

RISK MANAGEMENT PROGRAMME FOR BIOGAS PRODUCTION BY ANAEROBIC DIGESTION

In accordance with Government policy of promoting alternative fuel sources there has been a steady increase in biogas production plants.

This Guidance Note is limited to small/medium sized plant using anaerobic digestion tanks with feedstock primarily of farmyard slurries, energy crops or agricultural crop residue to produce hot water and/or electricity for own consumption with any surplus sold directly to the energy companies. It does not extend to merchant sites which accept a wide variety of biodegradable materials and generate income from electricity sales and gate fees nor to the production and conversion of biomethane for direct injection into the national grid.

This guidance is intended to provide appropriate risk management advice for biogas plant operators to help reduce the potential for losses.

The following information is provided for guidance only and for installers reference purposes

1) SCOPE OF BIOGAS PLANTS

- a) Output generally between 250 and 1500 kilowatts (kW) electrical generating capacity
- b) Digestate feedstock of animal manures and slurries, energy crops such as silage from maize or perennial grasses and fodder beet, food processing by-products and pack-house residues
- c) Operator either:
 - i) a large single farm or co-operative of several farms within a locality or
 - ii) non-farming operator using single source input from own operations (such as pack-house or food processing residue)
- d) Installations professionally designed and installed by competent engineering companies with experience in biogas installations
- e) Connections to the National Grid must be undertaken by appropriately qualified persons (Independent Connections Provider) approved by the Distribution Network Operator.

2) FIRE RISK ASSESSMENT

A fire risk assessment must be undertaken in accordance with the requirements of the Regulatory Reform (Fire Safety Order) 2005 or Fire (Scotland) Act 2005 and a copy should be lodged with the local fire prevention officer. This should identify the likely causes of ignition and fire spread within the plant and buildings and allow for effective control and fire safety measures to be introduced.

Further information and guidance may be found at the website for the Department for Communities and Local Government www.communities.gov.uk

3) DANGERS

The following dangers and risks may occur during the production and usage of biogas:

- a) danger to life and health by suffocation or poisoning in shafts and tanks due to presence of hydrogen sulphide (H₂S); methane (CH₄), and carbon dioxide (CO₂)
- b) health risks from fermentation by-products
- c) explosion by ignitable gas/air mixture
- d) fire hazards – plant rooms
- e) electrical hazards – plant rooms and generator
- f) build-up of condensation through cooling of gas/water mixture in pipes and subsequent freezing/blockage of pipes
- g) corrosion of components and subsequent failure caused by aggressive parts of the gas mix e.g. ammonia or hydrogen sulphide.

4) BUILDING/PLANT DESIGN

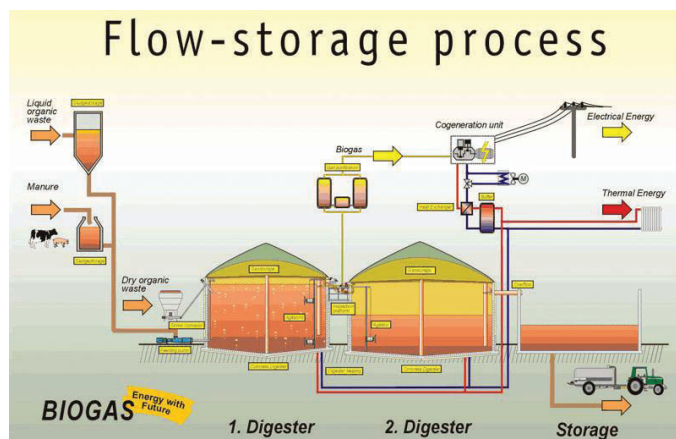
- a) The plant will normally comprise above ground digestion/fermentation tanks (typically primary and secondary) with the gas produced contained above the liquid mix within a double skin inflated foil or balloon roof. Systems may incorporate a stand alone flexible gas holder into which the gas is pumped prior to transmission to the Combined Heat & Power (CHP) engine(s). Gas is to be stored at no more than 50 mbar pressure with pressure relief valves fitted to allow venting to atmosphere



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- b) Alternate methods of biogas production utilise a series of interlinked below ground fermentation vessels feeding the CHP plant via a small scale gas holding tank
- c) A separate open topped tank is normally utilised for “spent” digestate storage prior to spreading on land as fertiliser
- d) Consideration of environmental issues and the potential for leaks to be undertaken and either an earth or concrete bund wall to be provided around the liquid tanks. A suitable small scale spill/leakage response to be developed.



5) SAFE DISTANCES

The distance of the biogas plant from other buildings or open storage on the property will depend on the volume of gas that potentially may be contained within the gas storage systems. Where it is not possible to achieve these safe distances due to restricted site boundaries it is possible to construct a protective fire wall between the plant and the surrounding buildings to deflect any fire/explosion. Such a wall to be to the full height of the buildings to be protected and conform to FR90 minutes fire rating (as defined within The FPA Design Guide for the Fire Protection of Buildings).

SAFE DISTANCE (M) FROM SURROUNDING PROPERTY

	Volume of gas in each tank (m ³)			
	Up to 300	300 - 1500	1500 - 5000	OVER 5000
Earth covered & underground storage tanks	3	6	10	15
Balloon, pillow or foil gas holders	4.5	10	15	20

6) HAZARD AREA ZONES

The design engineers to undertake suitable and sufficient assessment within the requirements of the Dangerous Substances and Explosive Atmosphere Regulations 2002 (DSEAR) and to ensure suitable ATEX compatible equipment is fitted. A copy of the Explosion Protection Zone plan to be made available and copies posted on site.

ZONE AREAS

- a) Zone 1 components are generally pressure relief vents, inspection hatches/windows and service openings on the gas tank. The Zone 1 designation will generally extend to a three dimensional radius of 1m from the opening where there is free ventilation
- b) Zone 2 explosion risk will extend for a radius of 3m around technical closed parts for the system, equipment connections and foil gas store
- c) It is unlikely there will be Zone 0 areas in a biogas installation (other than in the sealed combustion motor of the CHP plant)
- d) Suitable signage of the Zones to be provided around the plant and brought to the attention of employees and contractors.

7) CHP PLANT

- a) Plant rooms to be constructed from fire resisting materials and conform to FR90 minutes fire resistance. This area also to be subject to DSEAR assessment
- b) Containerised type plant to be positioned a safe distance from the biogas plant where possible (see table “safe distances”)
- c) Gas leak monitoring to be provided inside the plant room or container together with automatic fire detection
- d) The gas supply pipes to be provided with two gate valves which are self closing in the event of gas leak detection. One valve should be remote from the plant room
- e) Forced ventilation of the plant will be necessary in the event of gas leak detection by adequate ATEX protected air changing equipment to reduce maximum gas concentration below 1.5% vol
- f) Electrical control panels to be fitted with a suitable fixed automatic gaseous fire control system such as “Firetrace”.

8) SAFE OPERATING PROCEDURES

- a) The operation and maintenance of the systems is only to be carried out by specially trained personnel who are familiar with the systems, the operating instructions and with the safety requirements
- b) Operation instructions and protocol manuals to be available on site including instructions for breakdown and emergency situations
- c) Risk Assessments and safe systems of work to be developed for all operations including any breakdown and emergency situations. Special regard is necessary in the event of any potential to enter confined spaces or reduced oxygen atmospheres. These activities should normally only be undertaken by the installers
- d) Personal gas leak detection systems for plant operators should be considered
- e) In the event of CHP engine failure or maintenance a procedure to be developed to reduce output from the plant. If it is necessary to burn off biogas the burner to be positioned at least 30m from the plant.

9) MAINTENANCE

- a) All plant and equipment to be inspected, serviced and maintained in accordance with the manufacturer's recommendations by an approved and qualified engineer or suitably trained and qualified person under a strict permit to work system
- b) All records relating to periodic inspections, servicing and maintenance to be retained
- c) Contractors working on the plant to be approved and operate under a permit to work or control of contractors scheme
- d) Any proposed installation or changes to an existing biogas plant to be notified to your insurer
- e) The complete installation including gas producing plant and CHP plant to be subject to ongoing maintenance and servicing agreements by the installer or their appointed servicing agent.



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IMPORTANT NOTE

The information contained herein is designed for guidance only and NFU Mutual cannot accept responsibility for any errors or omissions arising from its use.

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