1.B.2.c - Venting and Flaring

Category Code	Method	AD	EF
1.B.2.c	T2	AS	CS

Method(s) applied	
D	Default
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/EEA Emission Inventory Guidebook - 2019, in category chapters.	
(source for) Activity Data	
NS	National Statistics
RS	Regional Statistics
IS	International Statistics
PS	Plant Specific
As	Associations, business organisations
Q	specific Questionnaires (or surveys)
M	Model / Modelled
C	Confidential
(source for) Emission Factors	
D	Default (EMEP Guidebook)
CS	Country Specific
PS	Plant Specific
M	Model / Modelled
C	Confidential

NO_x	NMVOC	SO_2	NH_3	$PM_{2.5}$	PM_{10}	TSP	BC	CO	Pb	Cd	Hg	PCDD/F	PAHs	HCB
-/-	-/-	-/-	-	-/-	-/-	-/-	-/-	-/-	-	-	-/-	-	-	-

L/-	key source by **L**evel only
-/T	key source by **T**rend only
L/T	key source by both **L**evel and **T**rend
-/-	no key source for this pollutant
IE	emission of specific pollutant **I**ncluded **E**lsewhere (i.e. in another category)
NE	emission of specific pollutant **N**ot **E**stimated (yet)
NA	specific pollutant not emitted from this source or activity = **N**ot **A**pplicable
*	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 m³	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^3]

	Value
NMVOC	0.005
NO_x	1.269
SO_2	8.885
CO	0.726

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

	Unit	Value
NO_x	kg/t	0.008
SO_2	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_2	kg/m³	0.003
NO_x	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
CO	0.001
SO_2	0.007
NO_x	0.004

The emission factors have been derived from the 2004 and 2008 emissions declarations Theloke et al. 2013 [1)]. 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 [2)].

Venting emissions are taken into account in category 1.B.2.b.iii. The SO_2 emissions are obtained from the activity data for the flared natural gas (Table 178) and an emission factor of 0.140 kg / 1,000 m³, a factor which takes account of an average H_2S 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) [3)].

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

[1), 3)] 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.
[2)] 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).