1.B.1 - Solid Fuels

Category Code	**Method**					**AD**					**EF**				
1.B.1.a	T2, M					AS					CS				
1.B.1.b	T2, T3					AS					CS				
Key Category	**NOx**	**NMVOC**	**SO2**	**NH3**	**PM2_5**	**PM10**	**TSP**	**BC**	**CO**	**PB**	**Cd**	**Hg**	**Diox**	**PAH**	**HCB**
1.B.1.a	-	-/-	-	-	-/-	-/-	-/-	-	-	-	-	-	-	-	-
1.B.1.b	-/-	-/-	-/-	-/-	-/-	-/-	L/T	-/-	-/-	-	-	-/-	-/-	L/T	-

.

T = key source by Trend **L** = key source by Level

Methods	
D	Default
RA	Reference Approach
T1	Tier 1 / Simple Methodology *
T2	Tier 2*
T3	Tier 3 / Detailed Methodology *
C	CORINAIR
CS	Country Specific
M	Model
* as described in the EMEP/CORINAIR Emission Inventory Guidebook - 2007, in the group specific chapters.	

AD - Data Source for Activity Data	
NS	National Statistics
RS	Regional Statistics
IS	International Statistics
PS	Plant Specific data
AS	Associations, business organisations
Q	specific questionnaires, surveys

EF - Emission Factors	
D	Default (EMEP Guidebook)
C	Confidential
CS	Country Specific
PS	Plant Specific data

.

The source category Solid fuels (1.B.1) consists of two sub-source subcategories – the source subcategory Coal mining (1.B.1.a) and the source subcategory Coal transformation (1.B.1.b). This chapter discusses fugitive emissions from coal mining, coal handling, including door leakages from coke ovens and quenching (emissions from the furnace are covered by category 1.A.1.c), and emissions from the beneficiation of solid fuels. In the mining sector, a distinction is made between open-pit mines, in which raw materials are extracted from pits open to the surface, and closed-pit mines, in which seams are mined underground. In Germany, hard coal used to be mined in closed-pits only (until 2018), while lignite is mined in four coal fields since 2003 with the open-pit method only.

Unitil 2018 Germany produced significant amounts of hard coal in underground mines. Since 2019, hard coal has been imported exclusively. NMVOC emissions are considered insignificant as the coal outgased along the import route. Particle emissions from loading and unloading as well as storage are reported under 2.L(a) - Handling of Bulk Products“

Lignite production

The activity rates for lignite production have been taken from the *Statistik der Kohlenwirtschaft*'s website (in German only) [1]. Extracted coal is moved directly to processing and to power stations. The emission factors used for calculating emissions from lignite production (TSP, PM_{10} and $PM_{2.5}$) already include possible emissions from transport and storage. They are taken from a 2006 research project [2] and the CEPMEIP-Database [3].

Table 1: Annual amounts of extracted raw lignite, in [Mt]

1990	1995	2000	2005	2010	2015	2019	2020
357	193	168	178	169	178	131	107

Table 2: Emission factors applied for lignite extraction, in [kg/t]

Pollutant	Value
TSP	0.05086
PM_{10}	0.025
$PM_{2.5}$	0.00375

Lignite coke production

Table 3: Annual amounts of lignite coke produced, in [Mt]

1990	1995	2000	2005	2010	2015	2019	2020
3.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1

Emissions from lignite production other than listed below are reported by plant operator. Particle emission factors were verified in a research project (Emissionen und Maßnahmenanalyse Feinstaub 2000-2020) [4] .

Table 4: Emission factors applied for liginte-coke production

Pollutant	Unit	Value
TSP	kg/t	0.1
PM_{10}	kg/t	0.048
$PM_{2.5}$	kg/t	0.013
PAH	mg/t	55
PCDD/F	µg/t	0.03

Hard coal coke production

The activity rates for hard coal coke production have been taken from the *Statistik der Kohlenwirtschafts*'s website (in German only) [9].

Table 5: Annual amounts of hard coal coke produced, in [Mt]

1990	1995	2000	2005	2010	2015	2019	2020
18.5	11.1	9.1	8.4	8.2	8.8	8.8	7.9

The emission factors for hard coal coke production have been obtained from the research project "Emission factors for the iron and steel industry, for purposes of emissions reporting" ("Emissionsfaktoren zur Eisen- und Stahlindustrie für die Emissionsberichterstattung") [5)].

Table 6: Emission factors for hard coal coke production

Pollutant	Unit	Value
CO	kg/t	0.015
NH_3	kg/t	0.000243
NMVOC	kg/t	0.096
SO_2	kg/t	0.004
TSP	kg/t	0.011
PM_{10}	kg/t	0.004
$PM_{2.5}$	kg/t	0.004
PAH	mg/t	55
PCDD/F	µg/t	0.0015

There are many potential sources of PAH emissions from coking plants. The dominant emission sources are leakages from coke oven doors and from charging operations. As there is limited data available on PAH emissions, the uncertainties of the estimated emission factors are very high. It should also be taken into account that emissions from coke production greatly vary between different coke production plants. The emission factors for benzo[a]pyrene and mixed PAH have been revised by research projects in 2010 [6)7)]. Split factors for Black Carbon (BC) are based on the EMEP Guidebook 2016 [8)].

Charcoal production

Small quantities of charcoal are produced in Germany – by one major charcoal-factory operator and in a number of demonstration charcoal kilns. The pertinent quantities are determined by the Federal Statistical Office and are subject to confidentiality requirements. The emission factors were obtained from US EPA 1995 [9)] .

> Use of charcoal (includes wood only) and barbecue coal (includes wood and lignite briquetts) is reported under 2.G. - Use of Charcoal for barbecues. The production of lignite briquettes is reported under 1.B.1.b.

Decommissioned hard-coal mines

NMVOC Emissions from decommissioned hard-coal mines play a role in this sub- source category. When a hard-coal mine is decommissioned, mine gas can escape from neighbouring rock, and from coal remaining in the mine, into the mine's network of shafts and passageways. Since the mine is no longer artificially ventilated, the mine gas collects and can then reach the surface via gas pathways in the overlying rock or via the mine's own shafts and passageways. Such mine gas was long seen primarily as a negative environmental factor. Recently, increasing attention has been given to the gas' positive characteristics as a fuel (due to its high methane content, it is used for energy recovery). In the past, use of mine gas was rarely cost-effective. This situation changed fundamentally in 2000 with the Renewable Energy Sources Act (EEG). Although mine gas is a fossil fuel in finite supply, its use supports climate protection, and thus the gas was included in the EEG. The Act requires network operators to accept, and provide specified compensation for, electricity generated with mine gas and fed into the grid. The NMVOC emissions from decommissioned hard-coal mines have been calculated in the research project "Potential for release and utilisation of mine gas" ("Potential zur Freisetzung und Verwertung von Grubengas") [10]. The relevant calculations were carried out for all mining-relevant deposits in Germany.

Table 7: NMVOC emission factor for decommissioned hard-coal mines, in [kg/m³]

EF
0.001599

Recalculations

Please refer to overarching chapter 1.B - Fugitive Emissions from fossil fuels

Planned improvements

New studies show a lower PM_{10} emission factor for open pit mining. Those studies will be evaluated and implemented in next submission.

References

[1] Statistik der Kohlenwirtschaft (2019) External Link (last pageview: March 2021)
[2], [4] Federal Environment Agency research project No. 204 42 202/2 "Emissionen und Maßnahmenanalyse Feinstaub 2000-2020", published in 2007 External Link
[3] Co-ordinated European Programme on Particulate Matter Emission Inventories, Projections and Guidance (CEPMEIP) External Link
[5] Hensmann et al. 2011
[6] Federal Environment Agency and DFIU research project "Anpassung der deutschen Methodik zur rechnerischen Emissionsermittlung an internationale Richtlinien, Teilbericht Prioritäre Quellen", 2010 (not available online)
[7] Federal Environment Agency and BFI research project No. 3707 42 301 "Emissionsfaktoren zur Eisen- und Stahlindustrie für die Emissionsberichterstattung", 2011 External Link
[8] EMEP/EEA Air Pollutant Emission Inventory Guidebook 2016; published in 2016 External Link (last pageview: Dec 2016)
[9] Neulicht, R. (1995): Emission Factor Documentation for AP-42 Section 10.7 "Charcoal". External Link
[10] Meiners, H. (2014): Potential zur Freisetzung und Verwertung von Grubengas