## 1.B.2.c - Venting and Flaring

Category Code	Method				AD				EF						
1.B.2.c	T2				AS				CS						
Key Category	NOx	NMVOC	SO2	NH3	PM2_5	PM10	TSP	BC	со	PB	Cd	Hg	Diox	PAH	НСВ
1.B.2.c	-/-	-/-	-/-	-	-/-	-/-	-/-	-/-	-/-	-	-	-/-	-	-	-

Method(s) applied	
D	Default
T1	Tier 1 / Simple Methodology *
T2	Tier 2*
T3	Tier 3 / Detailed Methodology *
С	CORINAIR
CS	Country Specific
М	Model
* as described in the EMEP/	EEA Emission Inventory Guidebook - 2019, in category chapters.
(source for) Activity Dat	a
NS	National Statistics
RS	Regional Statistics
IS	International Statistics
PS	Plant Specific
As	Associations, business organisations
Q	specific Questionnaires (or surveys)
М	Model / Modelled
С	Confidential
(source for) Emission Fa	ctors
D	Default (EMEP Guidebook)
CS	Country Specific
PS	Plant Specific
М	Model / Modelled
С	Confidential

Pursuant to general requirements of the Technical Instructions on Air Quality Control TA Luft (2002), gases, steam, hydrogen and hydrogen sulphide released from pressure valves and venting equipment must be collected in a gas-collection system. Wherever possible, gases so collected are burned in process combustion. Where such use is not possible, the gases are piped to a flare. Flares used for flaring of such gases must fulfill at least the requirements for flares for combustion of gases from operational disruptions and from safety valves. For refineries and other types of plants in categories 1.B.2, flares are indispensable safety components. In crude-oil refining, excessive pressures can build up in process systems, for various reasons. Such excessive pressures have to be reduced via safety valves, to prevent tanks and pipelines from bursting. Safety valves release relevant products into pipelines that lead to flares. Flares carry out controlled burning of gases released via excessive pressures. When in place, flare-gas recovery systems liquify the majority of such gases and return them to refining processes or to refinery combustion systems. In the process, more than 99 % of the hydrocarbons in the gases are converted to CO<sub>2</sub> and H<sub>2</sub>O. When a plant has such systems in operation, its flarehead will seldom show more than a small pilot flame.

	Unit	1990	1995	2000	2005	2010	2015	2020	2021
Flared natural gas	millions of m <sup>3</sup>	36	33	36	18.7	12.1	10.5	14.1	11.1
Refined crude-oil quantity	millions of t	107	96.5	107.6	114.6	95.4	93.4	84.0	84.1

Flaring takes place in extraction and pumping systems and at refineries. In refineries, flaring operations are subdivided into regular operations and start-up / shut-down operations in connection with disruptions.

Source of emission factor	Substance	Unit	Value
Flaring emissions in natural gas extraction	NMVOC	kg/ 1000 m <sup>3</sup>	0.005

Source of emission factor	Substar	ıce l	Jnit	'	Value			
Flaring emissions in natural gas extraction NOx			g/ 1000	) m³	1.269			
Flaring emissions in natural gas extraction SO <sub>2</sub>			g/ 1000	) m³	8.885			
Flaring emissions in natural gas extraction CO			g/ 1000	) m³	0.726			
Source of emission factor		Sub	stance	Unit	Value			
Flaring emissions at petroleum production	facilities	NO×		kg/t	0.008	1		
Flaring emissions at petroleum production	SO2		kg/t	0.010				
Flaring emissions at petroleum production	CO		g/t	0.1	]			
Source of emission factor				ance	Unit	Valu	e	
Flaring emissions at refineries: normal flari	ng opera	tions	NMV	'OC	kg/m³	0.00	4	
Flaring emissions at refineries: normal flari	itions	CC	CO		0.001			
Flaring emissions at refineries: normal flari	itions	SO <sub>2</sub>		kg/m³	0.00	3		
Flaring emissions at refineries: normal flaring operations					g/m³	0.4		
Source of emission factor	Sub	stance	Unit	Va	lue			
Flaring emissions at refineries: disruptions	NMVOC		kg/t	0.0	001			
Flaring emissions at refineries: disruptions	CO		kg/t	0.0	001			
Flaring emissions at refineries: disruptions	SO <sub>2</sub>		kg/t	0.0	07			
Flaring emissions at refineries: disruptions	NOx		kg/t	0.0	004			

The emission factors have been derived from the 2004 and 2008 emissions declarations Theloke et al. 2013 <sup>1</sup>). In 2019, they were updated for CH<sub>4</sub>, N<sub>2</sub>O, CO, NMVOC, NO<sub>x</sub> and SO<sub>2</sub>, on the basis of Bender & von Müller, 2019 <sup>2</sup>). Venting emissions are taken into account in category 1.B.2.b.iii. The SO<sub>2</sub> emissions are obtained from the activity data for the flared natural gas (Table 178) and an emission factor of 0.140 kg / 1,000 m<sup>3</sup>, a factor which takes account of an average H<sub>2</sub>S content of 5 % by volume. The emission factors are determined on the basis of emissions reports, crude-oil-refining capacity and total capacity utilisation at German refineries. The guide for this work consists of the evaluation assessment of Theloke et al. (2013) <sup>3</sup>.

## Recalculations

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

## **Planned improvements**

Currently no improvements are planned.

## References

<sup>2)</sup> Bender, M., & von Müller, G. (2019). Konsolidierung der Treibhausgasemissionsberechnungen unter der 2. Verpflichtungsperiode des Kyoto-Protokolls und der neuen Klimaschutz-Berichterstattungs-pflichten an die EU (FKZ 3716 41 107 0).

<sup>&</sup>lt;sup>1), 3)</sup> Theloke, J., Kampffmeyer, T., Kugler, U., Friedrich, R., Schilling, S., Wolf, L., & Springwald, T. (2013). Ermittlung von Emissionsfaktoren und Aktivitätsraten im Bereich IPCC (1996) 1.B.2.a. i-vi - Diffuse Emissionen aus Mineralöl und Mineralölprodukten (Förderkennzeichen 360 16 033). Stuttgart.