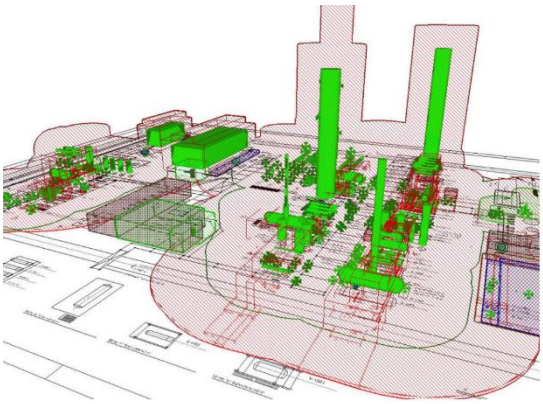
https://hac-online.com

Gases, vapours, mists and dusts can all form potentially explosive atmospheres with air. **Hazardous area Classification (HAC)** is used to identify places where, because of the potential for an explosive atmosphere, special precautions over sources of ignition are needed to prevent fires and explosions.

Hazardous area classification should be carried out to identify places (or areas) where controls over ignition sources are needed and those places where they are not. Hazardous areas are further classified into Zones / Class & Divisions / Classes & Zones, which distinguish between places that have a high chance of an explosive atmosphere occurring and those places where an explosive atmosphere may only occur occasionally or in abnormal circumstances.

METHODOLOGY:

- Hazardous Area Classification (HAC) is mandatory
- we do it according to IEC/EN 60079-10-1 (gas) and IEC/EN 60079-10-2 (dust),
- Model code of safe Practice Part 15 - IP15,
- IGEM/SR/25,
- API RP 505
- and many more industry specific standards…



Phase 1

- please fill out the input checklist and send it to hac@hac-online.com
- please send process description, and P&ID
- our pHAC expert will provide you a preliminary HAC (pHAC) for your convenience
- pHAC shall be a good basis for your project

Phase 2

- In case of project is finished you shall provide the final data of your project again like:
- please fill out the questionnaire and send it to hac@hac-online.com
- our HAC expert will provide you a final HAC (fHAC) for your convenience
- fHAC shall be kept for your files (Verification Dossier, EPD)
- All for your convenience. All terms and conditions will be sent in separate mail.

- HAC shall be a basis to ensure your Facility's safety.
- In case of further information requested, please contact us via hac@hac-online.com

A sample Table of Content for a proper HAC:

- Register
- Prelude
- General
- Legal background and applied standards
- Procedure of the classification of hazardous areas (basics)
- Statements
- Presentation of technology
- Determination of potentially explosive atmospheres
    - Environmental data
    - Release data
    - Calculation of the rates of releases
    - Evaluation of the effect of ventilation
    - Characteristics of the releases
    - Effects of releases
    - Determination of the minimum requirements for applicable equipments
- Summary
- Annexes
    - - Properties of Explosive substances
    - - Zone maps of explosion hazardous areas

Statement:

5. Statement

This [redacted] Hazardous Area Classification document was made by the application of the standard IEC 60079-10-1:2015 Classification of areas – Explosive gas atmospheres (Edition 2.0 2015-09.) and based on the data provided by the Client (full list please ANNEX C).

The following technical literatures have been additionally used to determine the sizes of the explosive zones:

- „Classification of hazardous location" (ISBN 0 85295 258 9); published by „Institution of Chemical Engineers";
- EI Model code of safe practice Part 15: Area classification code for installations handling flammable fluids;
- CEI 31-35 "Electrical apparatus for explosive atmospheres – Guide for classification of hazardous areas".

Budapest, 12. March 2020.

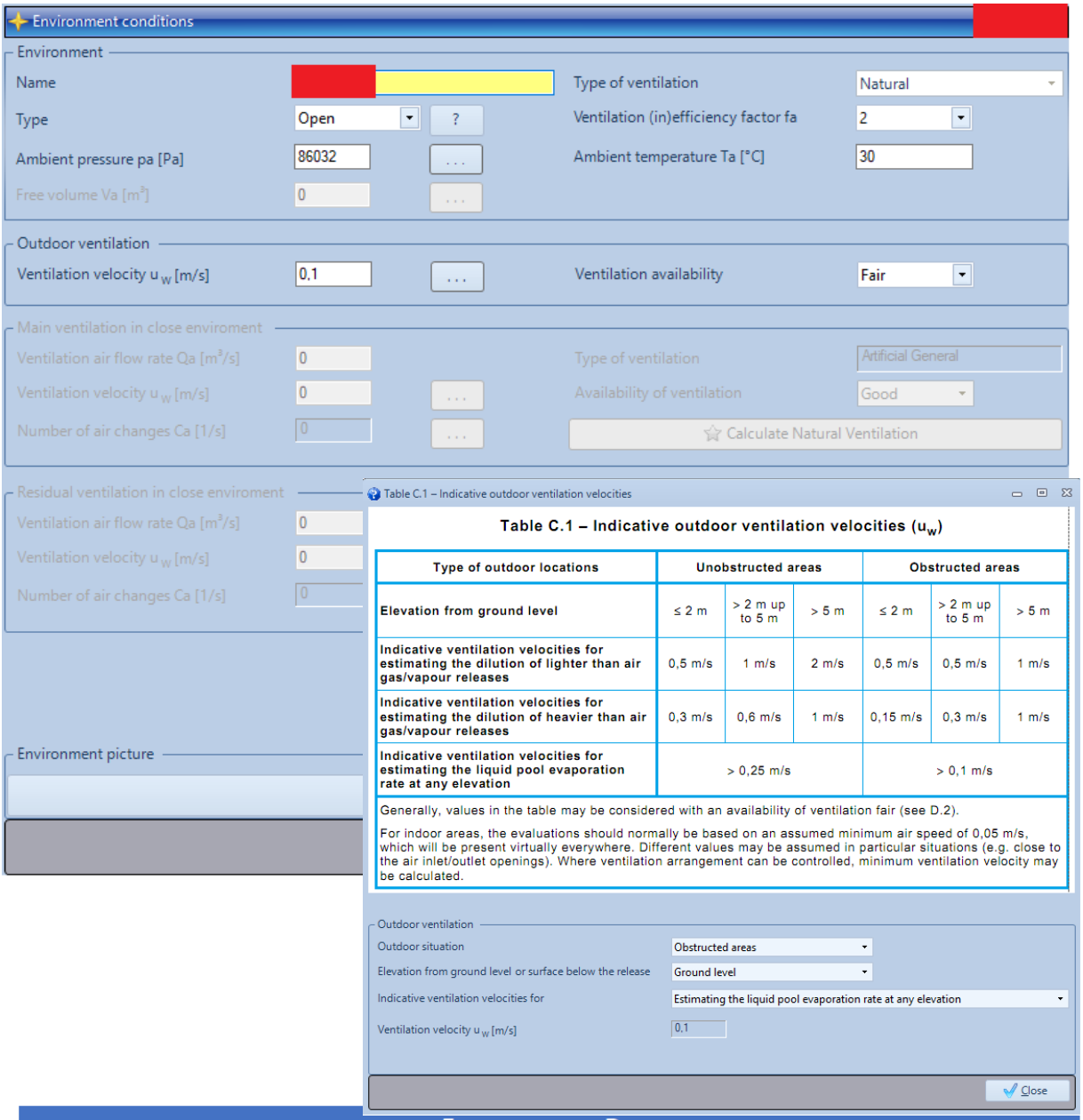
Created by: Approved by:

DRAFT

Presentation of the Technology, including:

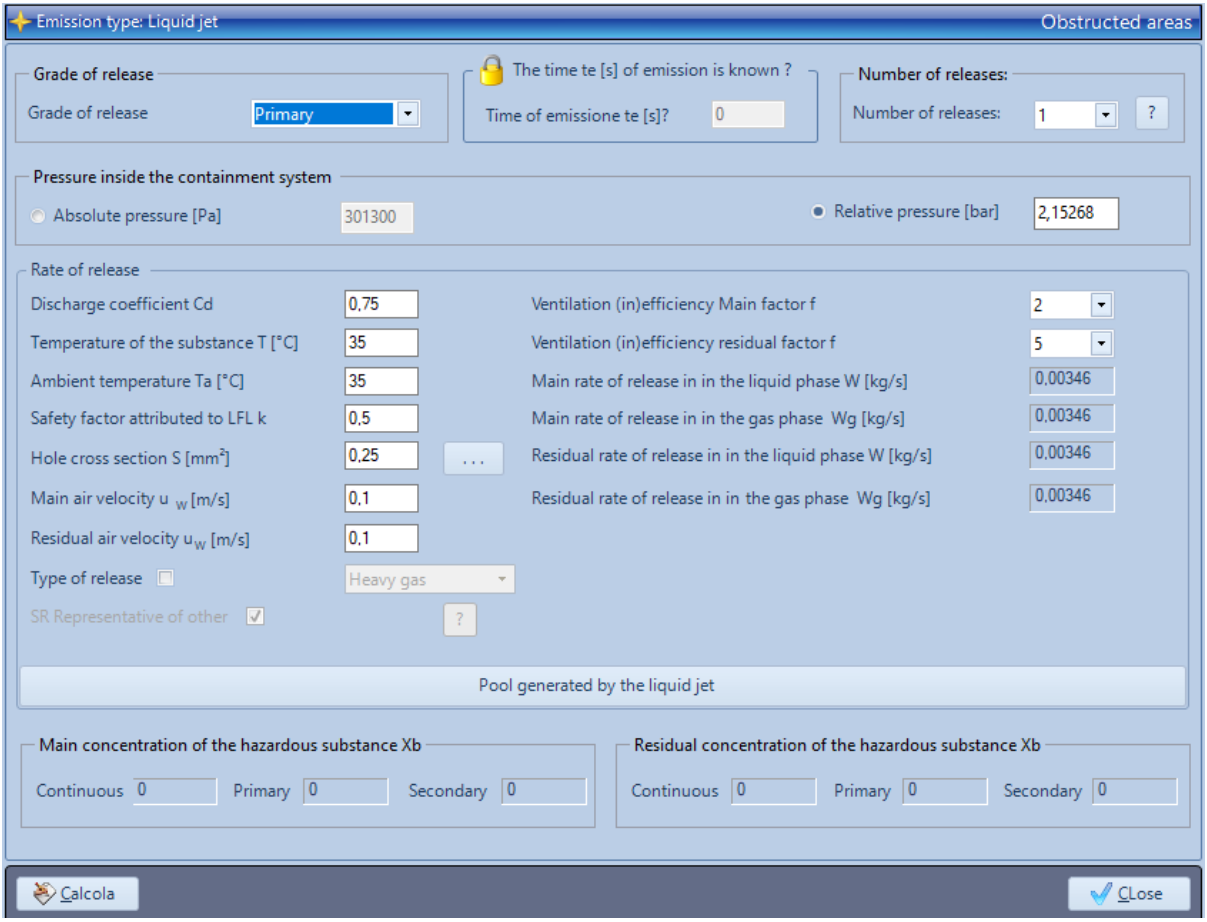
- the amount of dangerous substances involved;
- the work processes, and their interactions, including any cleaning, repair or maintenance activities that will be carried out;
- the temperatures and pressures at which the dangerous substances will be handled;
- the containment system and controls provided to prevent liquids, gases, vapours or dusts escaping into the general atmosphere of the workplace;
- any explosive atmosphere formed within an enclosed plant or storage vessel; and,
- any measures provided to ensure that any explosive atmosphere does not persist for an extended time, e.g. ventilation.

Determination of potentially explosive atmospheres



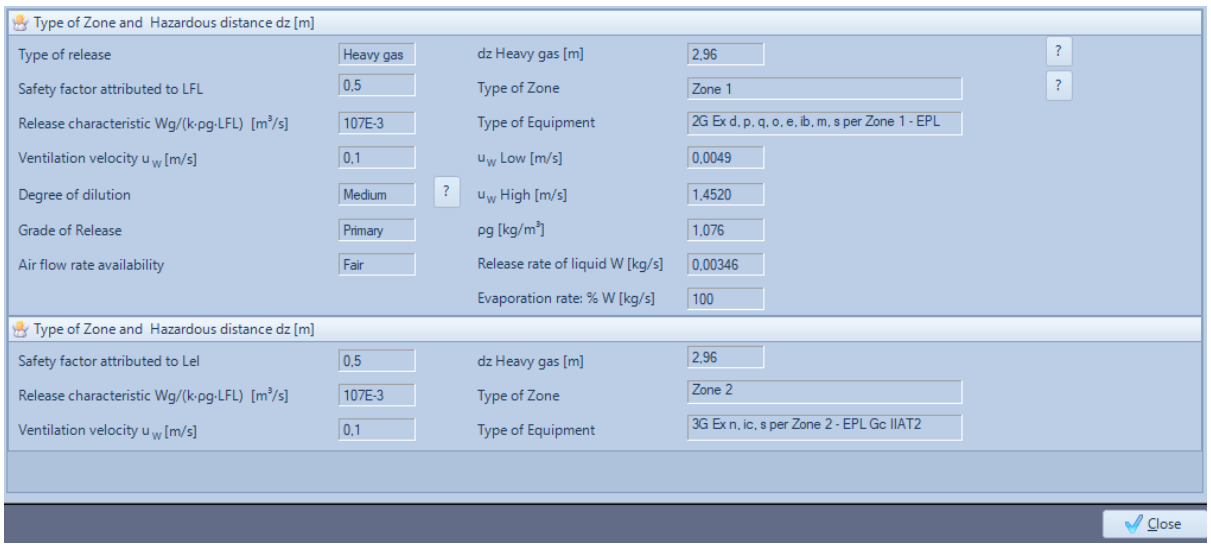
ENVIRONMENTAL DATA	
Environment name	[redacted]
Environment type	Open
Type of ventilation	Natural
Ventilation (in)efficiency factor, f	2
Ambient temperature, T_a	35 °C
Ambient pressure, p_a	101300 Pa
Outdoor situation	Obstructed areas
Ventilation availability	Fair
Ventilation velocity, uw	0,1 m/s

Release data

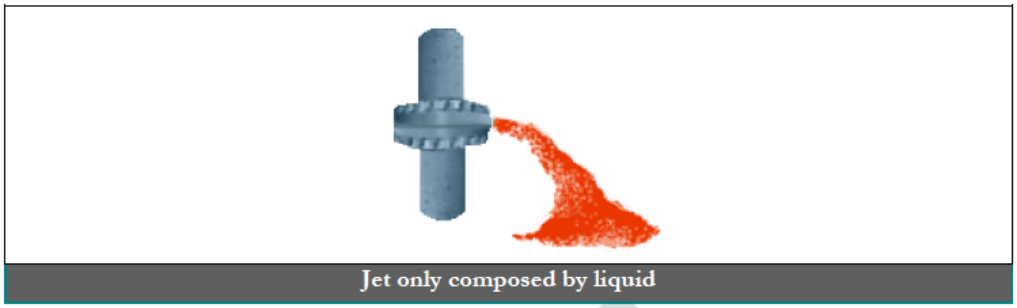


RELEASE DATA	
Source of release name	[redacted]
Source of release position	[redacted]
Flammable substance	Methyl alcohol
Ambient pressure, pa	101300 Pa
Ambient temperature, Ta	35 °C
Number of release sources, n	1
Discharge coefficient, Cd	0,75
Hole cross section, S	0,25 mm^2
Absolute pressure inside the container in the emission point, p	251 300 Pa (1,5 bar)
The Universal Gas constant, R	8314 J/kmol K
Temperature of the substance, T	308,15 K

Calculations of the rates of release:



Release rate of liquids



Jet only composed by liquid

The rate of a liquid release is evaluated by means the follow equation:

$$W = C_d \cdot S \cdot 10^{-6} \cdot [2 \cdot \rho \cdot (\Delta P)]^{0,5} = 0{,}75 \cdot 0{,}25 \cdot 10^{-6} \cdot [2 \cdot 792 \cdot (150000)]^{0,5} = 0{,}00289 \text{ kg/s}$$

The rate of vaporization of a liquid release is then required to be determined. Liquid releases may take many forms. The nature of the release and how any vapor or gas is generated is also dependant on many variables.

Evaporation rate of liquid, W_e [m^3/s]

To define the flow rate of gas emission shall be defined as the fraction of liquid that evaporates in the emission W_e (% W):

The evaporation rate of liquid W_e = % W = 100% ·W = 0,00289 kg/s

Where W is release rate of liquid (mass per time, kg/s);

The volumetric flow rate of gas in (m^3/s) is equal to:

$$Q_g = \frac{W_e}{\rho_g} = 0{,}00342 \text{ m}^3/\text{s} \text{ - [B.5 IEC 60079-10-1]}$$

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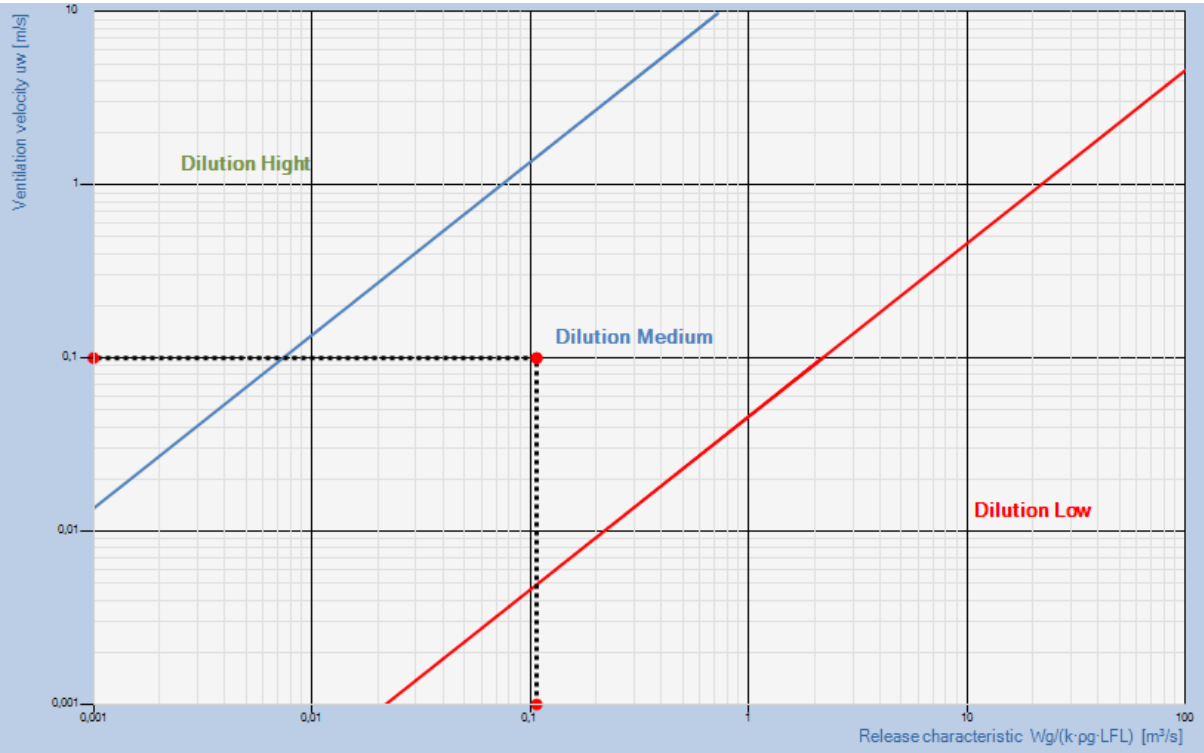
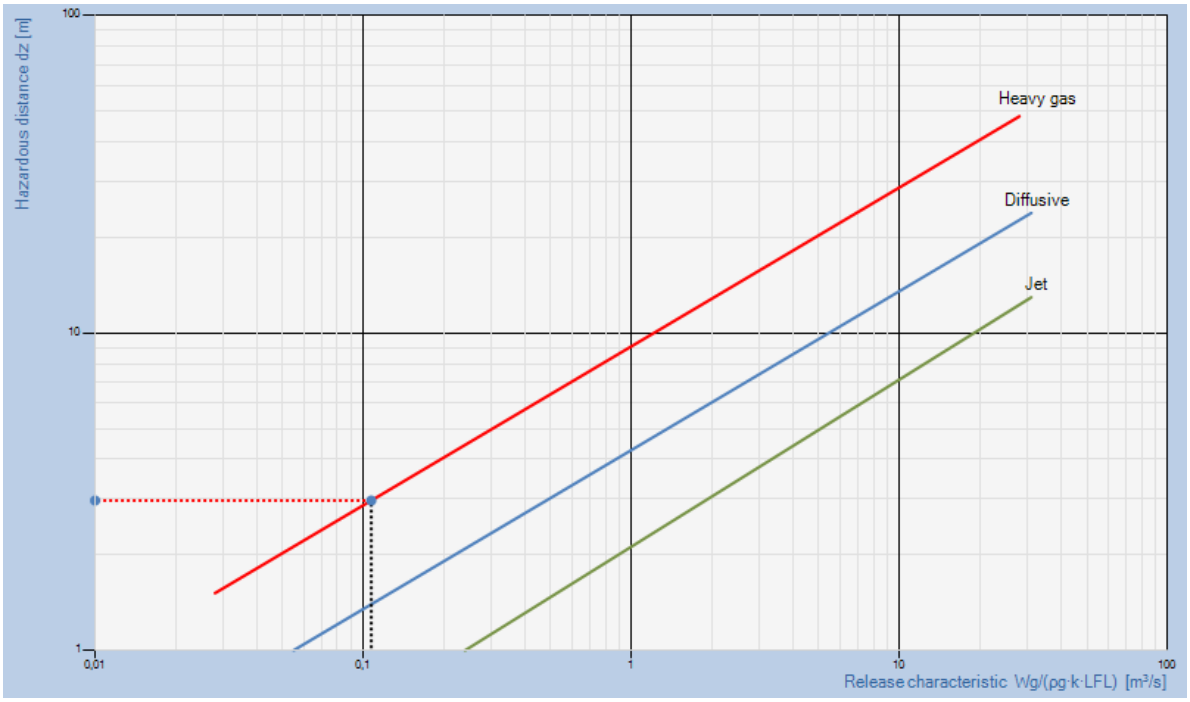
Evaluation of the effect of ventilation



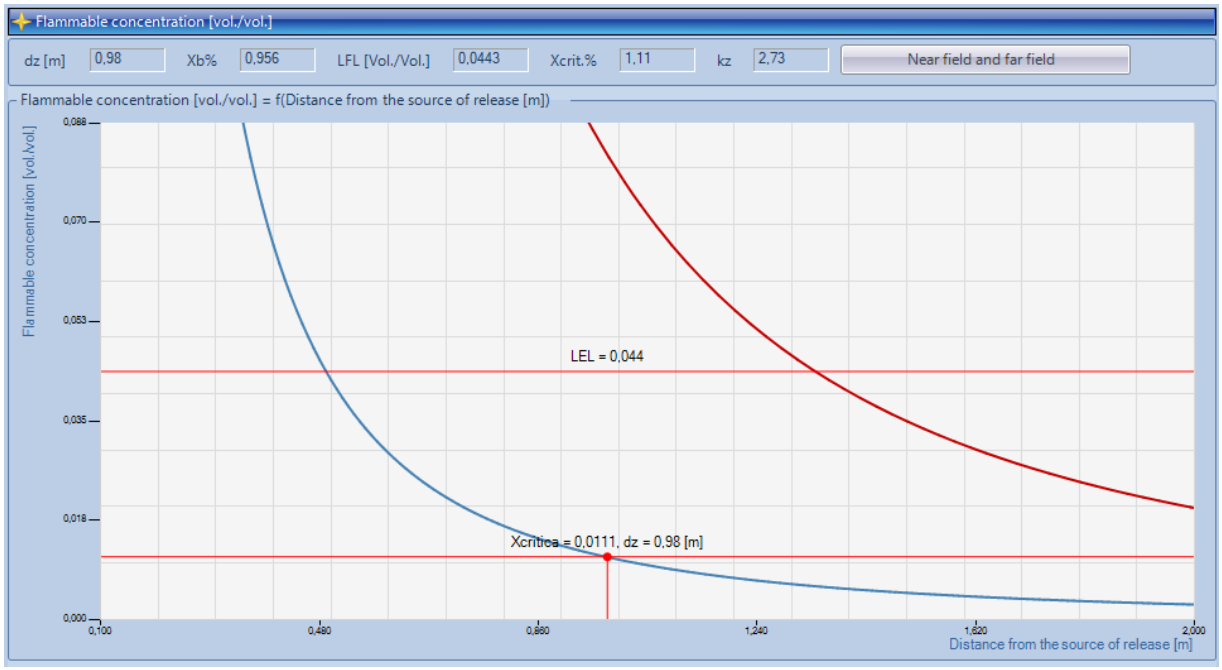
EFFECTIVENESS OF VENTILATION							
Grade of release	High Dilution			Medium Dilution			Low Dilution
	DISPONIBILITÀ DELLA VENTILAZIONE						
	Good	Fair	Poor	Good	Fair	Poor	Good, fair or poor
Continuous	Non hazardous (Zone 0 NE)	Zone 2 (Zone 0 NE)	Zone 1 (Zone 0 NE)	Zone 0	Zone 0 + Zone 2	Zone 0 + Zone 1	Zone 0
Primary	Non hazardous (Zone 1 NE)	Zone 2 (Zone 1 NE)	Zone 2 (Zone 1 NE)	Zone 1	Zone 1 + Zone 2	Zone 1 + Zone 2	Zone 1 o Zone 0
Secondary	Non hazardous (Zone 2 NE)	Non hazardous (Zone 2 NE)	Zone 2	Zone 2	Zone 2	Zone 2	Zone 1 o Zone 0

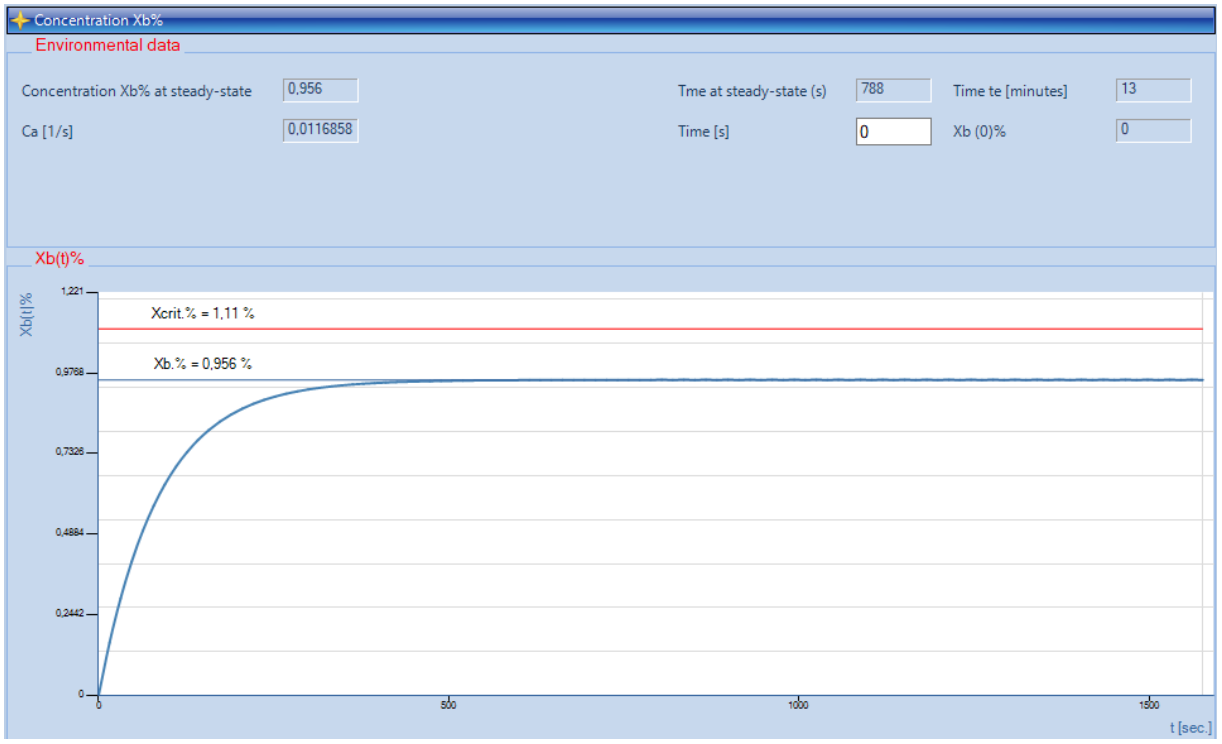
Characteristics of the releases

CHARACTERISTICS OF RELEASE:	
Flammable substance	Methyl alcohol
Physical state of the substance	Liquid
Molar mass, M	32,04 kg/kmol
Lower flammable limit, LFL	6 %vol.
Auto-ignition temperature, AIT	440 °C
Relative density of a gas or a vapour to air	1,11
Fugitive emissions	0 kg/s
Source of release, SR	Pump seals and pipe fittings/connections
Grade of release	Primary / Secondary
Safety factor, k	0,5
Main rate of release, Wg	0,00289 kg/s
Release characteristic, Wg/(k·ρg·LFL)	0,076 m³/s

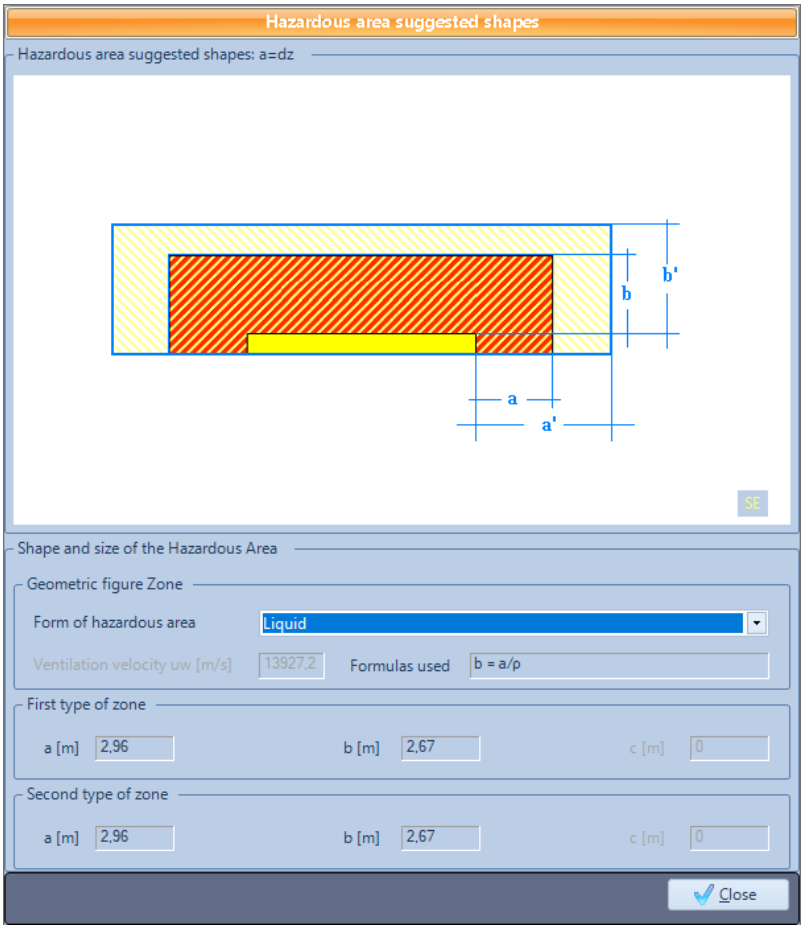


Dispersion and background concentration





Effects of releases and Determination of the minimum requirements for applicable equipments



EFFECTS OF RELEASE	
Type of release	Heavy gas
Critical concentration, Xcrit.	0,015 vol./vol. equal to 25 % of LFL
Background concentration, Xb.	0 vol./vol.
Time to Xcrit, td	Not applicable
Relationship of concentrations, Xb<Xcrit	Verified
Degree of delution	Medium
Type of zone	Zone 1 and Zone 2 Hazardous Area
Applicable equipment (minimum):	Zone 1 - IIA T2 Gb Zone 2 - IIA T2 Gc

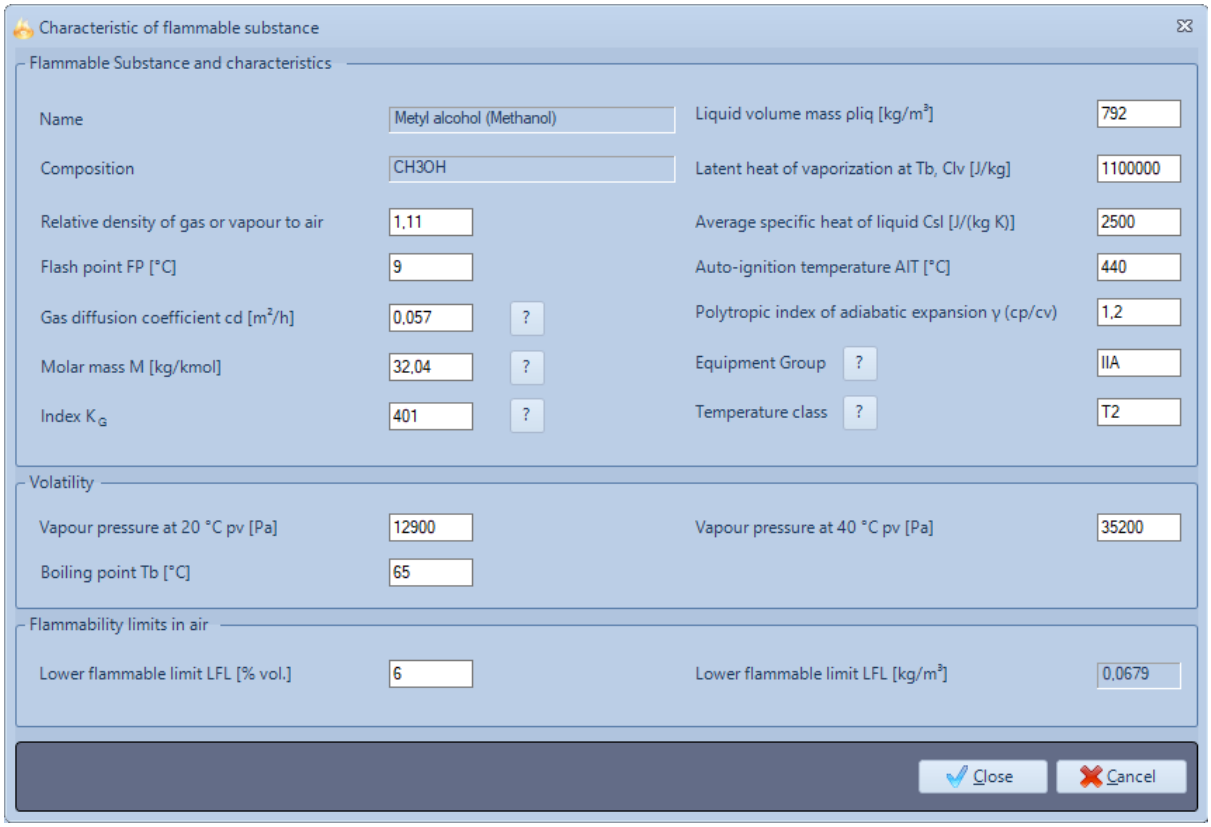
Minimum requirements for applicable products used in Zone 1:

IIA T2 Gb

Minimum requirements for applicable products used in Zone 2:

IIA T2 Gc

Properties of Explosive substances



ANNEX A -
Physical and chemical properties of the explosive materials

1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Flammable substance							Volatility[a]		LFL		Ex characteristics	
	Name	CAS No.	Molar mass [kg/kmol]	Relative density gas/air	Politropic index of adiabatic expansion γ	Flash point [°C]	Ignition temp. [°C]	Boiling point [°C]	Vapor pressure at 20°C [Pa]	Vol (%)	kg/m³	Equipment group	Temp. Class [°C]
1	Methyl alcohol (Methanol)	67-56-1	32,04	1,11	1,2	9	440	65	12900	6	0,185	IIA	T2
2	Xylene	1330-20-7	106,17	3,67	1,21	25	465	137	800	0,7	0,0408	IIA	T1
3	Acrylonitrile	107-13-1	53,06	1,83	1,15	0	481	77	11800	2,8	0,0618	IIB	T1

Zone maps of explosion hazardous areas

ANNEX B - List of sources of release

1	2		3	4	5	6		7	8	9	10	11	12		13
	Source of release				Flammable substance				Ventilation			Hazardous area			
	Description		Location	Grade of release	Hazardous material	Operating temperature and pressure		State (G - gas, L - Liquid)	Type (N - natural, A - artificial)	Degree of dilution	Availability	Zone type	Zone extent (m)		Appli-cable equip-ment
						(°C)	(barg)						Horizontal	Vertical	
1	IC-1136	COLUMN	Outside Building	S	METHANOL	100	0,7	G	N	Medium	Fair	Zone 2	2,1	1,9	IIA T2 Gc
		COLUMN				62,5	0,7	L				Zone 2	2,1	1,9	IIA T2 Gc
2	IC-1360	EXTRACTIVE COLUMN	Outside Building	S	METHANOL	35	2	L	N	Medium	Fair	Zone 2	2,7	2,4	IIA T2 Gc
3	IC-3138	PRIMARY CONDENSER	Outside Building	S	METHANOL	35	0,7	L	N	Medium	Fair	Zone 2	2,1	1,9	IIA T2 Gc
4	IC-0139	COOLING	Outside Building	S	METHANOL	35	1,5	L	N	Medium	Fair	Zone 2	2,5	2,3	IIA T2 Gc
5	IC-0137	HEATING	Outside Building	S	METHANOL	100	2	G	N	Medium	Fair	Zone 2	2,7	2,4	IIA T2 Gc