Convention on Long-Range Transboundary Air Pollution
48th Working Group on Strategies and Review
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Determination of costs for activities of annexes V and VII
Sector: Production of Iron and Steel

Preamble: This document has been composed to fulfil the task of assigning cost parameters to options discussed in the light of revising the Gothenburg Protocol. Providing representative cost data for general use is challenging, as site issues and country-specific issues may affect investment and operating costs severely.

Technical Introduction

The Gothenburg Protocol rules NO_x and dust emissions from iron and steel production as the only pollutants in this sector. NO_x ELVs are applicable at sinter plants, whereas dust emissions are ruled at multiple sources. In most cases, filtered dust is recycled back to the furnace, as it contains large quantities of iron or coke, or is sold. Recycling filtered dusts increases raw material efficiency, selling ashes and slags increases the economic performance of the processes. Only filter dust of certain process steps and in special cases needs to be disposed of (e. g. too large fractions of heavy metals).

Dedusting equipment used are electrostatic precipitators (ESP, wet, dry, and advanced types) fabric filters (FF), cyclones, hydrocyclones and wet scrubbers. The use of dry ESPs allows an easier dust recycling than the use of wet ESPs. Cyclones are mainly used for pre-dedusting of process gases.

Options in Gothenburg Protocol

Tables 1 and 2 present the suggested ELVs for ruled processes in the production of iron and steel. Table 3 shows example techniques mentioned by EGTEI industry experts, which are used for reaching dust emission concentrations equivalent to or below referred ELVs.

Literature cost data

Sufficient data on investment and operating costs could not be collected. For information purpose on the order of magnitude and the relation of costs of different dedusting techniques to each other, data collected in the Working Document for the determination of costs in the Sector of boilers and process heaters is referred to.

Table 1. Suggested options for limit values for dust emissions released from primary iron and steel production

	Suggested ELV for dust [mg/Nm³]		
	Option 1	**Option 2**	**Option 3** [b]
Sinter plant (>150 t/day)	15 [a]	50 [a]	50
Pelletization plant (>150 t/day)	5 [a]	10 [a]	25
Blast furnace: Hot stoves (>2.5 t/hour)	5 [a]	10 [a]	50
Basic oxygen steelmaking and casting (>2.5 t/hour)	10 [a]	30 [a]	50
Electric steelmaking and casting (>2.5 t/hour)	10 (existing) 5 (new)	15 (existing) 5 (new)	20

a/ As an exemption to paragraph 3, these ELVs should be considered as averaged over a substantial period of time

b/ Based on the heavy metal protocol based on a daily average

Table 2. Suggested options for limit values for NO$_x$ emissions released from primary iron and steel [a/] production

Plant type	Suggested ELV for NO$_x$ [mg/Nm³][b/]		
	Option 1	Option 2	Option 3
Sinter plants: New installation	[…[c/]]	400	400
Sinter plants: Existing installation	[...[c/]]	400	400

a/ Production and processing of metals: metal ore roasting or sintering installations, installations for the production of pig iron or steel (primary or secondary fusion) including continuous casting with a capacity exceeding 2.5 Mg/hour, installations for the processing of ferrous metals (hot rolling mills > 20 Mg/hour of crude steel).

b/ As an exemption to paragraph 3, these ELVs should be considered as averaged over a substantial period of time

c/ SCR is considered as part of the BAT in the European Reference document but no BAT-AEL is reported.

Table 3: Associated techniques to dust ELV options

PROCESS	OPTIONS	ELVS	ASSOCIATED TECHNIQUES FOLLOWING I&S BREF 2001
Sinter plant (>150 t/day)	OPTION 1	15 mg/Nm	ESP+FF **Note:** Generally use of dry ESP with 3 fields completed by a new bag filter ; in case of a new plant, it is however not sure that a new 3-fields ESP would be installed upstream the bag filter; it could be also advanced cyclones or advanced 2-fields ESP or any other alternative solution economically and technically applicable and feasible.
	OPTION 2	50 mg/Nm3	Advanced ESP or prededusting (ESP or cyclones) + high pressure wet scrubbing
	OPTION 3	50 mg/Nm3	Note: Advanced ESP generally means a dry ESP with 3 fields but revamped, in case of existing, or equipped, in case of new ESP, with new generation of equipments such as micro-pulses, cleaner or rapper of the electrodes and the plates, new regulators/transformers to minimize the corona effect and to maximize the voltage; in some cases, MEEP (moving electrodes) or a 4th field could be installed as an alternative solution depending on local conditions.
Pelletization plant (>150 t/day)	OPTION 1	5 mg/Nm3	[1]
	OPTION 2	10 mg/Nm3	[1]
	OPTION 3	25 mg/Nm3	Scrubbing or Semi-dry desulphurisation and subsequent de-dusting (e.g. gas suspension absorber (GSA)) or any other device with the same efficiency
Blast furnace: Hot stoves (>2.5 t/hour)	OPTION 1	5 mg/Nm3	[1]
	OPTION 2	10 mg/Nm3	Significantly depends on fuel composition and dedusting
	OPTION 3	50 mg/Nm3	
Basic oxygen steelmaking and casting (>2.5 t/hour)	OPTION 1	10 mg/Nm3	FF
	OPTION 2	30 mg/Nm3	Advanced ESP (3 field plus steam injection(optional))
	OPTION 3	50 mg/Nm3	ESP (2 or 3 fields)
Electric steelmaking and casting (>2.5 t/hour)	OPTION 1	10 mg/Nm3 (existing), 5 mg/Nm3 (new)	For new plants: Advanced FF For existing plants: [1]
	OPTION 2	15 mg/Nm3 (existing), 5 mg/Nm3 (new)	Advanced FF
	OPTION 3	20 mg/Nm3	FF

1/ No technique out of the BAT techniques referred to in the BAT Reference Document of 2001 can be associated with this option