

Biogas Association Roundtable Talk, 19th of October 2016, Bangkok

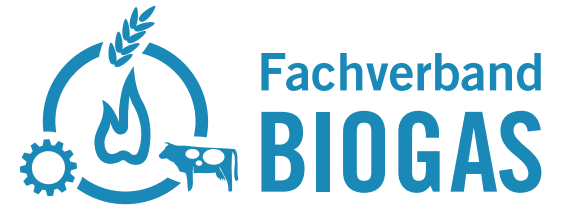


Biogas Safety Guidelines: Overview

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**Biogas
can do it!**

Content



- **Structure of the Guidelines**
- Hazards in biogas plants
- Hazardous areas in biogas plants
- Risk evaluations and precautions
- Lessons learnt

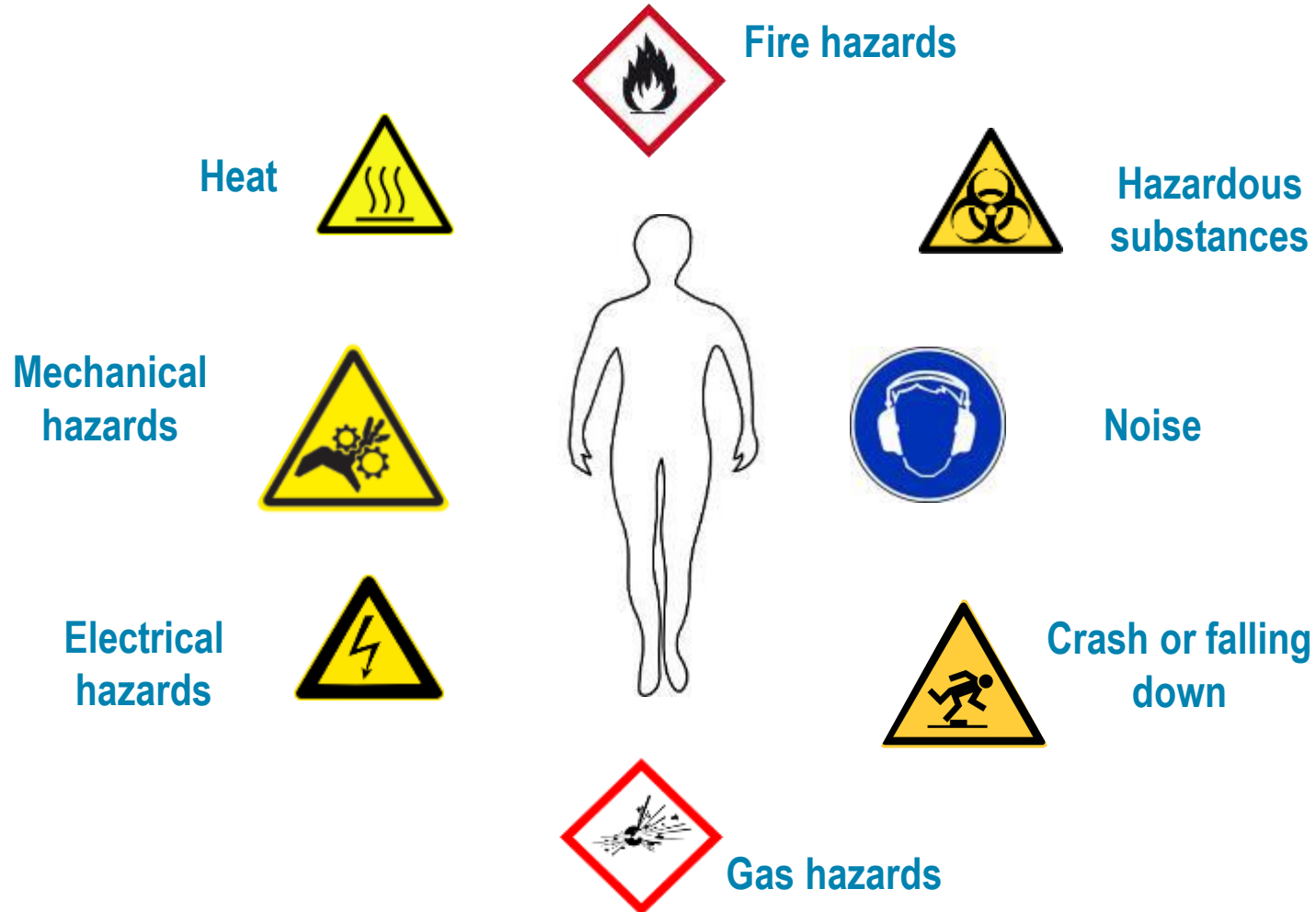
Structure of the guidelines

- **Part 1** General requirements
 - Hazards
 - Hazard assessment
 - Fire protection
 - Documentation
- **Part 2** Specific requirements
 - Technical, organisational and personal protective measures regarding relevant parts of the plant
 - Proper implementation of ex-zones
- **Part 3** Inspections and tests
 - Document inspection
 - Visual inspection and functional test

Structure of the guidelines

- **Part 4** Biogas upgrading
 - Upgrading
 - Conditioning
 - Injection
- **Part 5** Recommendations for safe plant operation from the legal standpoint
 - Recommendations for the legal framework
 - Training in the industry
- **Annexes**
 - Template of an hazard assessment
 - Instruction record for subcontractors and employees for maintenance, installation and repair work

Hazards on biogas plants



Examples of hazards on biogas plants

Mechanical hazards:



- Moving parts of machinery
- Dangerous surfaces



Examples of hazards on biogas plants

Explosion and subsequent fire due to welding

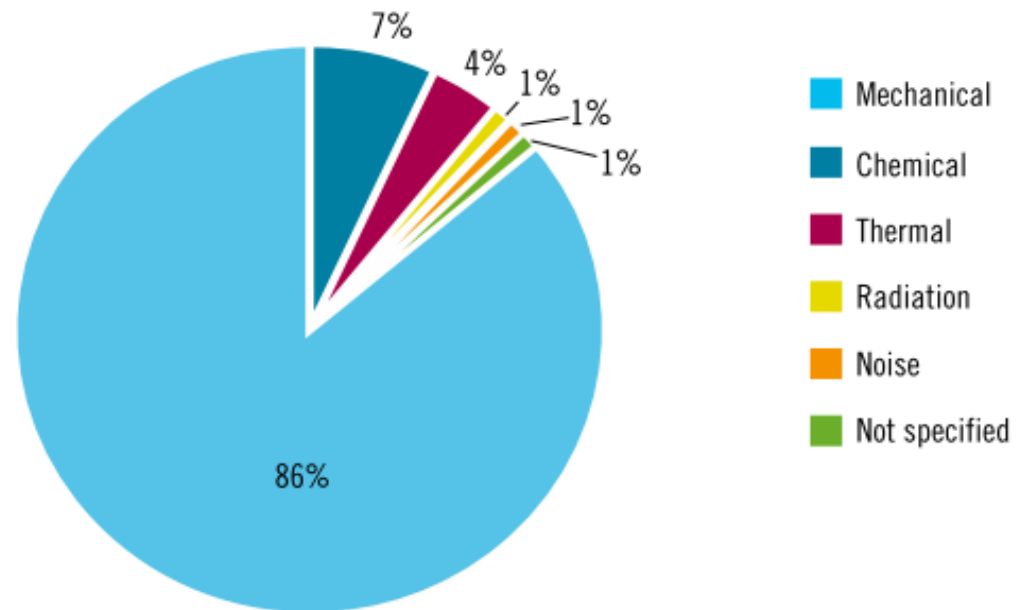


- Total loss of 80,000 €
- Commissioning of the biogas plant
- No injured persons

Hazards on biogas plants

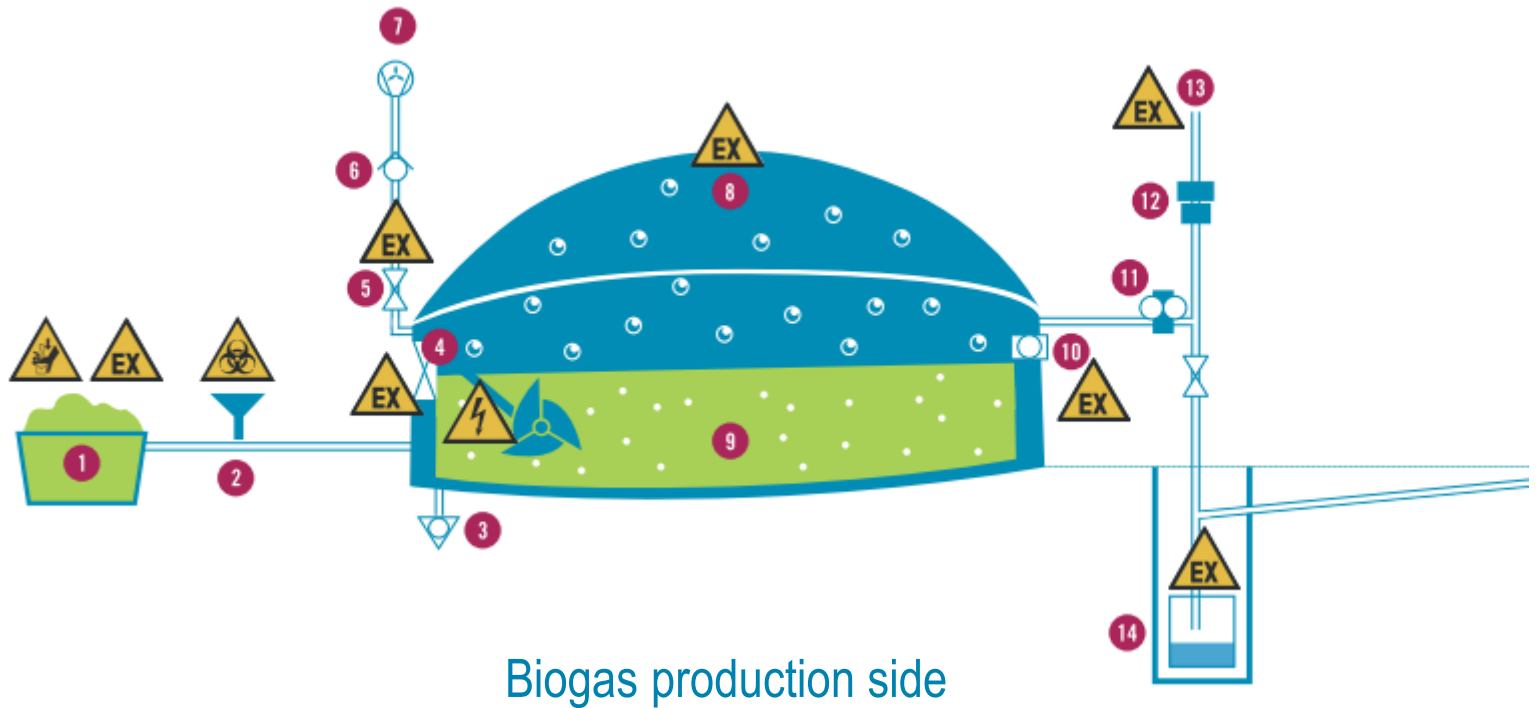
Types of accidents with injured persons at biogas plants

- In 2012 in Germany:
About 7,500 biogas plants
- About 270 accidents with injured people

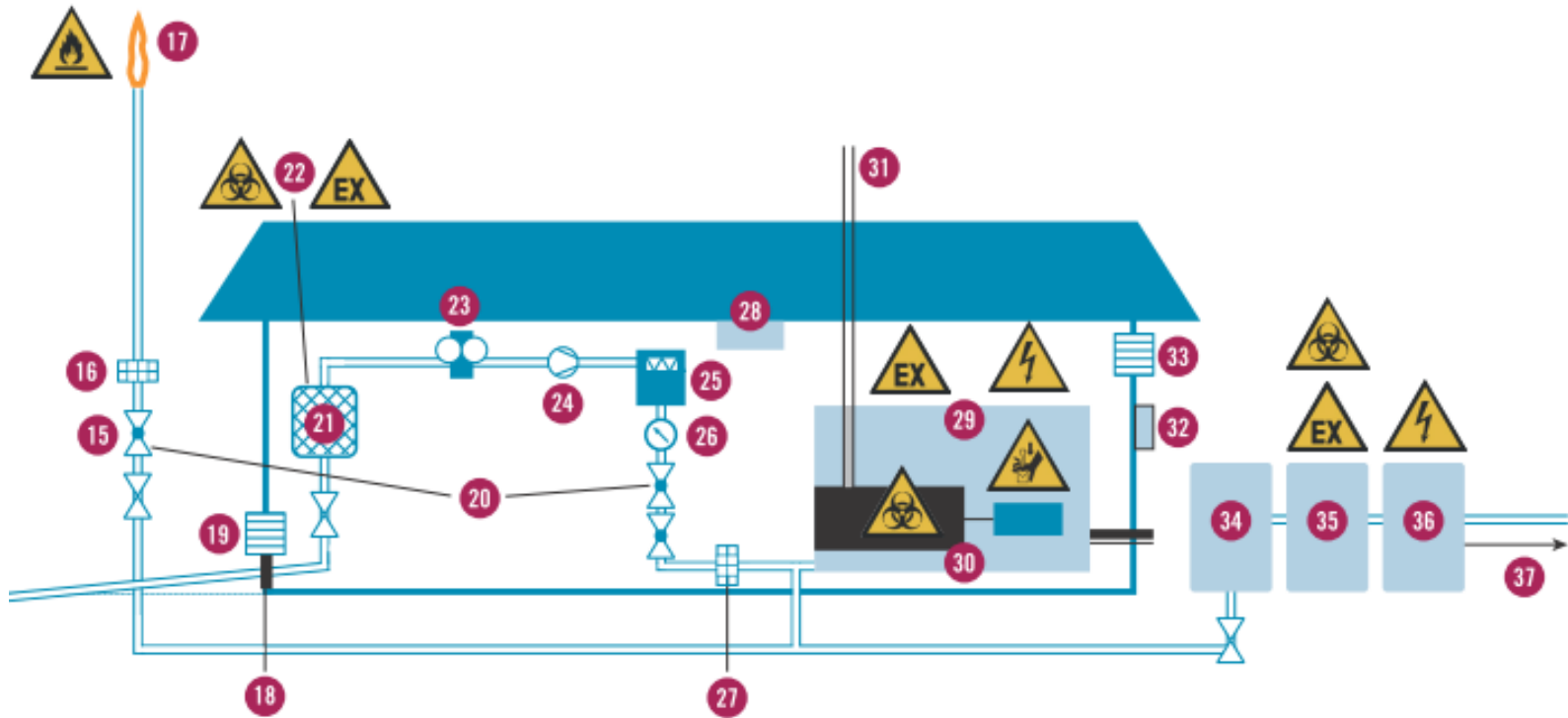


Source: SVLFG = German Agricultural Occupational Health and Safety Agency

Where do these hazards occur?



Where do these hazards occur?



Biogas utilization side

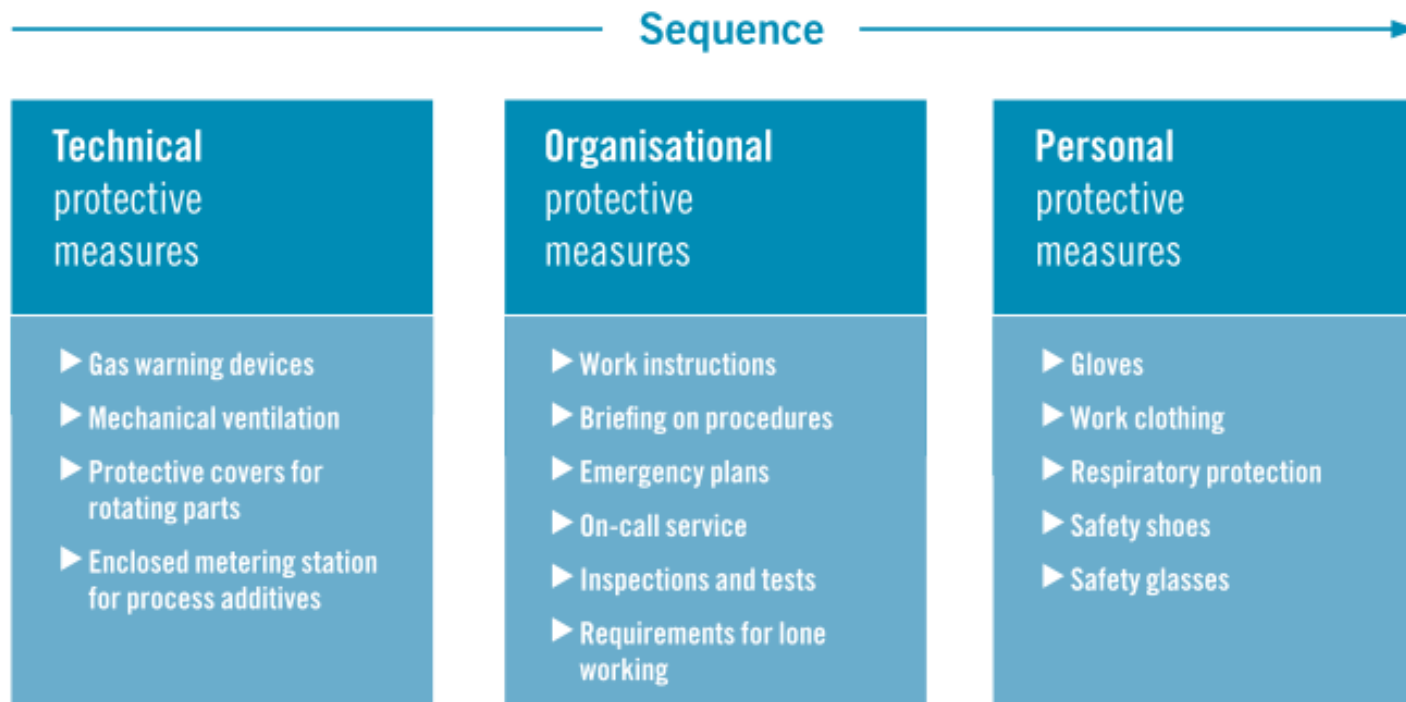
Risk evaluation and precautions

Risk Assessment

- The focus for the issue of a hazard assessment is **to protect and to reduce the exposure to risk and hazards of employees.**
- The **employer must** determine, evaluate, and **minimize the hazards** and must consider the acquired knowledge by
 - the design and selection of work tools
 - as well as the design of workplaces
 - work and production processes
 - work procedures
 - and interactions of all of the above

Risk evaluation and precautions

T-O-P Principle



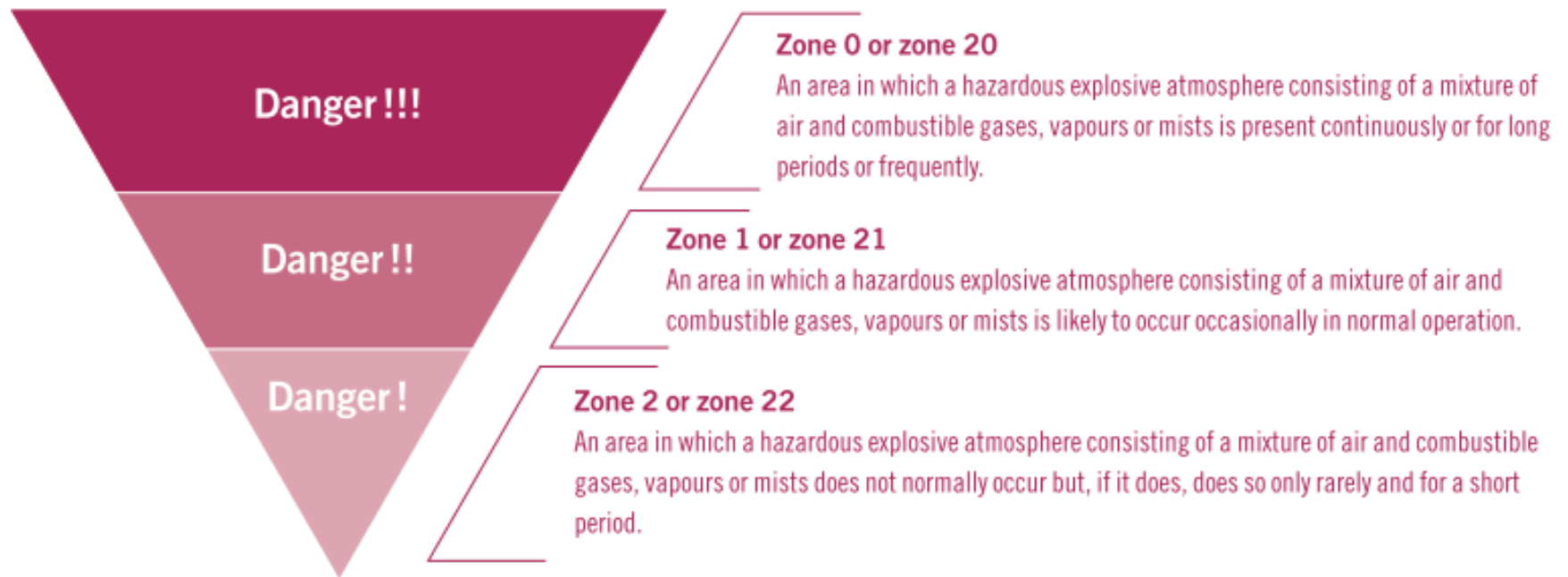
Risk evaluation and precautions

Integrated explosion protection

Primary Ex-Protection	Prevention of formation of explosive atmospheres ▶ Substitution, inert atmosphere, limitation of concentration, intensive ventilation
Secondary Ex-Protection	Prevention of ignition ▶ Ex-Zoning, preventing sources of ignition, organisational measures
Tertiary Ex-Protection	Reduction of explosion consequences ▶ Personal Protective Equipment (PPE), explosion suppression, explosion pressure resistance ▶ Evacuation or enough distance

Risk evaluation and precautions

Ex-Zoning



Documentation

Operating instructions and instruction manuals

- The manufacturers introduce products into the market with operating instructions.
- The **operating instructions** from the component manufacturers must be collected and stored safely from the plant operator.
- For the operation of different resources, equipment, etc., the operator has to provide an **instruction manual** which includes operating instructions, as well as information about hazards that result from the installation conditions.
- In addition, special operating states such as startup and shutdown of the system need a **specific instruction**.
- The employees must be **instructed regularly** about safe operation, e.g., using the instruction manual.
- The **risk assessment** and the **explosion protection document** have to be updated when there are changes in the operating processes. The operator bears the responsibility.

Inspections and tests

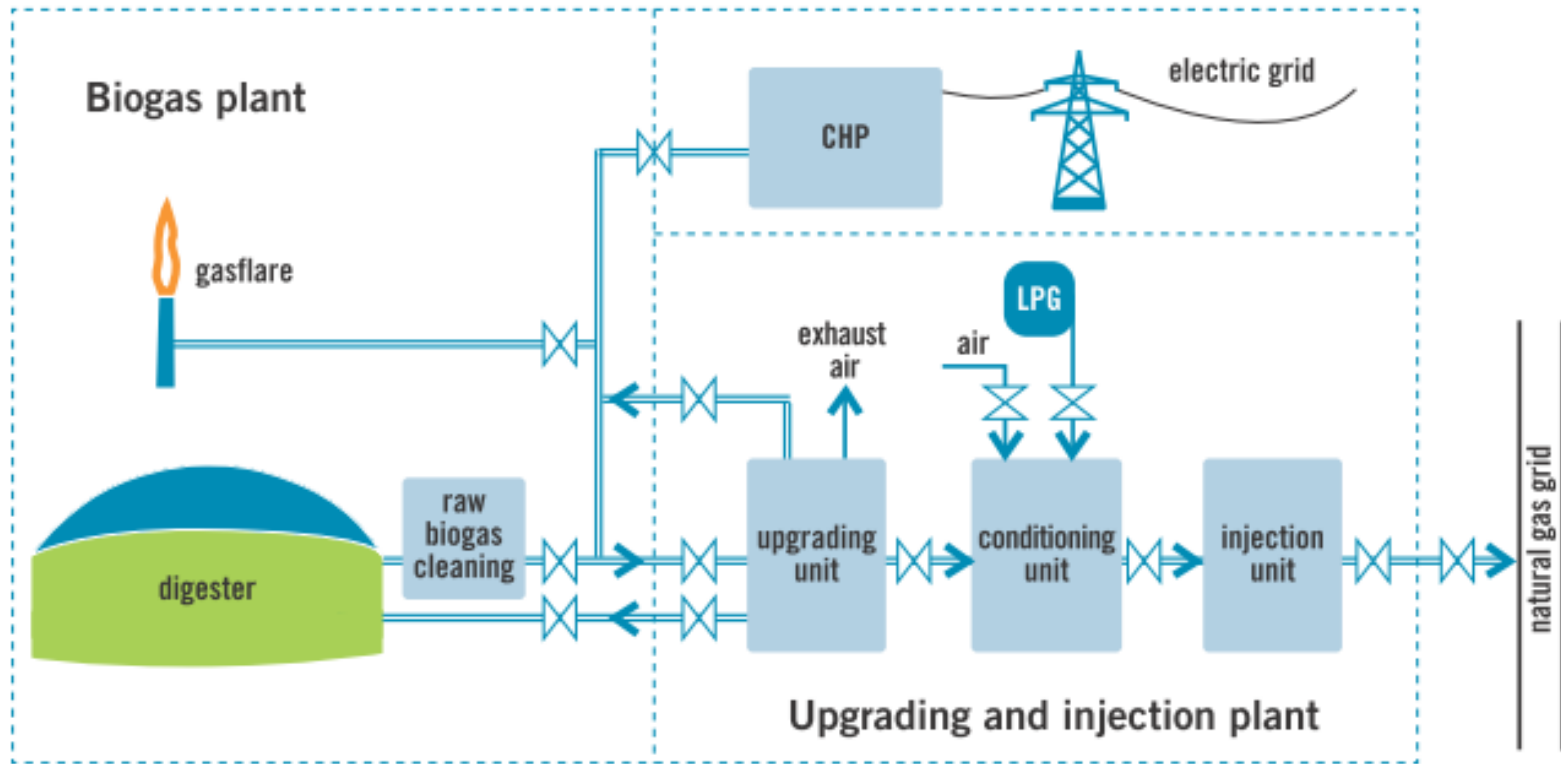
The inspections and tests can be divided into the following separate segments:



Inspections and tests

Test object	Test frequency
Fire extinguishers	Every 2 years
Safety equipment (e.g. gas warning equipment, ventilation systems and inerting equipment)	At least once a year
Apparatus, protection systems and safety systems	Every 3 years
Explosion protection testing (general)	Prior to commissioning and periodically at least every 6 years
Inspection for compliance with water legislation	Prior to commissioning, then every 5 years, in water protection areas every 2.5 years
Safety-related testing	Prior to commissioning, then every 3 or every 5 years (depending on approval)
Electrical testing of switchgear/'E-Check' inspection	Every 4 years
Pressure vessels	External inspection every 2 years Internal inspection every 5 years Strength test every 10 years

Biomethane: additional safety measures



Lessons learnt

- Biogas plants are complex process plants with several hazards.
- The operating staff and the plant owner **need professional skills and knowledge**. Important is periodic retraining!!!
- Also well-qualified plant designers and manufacturers are required.
- The German biogas plant manufacturers collected a lot of experience over the past 14 years.
- Experienced designers and manufacturers of biogas installations are available. Ideally, they have diverse references.

Lessons learnt

- Enhanced measures for the standardization of components and materials for biogas plants are in progress
- Currently in preparation: development of safety management systems
- Problem in Germany: we have a lot of responsible authorities and too many confusing rules.
- For the plant operator and the manufacturers, it is hard to be informed on the different regulations.
- Great danger of over-regulation and the disproportionate burden to the operators and manufacturers => economy in danger!
- ***Keep it safe and simple!***

Thank you for your attention!

