

Natural Gas Odourisation practices in Europe

LEGAL SECTION:

Country	Odourisation required on Transit	Transit Pressure (bar)	Odourisation required on transport ¹ ?	Transport Pressure (bar)	Odourisation required on distribution	Distribution pressure (bar)	Is a Level of concentration/olfactory sensation Required? (Yes or Not)	If Yes, please specify the requirement (i.e.: minimum concentration or olfactory degree at 1% natural gas in air)	Control required	Requirements specified standards or codes
AT	No		No		Yes		Yes	Minimum concentration	Yes	ÖVGW G 79 EN ISO 13734
BE	No	-	No	-	Yes	P < 14,7 bar	No	-	Yes	Synergrid recommendation 2000.50.32
CH	No	> 5 bar	No	20 to 70 bar	Yes	< 5 bar	Yes	Minimum concentration	Yes	SVGW G 11
CZ	No	> 40 bar	Not defined in CZ	Not defined in CZ	Yes	≤ 40 bar	Yes	Olfactory degree	Yes	TPG 918 01, TPG 905 01 (codes of practice)
DE	No		No ²	> 16 bar	Yes	< 16 bar	Yes	Minimum concentration	Yes	DVGW G 280 EN ISO 13734
DK	No	< 80 bar	No	< 80 bar	Yes	<50 bar	Yes	Minimum concentration	Yes	DVGW G 280 GR-A (Danish Gas Code)
EL	No	>55 bar	Yes	>16 bar-80 bar	Yes	19 bar (DP) 16 bar (OP)	Yes	Minimum concentration	Yes	National Regulation 1712/06
ES	Yes	80 bar	Yes	>16 bar	Yes	<16 bar	Yes	Minimum concentration	Yes	NGTS Code and R.D. 919/2006
FR	Not defined in France		No ³	16 to 95 bars	Yes	< 25 bar	No	-	Yes	Arrêté 13 juillet 2000 (law), RSDG 10 (Industry requirement), Décret n°2004-251 du 19/03/2004 (law)
HU	No		No	40 – 75	Yes ⁴		Yes	Minimum concentration	Yes	MSZ-09-74011/5-84
IE	Yes	70	Yes	70	Yes	<4 bar	Yes	Olfactory degree	Yes	Code of Operations

¹ For the purpose of this document, and although the terms may relate to different notion in EU countries, Distribution network is the network delivering gas to domestic customers, transit network is the network transmitting gas (generally connected to other big network or infrastructure as storages), transport network is the network transmitting gas to distribution network, sometime identified as regional transport.

² DE: The German law refers to DVGW codes or equivalent; odourisation in only a few transport systems, mostly based on sulphur free odorant.

³ FR: The law requires that transmission companies deliver odourised gas to all customers (industrial and distributors), not to odourise network. However, the current practice (all transported gas is odourised) is recognised by French authorities as best practice in safety studies.

⁴ HU: Transmission Company performs Odourisation.

Country	Odourisation required on Transit	Transit Pressure (bar)	Odourisation required on transport ¹ ?	Transport Pressure (bar)	Odourisation required on distribution	Distribution pressure (bar)	Is a Level of concentration/olfactory sensation Required? (Yes or Not)	If Yes, please specify the requirement (i.e.: minimum concentration or olfactory degree at 1% natural gas in air)	Control required	Requirements specified standards or codes
IT	No		No ⁵	> 5 > 24 from the fields 12-24 outside cities < 12 inside the cities	Yes	0,004-5 bar	Yes ⁶	Both: olfactory control is the primary requirement and it is legally accepted, but AEEGSI (Regulatory Body), for economic incentives purpose, considers only determinations of the level of concentration by gaschromatography ⁷	Yes	UNI CIG 7133 ⁽⁶⁾ UNI CIG 9463 Dir ARG/Gas 574/13
NL	No	>40	No	40-80 bar	Yes	<8bar	Yes	Minimum concentration	Yes	National Regulation Regeling gaskwaliteit (WJZ/13196684)
NO	No		No		Yes		Yes	Minimum concentration	Yes	No
PL	No	<84	No	20<p<63	Yes	<4	Yes	Olfactory degree	Yes	National Regulation Dz.U. 2010, No 133, 89 PN-C-04751:2011 PN-C-04753:2011
PT	No		No ⁸		Yes ⁹		Yes	Both: olfactory degree according to technical regulation; Minimum concentration according to TSO Standard ¹⁰	Yes	DVGW G 280
RO	No		Yes		No		Yes	Olfactory degree	Yes	SR 13406 (Natural Gas Odourisation), SR 3317 (Natural Gas Quality Requirements) EN ISO 13734
SK	No	---	No	18 to 40 bar	Yes	< 4 bar	Yes	Minimum concentration	Yes	TPP 918 01

⁵ IT: The gas transmission network is not odorised except for the gas delivered to the domestic customers and premises directly connected with them.

⁶ IT: Directive ARG/Gas 574/13 from AEEGSI (Regulatory Body) considers only “positive controls” referred to UNI 7133.

⁷ IT: UNI 7133 states the odorant concentrations that assure level 4 of Odourisation on DecaSales scale in natural gas.

⁸ PT: The Portuguese law and regulations do not require for odorisation in transport, and the Portuguese TSO (REN Gasodutos) does not odorise the gas transmission network; nevertheless, the gas entering by pipeline through the interconnection(s) with the Spanish grid (operated by Enagas) is, from the 18th January 2010 received in an odorized condition, as in Spain the odorisation in transport is mandatory. Thus, the transported gas has, now, a variable odorant concentration (ranging between 0 and 15mg/m³(n)).

⁹ PT: Distribution (pressure lower than 20 bar), the gas is odorised at the Transport Grid Delivery Points (GRMS - Gas Metering and Regulating Stations); the gas is also odorised at Delivery Points from the Transport Grid to Direct Consumers, which receive the gas at pressures > 20 bar.

¹⁰ PT: The Portuguese TSO REN Gasodutos holds a concession from the Portuguese State granted for the high pressure gas transmission system. The concession law refers that the gas quality shall be defined on a Technical regulation to be issued by the Energy Office. The concession law, which is dated 2006, did not yet formally published the referred Technical Regulation, so REN Gasodutos is following the previous mandatory article (from Decree Law 285/90, that states: “The supplied gas shall be odorized in a way that any potential leak can be easily detected by human olfact when the mixture gas/air presents a volumetric composition equals to 1/5 of LIL (Lower Inflammable Limit)).

Country	Odourisation required on Transit	Transit Pressure (bar)	Odourisation required on transport ¹ ?	Transport Pressure (bar)	Odourisation required on distribution	Distribution pressure (bar)	Is a Level of concentration/ olfactory sensation Required? (Yes or Not)	If Yes, please specify the requirement (i.e.: minimum concentration or olfactory degree at 1% natural gas in air)	Control required	Requirements specified standards or codes
UK	No	<85bar	No ¹¹	<85bar	Yes	<35bar	Yes	Olfactory degree ¹²	Yes	Gas Safety Management Regulations 1996

¹¹ UK: from 1998 must odourise 7 bar and below. National Transmission System is not odourised (>35bar). Distribution Networks Systems are odourised.

¹² UK: The concentration of odourant in natural gas will be such to achieve the alert olfactory degree 2 on the scale of Sales, which corresponds to a gas leak of 1 % natural gas concentration into the air (equivalent to 20 % of LEL).

ODORISATION CONTROL SECTION:

Country	Control on Transit	Control on Transport	Control on Distribution	Control location (end point of the pipe ¹³ , entry point of the pipe, odourisation station,...)	Frequency: continuous (CI) or periodical inspection (P)	Who asks for the control (regulation, voluntary)	Who does work the control (third part or not)	What is controlled (odorant concentration, smell, etc.)	Controlled by Olfaction	Controlled by gas chromatography	Controlled by chemical sensor	Controlled by odorant consumption
AT	No	No	Yes	End point of pipe	P: yearly	Legal requirement	Grid operator	Odorant concentration	No	Yes	Yes	Yes
BE	No	No	Yes	Pressure station MP/LP & LP grid (End point of pipe)	P: min. 3 months	Legal requirement (Royal Decree 28.06.1971)	Third party	Odorant concentration	No	Yes	No	Yes: visual inspection and calculation of odorant concentration
CH	Yes	No	Yes	Before the entry in distribution system	P: min. 4 times/year	Technical rules (SVGW G11)	Third party	Odorant concentration	No	Yes	No	No
CZ	No	No	Yes	Exit point and distribution system (fixed points)	P: 6 months	Technical rules (TPG 918 01, TPG 905 01)	DSO	Smell and odorant concentration	Yes	Yes	Yes	Yes
DE	No	No	Yes	End point of pipe / furthest point from injection	P: 2 times/year, one control must between May and September <i>Sometime CI near injection</i>	Legal requirement and technical rules (DVGW G 280)	Grid operator	Smell and odorant concentration	Yes	Yes (legal)	Yes	Yes
DK	No	No	Yes	At fixed strategic points. They are located far from the dosing plants	P: 2 times per year	Regulation (Danish Safety Technology Authority)	Grid Operator	Odorant concentration	No	Yes	No	Yes (odorant consumption continuously monitored)
EL	No	No	Yes	City gates and network points at random (especially the most remote ones from the odorant)	P	Regulation	DSO	Odorant concentration	No	Yes	No	No

¹³ It means the furthest location from injection point

Country	Control on Transit	Control on Transport	Control on Distribution	Control location (end point of the pipe ¹³ , entry point of the pipe, odourisation station,...)	Frequency: continuous (CI) or periodical inspection (P)	Who asks for the control (regulation, voluntary)	Who does work the control (third part or not)	What is controlled (odorant concentration, smell, etc.)	Controlled by Olfaction	Controlled by gas chromatography	Controlled by chemical sensor	Controlled by odorant consumption
				injection points)								
ES	Yes	No	Yes	In distribution: city gate and end point of the pipe	P: 1/month and CI	Legal requirement (Government)	DSO (CI) and third part (P)	Odorant concentration	No	Yes	Yes	No
FR	Not defined	Yes	Yes	Transport: At odourisation station (entry points and some node of the network) Distribution: Random locations on network	CI (Transport): ≈ 55 locations on network P (Distribution): several controls per year	Regulation (Transport) Voluntary (Distribution)	Grid operator	Odorant concentration	No	Yes	Yes	No
HU	No	Yes	No	Exit point and distribution system	P and CI	Regulation	Third party	Odorant concentration	No	No	No	Yes
IE	Yes	Yes	Yes	Primary test point for each Entry point and secondary test-points across the distribution system	CI of odorant injection rate at each plant + P: Monthly samples at TX and DX points	Technical rules (Code of Operations) only require gas to be odourised	TSO/Third Party	Odorant concentration	No	No	No	Yes
IT	No	Yes (domestic customers) ¹⁴	Yes	End point of the pipe, and odourisation station	P: 6 months	Legal requirement (Law 1083/71) Regulation (ARG/Gas 574/13)	Grid operator	Odorant concentration , smell (see note 7)	Yes (see note 7)	Yes	No ¹⁵	No (only for odourisation plants check, as option)
NL	No	No	Yes	City gate station, Odourisation station	P: 3 weeks	Regulation	Grid operator	Odorant concentration	No	Yes	No	Yes
NO	No	No	Yes	-	P	Voluntary	Grid operator	Odorant concentration	No	Yes	No	No
PL	No	No	Yes	End point of the	P: 2 weeks	Technical	DSO and/or	Smell and	Yes	Yes	Yes	Yes

¹⁴ IT: The gas transmission network is not odourised except for the gas delivered to the domestic customers and premises directly connected with them.

¹⁵ IT: Sensors sometimes are used as indicators.

Country	Control on Transit	Control on Transport	Control on Distribution	Control location (end point of the pipe ¹³ , entry point of the pipe, odourisation station,...)	Frequency: continuous (CI) or periodical inspection (P)	Who asks for the control (regulation, voluntary)	Who does work the control (third part or not)	What is controlled (odorant concentration, smell, etc.)	Controlled by Olfaction	Controlled by gas chromatography	Controlled by chemical sensor	Controlled by odorant consumption
				pipe, pressure stations MP/LP	and CI	rules (Dz.U. 2010, No 133, 89 PN-C-04751:2011 PN-C-04753:2011)	grid operator	odorant concentration	(olfactory is the primary method)		(indicative measurements)	
PT	No	Yes	No	End point of pressure regulating and metering stations	P: monthly and CI	Voluntary	TSO (O&M Department)	Odorant concentration	No	No	Yes	Yes
RO	No	Yes	Yes	-	P: 3 months	Technical rules (SR 13406 SR3317)	Grid operator	Smell and odorant concentration	Yes (olfactory is the primary method)	Yes	Yes	No
SK	No	No	Yes	Selected points of transport pipes and end point of the distribution system	P: 6 months and CI	Legal requirement (State legislation)	DSO	Smell and odorant concentration	Yes (olfactory is the primary method)	No	Yes	No
UK	No	No	Yes	At entry to and across distribution network	P and CI	Regulation	The relevant distribution network	Smell	Yes (olfactory is the primary method)	No (only when required)	No	Yes (continuously monitored)

ODORISATION PLANTS SECTION:

Country	Injection on transit	Injection on Transport	Injection on City Gate	Injection on other	Number of plants	Use of Electronic pump	Use of Pneumatic pump	Use of Bypass	Can odorised gas be received from outside the Country?
AT	No	Yes	Yes	Yes	About 300	Yes	Yes	Yes	No
BE	No	No	Yes	No	≈ 150	Yes	No	No	No
CH	No	Yes	No	No	Not communicated	Yes	Yes	Yes	Yes (from France)
CZ	No	No	Yes	Yes (HP 25 and 40 bar pipelines)	≈ 100	Yes	No	No	Yes ¹⁶
DE	No	No	Yes	Yes (HP 16-70 bar pipelines)	Not communicated	Yes	No ¹⁷	No ¹⁶	Yes ¹⁸
DK	No	No	Yes	No	45	Yes	No	No	No
EL	No	No	Yes	No	Not communicated	Yes	No	No	No
ES	No	Yes	Yes	No	Transport: 7 City Gate: ≈ 300	Yes	No	No	Yes (from France)
FR	Yes ¹⁹	No	No	Yes (underground storage, operating only when emitting)	11 (Transit) ²⁰ 14 (underground storage)	Yes	No	No	Yes (from Spain and Switzerland)
HU	Yes	No	No	No	14 (transmission nodes) 100 (exit points)	Yes	No	No	No
IE	No	Yes	No	At DX Bio-methane injection points	5 x plants, 4 x plants at 3 x Entry Points + 1 x plant at Bio-methane injection site	Yes	Yes	No	Yes (from UK)
IT	No	Yes ⁵	Yes	No	> 1250	Yes	Yes	Yes	Yes (from France)
NL	No	Yes (up to 40 bar transmission pipeline)	Yes	No	80 (Transport) 50 (City Gate)	Yes	No	No	No

¹⁶ CZ: It is possible, but with really small amount (4 crossborder villages with Germany, Austria or Poland)

¹⁷ DE: Generally not, but exceptions, e.g. LNG stations, may exist.

¹⁸ DE: Possible only, if gas odorisation is guaranteed by contract to be contained in accordance with DVGW-G 280, gas to comply with DVGW-G 260

¹⁹ FR: Except in the North of France where a 30 km pipeline is not odorised.

²⁰ FR: At the entry points of transmission network (including LNG terminals), operating continuously.

Country	Injection on transit	Injection on Transport	Injection on City Gate	Injection on other	Number of plants	Use of Electronic pump	Use of Pneumatic pump	Use of Bypass	Can odorised gas be received from outside the Country?
NO	No	No	No	Yes (4 bar pipeline)	Not communicated	Yes	No	No	No
PL	No	Yes	No	No	Not communicated	Yes	Yes	Yes	No
PT	No	Yes ²¹	No	No	84	Yes	No	No	Yes (from Spain)
RO	No	No	No	Yes (0 - 10 bar pipeline)	Not communicated	Yes	No	Yes	No
SK	No	No	Yes	No	≈ 1600	Yes	No	No	No
UK	No	No	Yes ²²	No	>100	No	Yes	No	Yes ²³

²¹ PT: Leaving National Transport System

²² UK: Leaving National Transmission Pipeline

²³ UK: Gas entering via Interconnectors connected to the Transmission system is unodorised.

GASCHROMATOGRAPHIC ANALYSIS AT ODORISATION PLANTS:

Countries/ Questions	Are odourisation control measurements performed in your country?	Are they requested by laws or standards? (Please give references)	Continuous or spot analysis?	Type of gaschromatographs/ detectors	Prescriptions on location of the sampling point and instrumentation (distance from the injection point, grid layout between injection and measurement, etc.)	Any other point of concern
AT						
BE						
CH						
CZ	No	No	-	-	-	The relationship between odourant consumption (kg) and the amount of odourised gas (m ³) is compared to the working setting value of the injection pump.
DE	Yes	gaschromatographic methods are not mandatory according to DVGW G 260 but common practice	usually spot, continuous is possible (see Table: ODORISATION CONTROL SECTION)	no special design is compulsory, (micro-)gc equipped with ECD, AED or SCD are common practice As reference method for calibration gaschromatographic methods (i.e. DIN 51855) are mandated For S-Free control measurements a FID or TCD are suitable	End point of pipe / furthest point from injection (see Table: ODORISATION CONTROL SECTION) Sampling point must be representative for the grid in question	before sampling an adequate amount of gas shall be blown off. The rinsing volume shall exceed three times the dead volumen of the sampling facility
DK						
EL						
ES						
FR	Yes	No standard or law. Technical specification	Continuous	Microchromatography	The sampling point is usually at 80-100D to the injection point (Natural Gas). For biomethane the distance is shorter, a static mixer is added to improve the odourant blending	/
IE	Yes as back-up control at some entry points	No	Continuous	Chromatograph (Encal 3000)	Must be at least 60D downstream of injection point	
IT	Yes, at least two times per year	Standard: UNI 9463	Spot (usually)	Portable microgc	No particular prescriptions: the sampling point must be as close as possible to the Odourisation plant	Periodical check can be done by comparison between odourant consumption and gas volume
NL	Yes, once every 3 weeks	Yes (Meet-code gas LNB)	Spot	Portable	In case of Odourisation on transport: at the first City gate station; In case of Odourisation on City Gate station: in the grid of the DSO or industry	

Countries/ Questions	Are odourisation control measurements performed in your country?	Are they requested by laws or standards? (Please give references)	Continuous or spot analysis?	Type of gaschromatographs/ detectors	Prescriptions on location of the sampling point and instrumentation (distance from the injection point, grid layout between injection and measurement, etc.)	Any other point of concern
PL						
PT						
RO						
SK						
UK	No	No	-	-	-	-

ODORISATION PLANTS SECTION (BIOMETHANE INJECTION):

Country	Biomethane injection on Transport?	Number of biomethane injections on Transport (if known)	Number of Odorisation plants on Transport (if known)	Biomethane injection on Distribution?	Number of biomethane injections on Distribution (if known)	Number of Odorisation plants on Distribution (if known)	Specific requirement for biomethane Odorisation?	Standards for biomethane Odorisation
AT	No			No				No
BE	No	0	0	No	0	0	Synergrid G5/42 (Odorants and odorant concentrations are the same as in natural gas.)	No
CH	No			No				No
CZ	No	0	0	No	0	0		No
DE	Yes	~20 ²⁴	0 ²⁵	Yes	~185	185	No	DVGW G 280 ²⁶
DK	No			No				No
EL	No			No				No
ES	Yes	1	1	Yes	1	1	No (the same requirement for Odorisation in natural gas)	No
FR	Yes	10	9	Yes	60	60	The requirements for Odorisation are the same as for natural gas. No specific requirements. Injection of THT and control of Odorisation by gas chromatography	No
HU	No			No				No
IE	No (but planned in future)	0	0	Yes	1	1	Requirements are very similar to Natural Gas specification except for modification to permit higher oxygen content	IGEM/SR/16 & IGEM/TD/16
IT	Yes	10	If injected in TSO grid, biomethane is not odorised	Yes	3	If injected in DSO grid, biomethane must be odorised	Before injection, both on TSO and DSO grids, biomethane must be proven to be odorisable giving, after odorant addition, the same warning as odorized natural gas. Only when injected in DSO grid it must be odorised. Odorants and odorant concentrations are the same as for natural gas.	UNI TS 11537/2019 UNI 7133-2/2019
NL	No	3 (Transport < 40 bar)	3 (Transport < 40 bar)	Yes	~40	~40	Before injection, both on odorized TSO (< 40 bar) and DSO grids, biomethane must be proven to be odorized giving the same warning as odorized natural gas. Odorants and odorant concentrations are the same as for natural gas.	Same as natural gas
NO	No			No				No
PL	No			No				No

²⁴ DE: 204 biomethane plants (+6 injections of hydrogen or syngas) end of 2017. Thereof around 20 biomethane plants inject in transmission grids.

²⁵ DE: no odorisation of natural gas/biomethane on transport grid.

²⁶ DE: German technical rule for odorisation of natural gas, no specific requirements or a separate standard for odorisation of biomethane.

Country	Biomethane injection on Transport?	Number of biomethane injections on Transport (if known)	Number of Odourisation plants on Transport (if known)	Biomethane injection on Distribution?	Number of biomethane injections on Distribution (if known)	Number of Odourisation plants on Distribution (if known)	Specific requirement for biomethane Odourisation?	Standards for biomethane Odourisation
PT	No			No				No
RO	No			No				No
SK	No			No				No
UK	Currently local transmission systems only (not NTS – National Transmission System)	17	17	Yes	77	77	NTS is unodorised and so any biomethane plant connected to NTS would not require odourisation. For local transmission distribution systems there are no specific requirements.	IGEM/SR/16 Edition 2 (Edition 3 currently in production - expected publication late 2019)

OLFACTORY LEVEL SECTION:

Country	Minimum required olfactory degree	Control required	Requirements specified standards or codes
AT	Not required	No	-
BE	Not required	No	-
CH	Not required	No	-
CZ	3 DVGW scale (Table 1, A 3, TPG 918 01)	Yes	TPG 918 01, TPG 905 01 (codes of practice)
DE	Not required	No	-
DK	Not required	No	-
EL	Not required	No	-
ES	Not required	No	-
FR	Not required	No	-
HU	Not required	No	-
IE	2 (Sales scale)	Yes	Code of Operations
IT	4 (DecaSales scale ²⁷)	No: National Authority considers mandatory only gaschromatographic analyses.	UNI CIG 7133 Dir ARG/Gas 574/13
NL	Not required	Yes	-
NO	Not required	No	-
PL	Olfactory is the primary measurement	Yes	National Regulation Dz.U. 2010, No 133, 89 PN-C-04751:2011 PN-C-04753:2011
PT	Olfactory degree is required by Technical regulation	Yes	DVGW G 280
RO	2 (Sales scale)	Yes	SR 13406 (Natural Gas Odourisation), SR 3317 (Natural Gas. Quality Requirements),
SK	Not required	No	-
UK	2 (Sales scale)	Yes	Gas Safety Management Regulations, GS(M)R1996

²⁷ The new DecaSales scale was introduced in UNI 7133-1: 2019, doubling the Sales Scale and using only integer from 0 to 10 olfactory degrees.

ODORANTS CONCENTRATIONS SECTION:

Country	Odorant	Percent consumption	Minimum concentration (mg/m ³)	Maximum concentration (mg/m ³)	Typical concentration (mg/m ³)	Unit reference (Standard or Normal)	Customers receiving non-odorized gas: specify what type of industry is receiving non odorized gas	Odorised gas in Salt cavern?	Odorised gas in lined cavern?	Odorised gas in aquiferous storage?	Odorised gas in depleted field?
AT	THT Other odorants Sulphur Free Odorant	93% 5% 2%	9,0 - 8,0	As required at the endpoint	12-14 - 10	Normal	Industry: glass, ceramics, chemical, power plants	No	No	No	No
BE	THT TBM+IPM+NPM	-	17 5,4	34 7,1	20 6	Normal	Chemical Industry & power plants	No	No	No	No
CH	THT S-Free Acrylate	100% -	10 8,8	30 -	15-30 12 14	Normal	some Industry	No	No	No	No
CZ	THT TBM+DMS Gasodor S-free	10% 89% 1%	8 5 8	Not specified	12 10 8,8	Normal	Chemical Industry	No	No	No	No
DE	THT Other odorants mixt THT + EA Sulphur Free Odorant TBM+IPM+NPM	59 – 74% 2% - 21% 15-17%	10 Not specified 6 8 3	According to DVGW G 260 the total sulfur concentration shall not exceed 8 mg/m ³	15-18 - 11-15 11-15 5-8	Normal	Industries: glass, ceramics, chemical	No	No	No	No
DK	THT	100%	10,5 (at consumer location)	Not specified	11-17	Normal	Not allowed in Denmark. All gas is odorized	No	No	No	No
EL	THT	100%	15	35	20	Normal					
ES	THT	100%	15 (TSO) 18 (DSO)	-	22	Normal	None				
FR	THT	100%	15	40	25	Normal	None	Yes	No	Yes	Yes
HU	THT + TBM	100%	13	25	16	Not known	Every customer receives odorized gas	Yes (16)	No	No	No
IE	TBM+DMS	100%	3	10	6	Standard	Every customer receives odorized gas	No	No	No	Yes
IT	THT TBM+IPM+NPM (²⁸)	40% 60%	32 9,3 ²⁹	As required at the endpoint	-	Standard	Industry	No	No	No	Yes
NL	THT	100%	10	40	18	Normal	Industry; Power plant; Dedicated Pipe	No	No	No	No
NO	THT	100%	12	15	-	Not known	Industry				
PL	THT	100 %	Not specified	Not specified	25	Standard	Industry				
PT	THT	100%	8	40	24	Normal	Combined Cycle Power Plants ³⁰	Yes	No	No	No

²⁸ IT: The 2019 revision of UNI 7133 – Part 2, has an annex in which a concentration of 24,1 mg/m³ is given as basis for further studies for usage of odorant without sulphur with a composition of 32% of methyl acrylate, 66% of ethyl acrylate and 2% of 2-ethyl-3-methylpyrazin.

²⁹ IT: the concentration is expressed as TBM, because it is the only compound of the mixture that can be analysed on the field at the lower concentration. This concentration of TBM alone reach 4 olfactory degrees at 1% of natural gas in air even in absence of the other two mercaptans of the odorant mixture (IPM and NPM are more reactive, and can be easily lost in the grid).

Country	Odorant	Percent consumption	Minimum concentration (mg/m ³)	Maximum concentration (mg/m ³)	Typical concentration (mg/m ³)	Unit reference (Standard or Normal)	Customers receiving non-odorised gas: specify what type of industry is receiving non odorised gas	Odorised gas in Salt cavern?	Odorised gas in lined cavern?	Odorised gas in aquiferous storage?	Odorised gas in depleted field?
RO	EM	100%	3	30	8	Not known	Some Industry	No	No	No	No
SK	THT	59 %	8	40	18	Normal	Chemical industry and some technological customers	No	No	No	No
	TBM(80%)+MES(20%)	41 %	5	15	10						
UK	TBM+DMS	100%	Not specified	As required, but must not exceed total sulphur limit of GS(M)R regulation	6	Standard	Any before injection ⁽¹⁵⁾	No	No	No	No

NOTE 1: The unit can be expressed in reference to normal or standard conditions: the difference is related to the temperature to which the volume is expressed; the following definitions are taken from the EN ISO 14532:

Normal reference conditions: reference conditions of pressure, temperature and humidity (state of saturation) equal to: 101,325 kPa and 273,15 K for a dry, real gas.

Standard reference conditions: reference conditions of pressure, temperature and humidity (state of saturation) equal to: 101,325 kPa and 288,15 K for a dry, real gas.

ODORANTS TABLE															
Odorant	Composition %										%S	Density at 273K (kg/m ³)	Vapour Pressure at 273K (mbar)	Density (kg/m ³ at 15°C)	Vapour Pressure (bara at 15°C)
	THT Tetrahydro thiophene	TBM Tertiary Butyl Mercaptan	IPM Isopropyl Mercaptan	NPM Normal Propyl Mercaptan	MES Methyl Ethyl sulfide	DMS Diethyl sulfide	EM Ethyl Mercaptan	Ethyl Acrylate	Methyl Acrylate	2-Ethyl-3-Methylpyrazin					
Formula	C ₄ H ₈ S	C ₄ H ₁₀ S	C ₃ H ₈ S	C ₃ H ₈ S	C ₃ H ₈ S	C ₂ H ₆ S	C ₂ H ₆ S	C ₅ H ₈ O ₂	C ₄ H ₆ O ₂	C ₇ H ₁₀ N ₂					
Molecular weight	88,2	90,2	76,2	76,2	76,2	62,1	62,1	100,1	86,1	122,2					
Sulphur Free								66 %	32 %	2 %	0,0	Note ³¹	Note ³²		
THT+ EA (Ethyl Acrylate)	12 %							88 %			4,4	950	11		
THT+TBM	70 %	30 %									36,1			893,1	0,084
THT	100 %										36,4	1016	5,8	1002,8	0,014
TBM+IPM+NPM		76 %	16 %	8 %							37,1	825	82	810,8	0,17
TBM+MES		80 %			20 %						36,9	828	71		
TBM+DMS (UK+IE)		80 %				20 %					38,8	830	114	814,4	0,23
TBM+DMS (CZ)		65 %				35 %					41,2	837	140		

³⁰ PT: For the customers to be exempted from receiving odorised gas the Energy Office (DGEG – Direção Geral de Energia e Geologia) must issue a formal permit. This permit is supported on a demonstration that the customer has installed a gas detection system or, alternatively, a leak detection system; in one of the CCPP, REN Gasodutos installed a leak detection system based on flow measurement by annubar metering devices.

³¹ From the Safety Data Sheet: 0,9300 - 0,9400 at 20 °C (relative density).

³² From the Safety Data Sheet: 83 mbar (at 25 °C).

EM							100 %				51, 6	861	246	844,3	0,474
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NOTE

The information and data included in this document have been compiled by MARCOGAZ from a variety of sources from its Members. MARCOGAZ will not accept any liability for the data accuracy and completeness.

UPDATING REFERENCES:

Country	Data of updating	Comments
AT	02/10/2012	
BE	15/03/2018	
CH	02/10/2012	
CZ	15/03/2018	
DE	11/10/2019	DVGW code of practice G 280 was revised in December 2018
DK	02/10/2012	
EL	02/10/2012	
ES	18/10/2019	
FR	15/03/2018	
HU	02/10/2012	
IE	17/10/2019	
IT	24/10/2019	The new revision of UNI 7133 was published in May 2019
NL	09/01/2020	
NO	02/10/2012	
PL	02/10/2012	
PT	02/10/2012	
RO	02/10/2012	
SK	02/10/2012	
UK	16/09/2019	