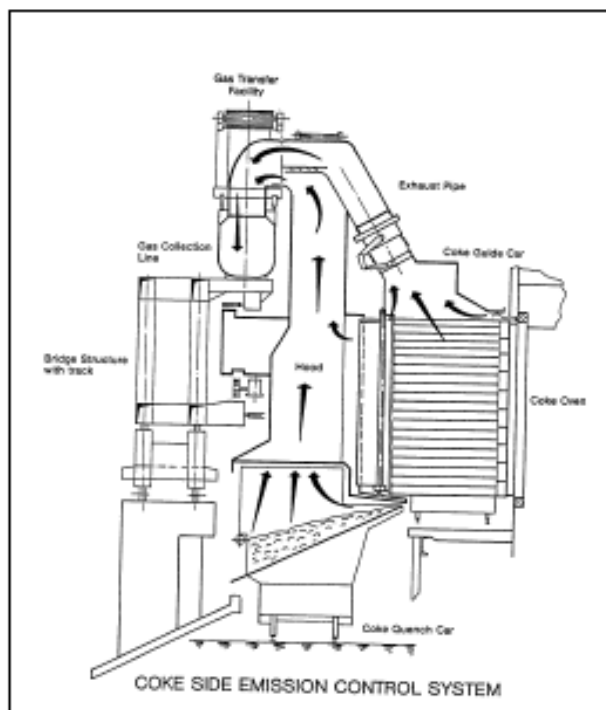


Figure 1. Example for a de-dusting system for dust from coke pushing [2]

#### Main achieved emission level

Emission of particulate matter without abatement is about 500 g/t coke. Of the five techniques mentioned above, the "Minister Stein System" gives the best performance, achieving >99% collection efficiency, combined with good working conditions for operators (in contrast to coke side sheds). Emission factors (at the stack) below 5 g particulate matter/t coke can be achieved. At existing plants, a particulate matter collection rate of >99% is also achievable, as has been shown at the Ruhrkohle Hassel coking plant, Germany. A particulate matter concentration in the exhaust air of <30 mg/Nm<sup>3</sup> was achieved. The system was also based on evacuation through a stationary duct. Air extraction capacity is often in the order of 200000 Nm<sup>3</sup>/h in plants using the Minister Stein System but is depending on chamber size. A fabric filter is used to minimise particulate emissions. Reported dust capture and removal efficiency of the Draught-hood-system was 95-96%.

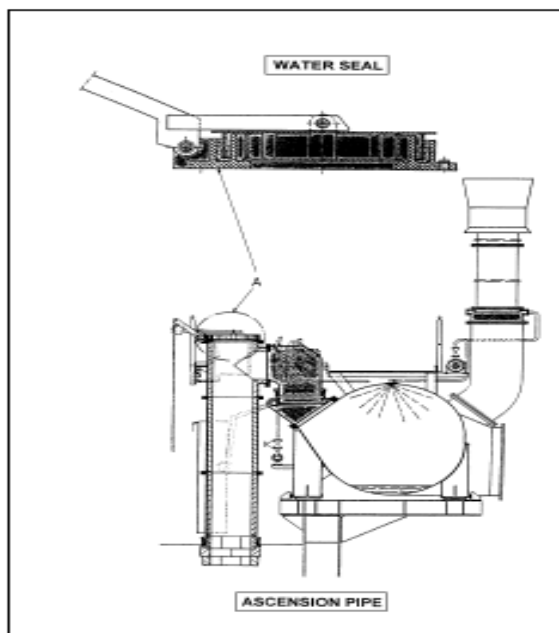
#### **3.1.2. Proposed BAT recommendations for reducing fugitive emissions from ascension pipes Zenica's coke plant - sealing of ascension pipes**

During the coking period diffuse emissions from coke oven openings can be minimised by sealing these openings efficiently after the pushing and charging operation. However, such measures can only be successful when accompanied by careful maintenance and cleaning. Water-sealed ascension pipes are standard equipment at most new coke oven plants (Figure 2).

Additionally many older plants are also fitted with water-sealed ascension pipes. The water sealing can be very effective, providing that the water supply and run-off pipes are kept free of obstructions. Nowadays, the best way to keep the charging holes leak-proof is to lute them carefully with a clay-water suspension.

### Applicability

Applicable both at new and existing plants. In new plants the design of the ascension pipes and the charging holes can be optimised in order to reduce fugitive emissions.



*Figure 2. Ascension pipe of a coke oven chamber[2]*

### Main achieved emission levels

Water sealed ascension pipes will significantly reduce emissions of particulate matter, CO and hydrocarbons. Expressed as a frequency of leaking (% of the total number of charging holes) possible achievements with luted lids are a maximum of 1% of charging holes showing visible leaks.

### Reference plants

Many plants in the world have water sealed ascension pipes. Furthermore, almost all plants lute the charging holes, either automatically or by hand.

### Cross-media effects

Water sealed ascension pipes generate a wastewater flow. However, this wastewater can in some cases be recycled to the ammonia liquor tank or led to the ammonia stripper/still. Electricity is consumed by the pumps to circulate the water. Luting of charging holes causes no significant cross-media effects.

### **3.2. Proposed other technological solutions to reduce fugitive emissions**

Other technological solutions include modification of existing equipment to reduce emissions. Solutions are excluded from the Technical project [1]. Based on the proposed solution, in addition to rehabilitation of the tower of coke quenching, make modifications equipment of coal charging and doors of coke battery. If the above modifications do not reduce the emission limit values that apply in Bosnia and Herzegovina, will be investigated all other options.

#### **4. CONCLUSION**

Estimate of emission primarily particulate matter with uncontrolled source Zenica's coke plant, fugitive emission, to show that its value, in all places at which we estimate, over the value of the BAT recommendations. At all locations where emission PM exceed the limit values from the BAT technology, within the framework of an Action Plan with Measures and Deadlines for the Gradual Reduction of Emissions and Pollution and for Harmonization with the Best Available Technique for the Department "Coke Plant" Arcelor Mittal Steel Zenica, proposed the modification and improvement of technical-technological equipment in order that a greater reduction in emissions of the above. It is expected that the application of BAT technologies to reach the enormous emissions reductions at places where such measures are proposed. In places where the proposed other technological solutions, should the excess emissions, will explore the measures and solutions for bringing the emissions limits, including the BAT recommendations.

#### **5. REFERENCES**

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