SNAP CODE : 040203

SOURCE ACTIVITY TITLE: PROCESSES IN IRON & STEEL INDUSTRIES & COLLIERIES
Pig Iron Tapping

NOSE CODE: 105.12.03

NFR CODE: 2 C 1

1 ACTIVITIES INCLUDED

Pig iron tapping is a part of the production process for primary iron and steel.

2 CONTRIBUTION TO TOTAL EMISSIONS

Table: Contribution to total emissions of the CORINAIR90 inventory (*28 countries*)

Source-activity	SNAP-code	Contribution to total emissions [%]							
		SO_2	NO_x	NMVOC	CH_4	CO	CO_2	N_2O	NH_3
Pig Iron Tapping	040203	0	0	-	0	0	-	-	-

0 = emissions are reported, but the exact value is below the rounding limit (0.1 per cent)
- = no emissions are reported

Emissions of heavy metals from primary iron and steel industry, including pig iron tapping give a relevant contribution to the emissions on a national level. For heavy metal emissions, no specific figures for this source activity are available. The average relative contribution from the total iron and steel production industry and the production of pig iron, to the total emission of heavy metals has been presented for European countries in table 1. Pig iron tapping is part of the production of pig iron. The data in table 1 is according to Baart *et al.* (1995). /1/

Table 1: Average relative contribution of the production of iron and steel and the production of pig iron to the total emission of heavy metals in European countries

Compound	Total iron & steel production (%)	Pig iron production (%)
Cadmium	22	-
Chromium	36	3.7
Copper	16	-
Nickel	14	3.0
Lead	12	-
Zinc	33	-

- = not available

3 GENERAL

3.1 Description

The liquid molten iron and the sludge gathering in the bottom of the smelter are tapped on a regular basis. A smelter has usually three holes that are plugged with refractory material. After the process holes are bored by remote boring, and the mixture of pig iron and slag is guided by the trough to the skimmer where iron and slag are seperated. The liquid pig iron is guided by the iron runner and the tilting runner to the mixer; the sludge is removed for granulation or dumping. After emptying the smelter the bore holes are closed again with refractory material. The fire resistant coating of the guides has a limited lifetime, and has to be exchanged regularly.

3.2 Definitions

Trough	Covered guide between the oven and the skimmer.
Skimmer	Tunnel shaped construction where the heavier pig iron is seperated from the lighter slag floating on the iron.
Iron run	Connection between the skimmer and the tilting runner.
Tilting runner	A bridge on the end of the iron runner where the mixers can be filled and exchanged. The mixer is a container placed on a railroad carriage used for transport to for instance the steel factory.(Basic Oxygen Furnace).
Refractory material	Material used for closing a tap hole. The refractory material contains in general coal and tar.
Runner coating	Fire resistant material used for coating the runners. This product also contains coal and tar.

3.3 Techniques

3.4 Emissions

The boring of the tap and the filling of the trough gives rise to dust emissions. Also dust emissions occur after the skimmer, but to a lesser extent than in the first part of the route. The dust contains some heavy metals. The particle size of the dust during the boring is mainly below ten micron. The size of the particles from the emissions from the roof is usually about 50 % bigger than ten micron.

After coating, the transport trough has to be heated. This gives volatile decomposition products. These decomposition products are also emitted by the heating of the plugging material.

Decomposition products from tar are polycyclic aromatic hydrocarbons (PAH) and benzene containing aromatics. The exact benzene content is not available. In principle the same

products are produced by the heating of coal. The amount of coal used is however so small that these emissions can be neglected.

3.5 Controls

The trough, the skimmer, and the transport runners are usually covered. Dust and decomposition products are removed, and are passing fabric filters before emission into air. The part not captured passes through the roof. This emission is not abated. The total amount escaping through the roof is about 40 % of the total emission.

From the decomposition products of tar and coal only the condensable part of the PAH emissions is captured by the fabric filters.

4 SIMPLER METHODOLOGY

A simpler methodology may be a calculation on the basis of production statistics. General applicable information supporting this approach however, is not available for all pollutants.

5 DETAILED METHODOLOGY

An extensive measuring programme related to the circumstances in the individual plant would be the best method for a detailed methodology.

6 RELEVANT ACTIVITY STATISTICS

National and international statistics on pig iron production.

7 POINT SOURCE CRITERIA

The emissions of the complete plant should be considered as a point source.

8 EMISSION FACTORS

The total air flowing from a representative smelter is between 540,000 and 660,000 m^3/hour. The dust content is measured from time to time. The emissions from the roof are based on information from a measurement campaign in a plant in the Netherlands. The emissions of hydrocarbons by decomposition of tar and coal from plugging mass and coating materials are based on expert estimations.

The emission factors presented in Table 1 are calculated by relating the measured dust production with the known production of the smelter in the same period.

Table 1: Emission factors for the emission of dust and heavy metals related to pig iron tapping

	Emission factor (in g.Mg^{-1} pig iron produced)		
	total	unabated	fabric filters
Dust	30.2	12.8	17.4
Arsenic	0.0009	0.0003	0.0006
Cadmium	0.0003	0.0001	0.0002
Chromium	0.015	0.006	0.009
Copper	0.015	0.006	0.009
Lead	0.015	0.006	0.009
Mercury	0.0003	0.0001	0.0002
Nickel	-	-	-
Zinc	0.021	0.009	0.012

Although the amount of decomposition products is determined by the amount of tar and coal used, a relation can be established with the total amount of pig iron transported through the transport runners. This calculation results in the emission factors for organic compounds as presented in Table 2.

Table 2: Emission factors for the emission of organic compounds related to pig iron tapping.

	Emission factor (in g.Mg^{-1} pig iron)		
Substance	total	unabated	fabric filter
PAH	3.45	2.5	0.95
Aromatic hydrocarbons, including benzene	0.3	14.3	66
Benzene	2.5	0.45	2.05

9 SPECIES PROFILES

The dust emissions could be related to the profile of the ore. No general applicable information about ore compositions is available.

10 UNCERTAINTY ESTIMATES

The quality code of the emission factors is estimated to be C.

11 WEAKEST ASPECTS/PRIORITY AREAS FOR IMPROVEMENT IN CURRENT METHODOLOGY

The only improvement measure for this part of the process is the exchange of tar with tar-free products in the plugging material and the coatings.

12 SPATIAL DISAGGREGATION CRITERIA FOR AREA SOURCES

13 TEMPORAL DISAGGREGATION CRITERIA.

The tapping is a discontinuous process, the use of the smelter as such is a continuous process.

14 ADDITIONAL COMMENTS

15 SUPPLEMENTARY DOCUMENTS.

Environmental Protection Agency, Compilation of air pollutants emission factors AP-42
PARCOM-ATMOS Emission factors Manual
W. Mulder, personnal communication, Delft, 1995.

16 VERIFICATION PROCEDURES.

A comparison between the metals profile of the ore and the emissions calculated might be used as a verification method.

17 REFERENCES

/1/ A.C. Baart, J.J.M. Berdowski, J.A. van Jaarsveld; Calculation of atmospheric deposition of contaminants on the North Sea; IWAD; ref. TNO-MW-R 95/138; TNO MEP; Delft; The Netherlands; 1995

18 BIBLIOGRAPHY

General literature references about the primary steel industry.

19 RELEASE VERSION, DATE AND SOURCE

Version: 2.1

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20 POINT OF ENQUIRY

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