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

Category Code	Method	AD	EF			
1.B.2.c	T2	AS	CS			
Method(s) applied			-			
D	Default					
<b>T1</b>	ier 1 / Simple Methodolo	gy *				
<b>T2</b>	īier 2*					
<b>T3</b>	ier 3 / Detailed Methodol	ogy *				
C C	CORINAIR					
CS (	Country Specific					
M N	Iodel					
* as described in the EMEP/EE	A Emission Inventory Gui	debook - 2019, in (	category chapters.			
(source for) Activity Data						
NS N	National Statistics					
RS F	Regional Statistics					
IS I	International Statistics					
PS F	Plant Specific					
As A	Associations, business organisations					
<b>Q</b> 5	specific Questionnaires (or surveys)					
M 1	Model / Modelled					
	Confidential					
(source for) Emission Facto						
	Default (EMEP Guidebook)					
	Country Specific					
	Plant Specific					
M 1	Model / Modelled					
C C	Confidential					

NO <sub>x</sub>	NMVOC	SO <sub>2</sub>	NH₃	<b>PM</b> <sub>2.5</sub>	<b>PM</b> <sub>10</sub>	TSP	BC	CO	Pb	Cd	Hg	Additional HM	POPs
-/-	-/-	-/-	NA	-/-	-/-	-/-	-/-	-/-	NA	NA	-/-	NA	NA
L/-	/- key source by Level only												
-/T	key source by <b>T</b> rend only												
L/T	Key source by both Level and Trend												
-/-	no key source for this pollutant												
IE	emission of specific pollutant Included Elsewhere (i.e. in another category)						gory)						
NE	emission of specific pollutant Not Estimated (yet)												
NA	specific pollutant not emitted from this source or activity = Not Applicable					cable							
*	no analysis done												

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  $CO_2$  and  $H_2O$ . When a plant has such systems in operation, its flarehead will seldom show more than a small pilot flame.

#### Table 1: Activity data applied for 1.B.2.c

	Unit	1990	1995	2000	2005	2010	2015	2020	2022
Flared natural gas	millions of m <sup>3</sup>	36	33	36	18.7	12.1	10.5	14.1	10.4
Refined crude-oil quantity	millions of t	107	96.5	107.6	114.6	95.4	93.4	84.0	90.0

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.

Table 2: Emission factors applied for flaring emissions in natural gas extraction, in [kg/ 1000 m<sup>3</sup>]

	Value
NMVOC	0.005
NOx	1.269
SO <sub>2</sub>	8.885
CO	0.726

Table 3: Emission factors applied for flaring emissions at petroleum production facilities

	Unit	Value
NOx	kg/t	0.008
SO2	kg/t	0.010
CO	g/t	0.1

Table 4: Emission factors applied for flaring emissions at at refineries: normal flaring operations

	Unit	Value
NMVOC	kg/m³	0.004
CO	kg/m³	0.001
SO <sub>2</sub>	kg/m³	0.003
NO <sub>x</sub>	g/m³	0.4

Table 5: Emission factors applied for flaring emissions at at refineries: disruptions of flaring operations, in [kg/t]

	Value
NMVOC	0.001
СО	0.001
SO <sub>2</sub>	0.007
NOx	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  $CH_4$ ,  $N_2O$ , CO, NMVOC,  $NO_x$  and  $SO_2$ , 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



For more details please refer to the super-ordinate chapter 1.B - Fugitive Emissions from fossil fuels

# **Planned improvements**

Currently no improvements are planned.

# References

<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.

<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).