

EU directive 99/92 - Explosion protection documents for gas extraction systems and gas utilisation with a risk analyses

11th International Waste Management and Landfill Symposium / Sardinia 2007

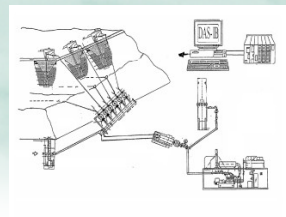
October 1st – 5th

Presentation by Wolfgang H. Stachowitz

DAS – IB GmbH
LFG - & Biogas - Technology

Biogas-, Sludge gas and Landfill gas technology:

- Consulting, planning & design, project management
- Familiarisation and training of system operators
- Independent Expert & Specialist
- Expert in ATEX – Zoning according to 99/92/EG and 94/9/EG



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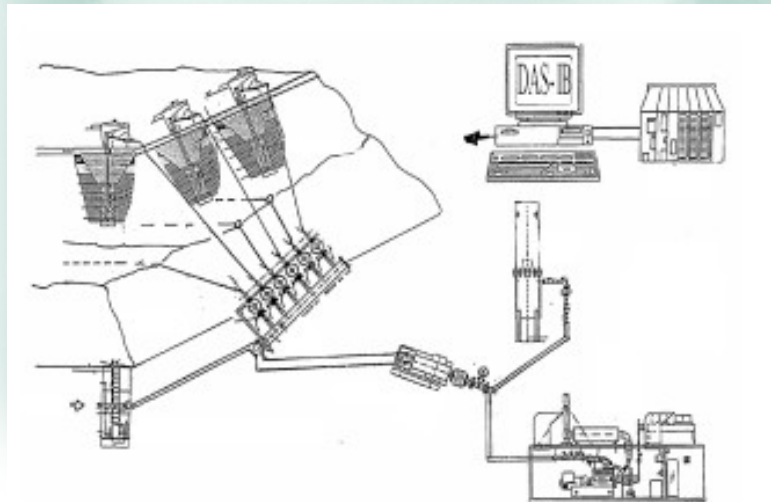
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Presentation # 23, p.1

**"Nothing is impossible"
or
"I take this liberty"**

ATEX 137 (118), better known as the 1999/92/EC Directive dated December 16th 1999: „On minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres”.

In Article (9) it is written:” ... the employer [=operator] is to draw up an explosion protection document, or set of documents, which satisfies the minimum requirements ... “



Gas extraction system with gas utilisation

The 99/92 Directive (ATEX 137) is addressed to operators. The operator needs to implement safety requirements, such as:

- **Prevention of ex-mixtures**, ignition sources, (...) and, if this is not realisable



Gas manifold station / gas well on site



Ternary (three component) diagram, atmospheric

For the explosion area methane / air / CO₂- N₂ - mixture

Acc. to Tabasaran / Rettenberger (UBA – Forschungsbericht 12/1982, Nr. 10302207 Teil1)

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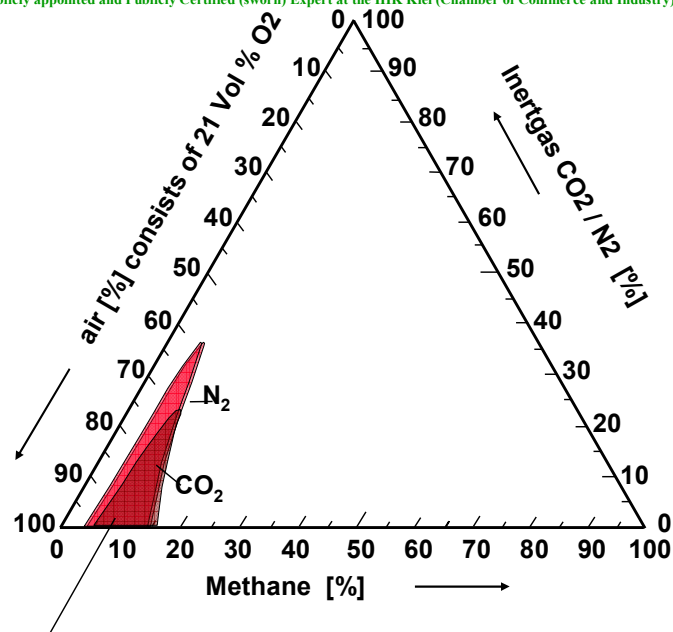
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Biogas, sewage gas and landfill gas technology:

• Consultation, planning, projecting

• Training of operating personnel

• Expert services (among other things in accordance with § 29a BImSchG (Federal Immission Control Act) and a publicly appointed and Publicly Certified (sworn) Expert at the IHK Kiel (Chamber of Commerce and Industry)



Explosion area : Exceeding of 11,6 Vol % oxygen
and
between 4,4* (5)**Vol % methane (100 % LEL) and 15
(16,5) Vol % methane (100 % HEL)

* IEC 60079-20 and PTB ** EN 50054

Explosion prevention

Primary explosion protection:

Through the prevention of the formation of an explosive atmosphere

e.g.:

Monitor and optimise gas plants with regard to operation, inertisation, safety-related control, meaning concentration limitation below the lower and above the upper explosion limit, aeration & measurement



Secondary explosion protection

Through the prevention of the ignition of an explosive atmosphere

For ignition sources please refer to -> EN 1127-1

Tertiary explosion protection

Through the prevention / reduction of effects

e.g. compression-proof (shockproof) material

Zone 1

Previous definition: includes areas in which a dangerous explosible atmosphere, caused by gases, vapours or mist must occasionally be anticipated.

New: A place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally.

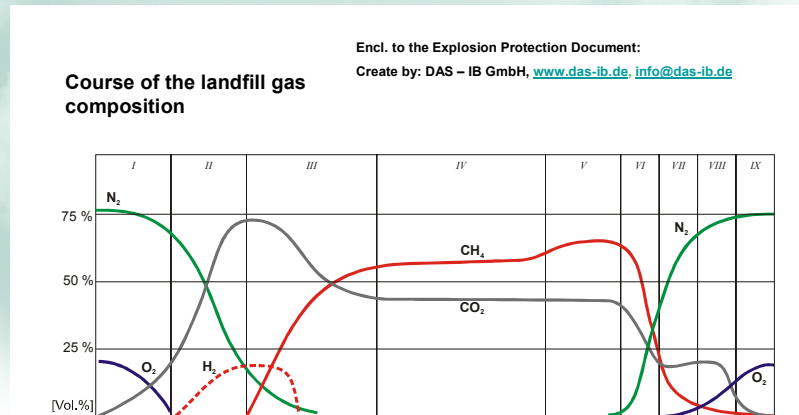
Zone 2

Previous definition: includes areas in which a dangerous explosible atmosphere, caused by gases, vapours or mist must rarely be anticipated and only for a short period of time.

New: A place in which an explosive atmosphere consisting of a mixture with air of flammable substances in form of gas, vapour or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

What is NORMAL according to EU 99/92 ?

Normal operation is the state in which the tools and systems are used and operated within the limits of their design parameters.



(Farquhar/Rovers 1973) and long term model of Franzius 1981 and Rettenberger& Mezger 1992

2 different booster systems 500m³/h each



Booster station: „EX“ and „Normal“ but gas tight

What is NORMAL? Should everything be ex-protected or gas-tight

Leak tests to prevent the formation of an explosible atmosphere

Leak tests (e.g. in accordance with DVGW (The German Technical and Scientific Association for Gas and Water), G 469 A4: inspection method with operating pressure and foaming agents



Ignition sources part I

- Hot surfaces - > T4, methane > 500 °C
- Flames and hot gases (form, structure, residence time)
- Mechanically produced sparks - > rubbing, striking, abrading
- Electrical plants - > sparks (switching operations, loose connections, compensating currents), hot surfaces (component)

Electrical currents, cathodic corrosion protection

- > stray, return currents (welding facilities)
 - > body contact or earth fault
 - > magnetic induction (> I, HF)
 - > lightning stroke, Static electricity
 - > discharge of charged conductive parts which are arranged in an isolated fashion
- > charged parts made of non-conductive materials (plastic) – bunch discharges, separating processes

Ignition sources part II

Lightning stroke - > direct and indirect (induction)

Electromagnetic waves 10,000 Hz – 3, 000, 000, 000, 000 Hz (HF)

- > radio transmitters, welding machines

Electromagnetic waves 10,000 Hz

- 3, 000, 000, 000, 000 Hz (HF)

- > radio transmitters, welders

Electromagnetic waves 300,000,000,000 Hz – 3,000,000,000,000,000 Hz -> focusing, strong laser radiation

Ionising radiation - > X-ray, radioactive radiation

Ultrasonic

Adiabatic compression and impulses

Exothermic reaction, including self-ignition of dusts

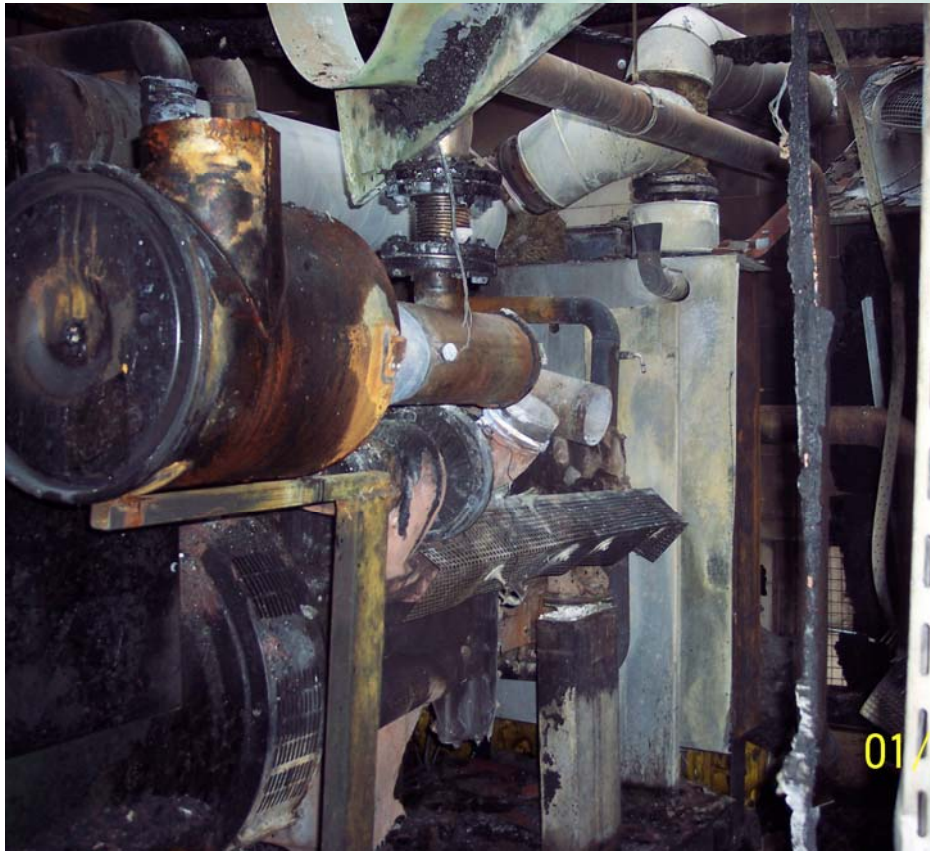
Forecast of undesirable events

Who can help: prophets - palmists - fortune tellers - oracles or **risk analysis?**

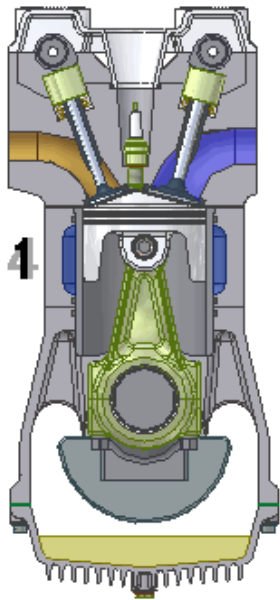
However, the risk is the product of the:

Occurrence probability x significance of the event
PROBABILITY CONSEQUENCE (effects)
Function / product of

SAFETY prevails, when the risk is justifiable!



Fire by accident
(CHP units) but no
trouble with the gas
pipes

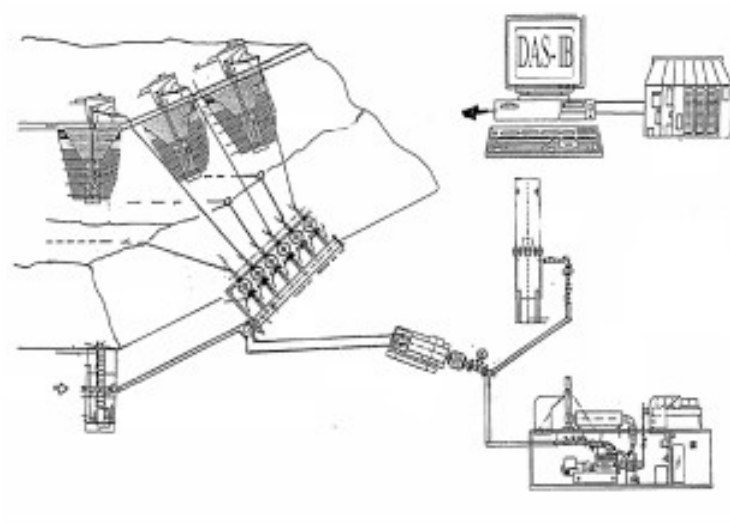


Normal operation of gas engines:

- 40 Vol % of methane
- NO explosive atmosphere

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Thank you for your attention

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