

Methanation: Discharges of hazardous or polluting materials

In recent years, methanation has been undergoing development in France, particularly in the circular economy. This industrial process is doubly advantageous as it creates value from organic waste material and is a source of energy. It can be used to process greasy or very wet organic waste that is not compostable, and reduces the amount of organic waste to be processed through other channels.

The increase in the number of anaerobic digestion plants over the last few years has been accompanied by an increase in accidents from which it is necessary to draw feedback. As illustrated by recent accidents, incidental or accidental events occur at the process level, when incoming material is received, and biogas is recovered.

The release of hazardous or polluting materials is the phenomenon that is most frequently encountered in accidents related to methanation. Two types of releases are observed:

- gaseous emissions (channelled, diffuse and fugitive) occur at various levels of the anaerobic digestion process. Biogas leaks are attributed to fugitive emissions from various equipment (piping systems, pumps, etc.). They can also be the source of fire and/or explosion risks;
- the release of materials due to the rupture or the loss of structural integrity. Non-retention of these materials on-site or non-retention of the mixture of these materials with rainwater is also observed and result in water and soil pollution.

It should also be noted that fires or explosions can lead to the release of hazardous or polluting materials.

[ARIA 53738](#) – 09/06/2019 – LOIR-ET-CHER

At around 4 a.m., a leak of **biogas** was discovered on a length of polyethylene piping between the biogas storage site and a site where gas is injected into the natural gas distribution network. A motorist had seen a "**cloud of smoke**" and contacted the fire brigade. A crater measuring slightly more than 1 m in diameter was seen on the ground [...].

The leak is believed to have been due to **overpressure** which caused the gas line supplying the injection station to rupture. A **pressure regulator malfunction** was suspected. This was thought to have caused a sudden increase in pressure and the immediate securing of the injection station, generating hammering on a coupling in the polyethylene network. The **volume of biomethane release was evaluated at more than 3,500 Nm³**. **Safety devices** built into the automation system controlling a valve **did not operate properly**. A **communication problem** with the remote site monitoring the installations, caused by an outage on the internet network, also **prevented a text alarm from being sent to the operator**. The remote control valves could not be closed until the on-site emergency stop button had been pressed [...].

Several **regulatory non-conformities** were noted: the absence of a list of equipment subject to in-service monitoring, absence of a control programme for pipes, and declarations and commissioning inspections not performed.



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Methanation in France

Various types of methanation facilities can be found in France:

- on farms,
- collective and/or centralised installations (receiving waste of various origins, including agricultural waste),
- in wastewater treatment plants (for sludge from water treatment plants),
- in the food industries,
- on bio-waste processing units (from selective waste collection),
- in mechanical biological treatment plants processing household waste.

[ARIA 56206](#) – 14/09/2020 – AUBE

At around 10:45 p.m., a **digestate leak** was detected on an **agitator shaft** in a methanation installation, and **380 m³ of fermentable material** spilt into the establishment's courtyard. Two days after the event, all the effluent had been pumped out and the topsoil scraped.

Maintenance and repair work was being performed on the agitator just a few hours before the event. Once the installation was reassembled and restarted, the agitator retracted into the tank, freeing up its opening and causing the digestate to leak out. **This particular phenomenon had not been included in the risk analysis** [...].

[ARIA 54788](#) – 24/11/2019 – YVELINES

At around 11 p.m., **biogas** was released into the atmosphere at a wastewater treatment plant. Following the shutdown of 2 cogeneration engines, the **biogas storage gasometer reached full capacity despite the flare being in operation** [...]. At the time of the event, the company was operating at **104% capacity**. The direct cause was a one-time defect in the automatic control system. [...]

[ARIA 53892](#) – 09/04/2019 – VENDEE

At around 2 p.m., a **digestate leak** occurred on an **underground pipe** on a plot of agricultural land. [...]

Slightly **less than 10 t of liquid digestate** of the 40 t present spilt onto the ground. The amount spilt was **greater than the recommended application rates** in the location where the leak occurred.

[ARIA 55959](#) – 17/08/2020 – FINISTERE

During the night, a digestate tank overflowed in a biogas plant during an **automated transfer operation in which no operator was present**. The liquid spilt onto the vehicle platform and into the rainwater drainage network. Once the rainwater basin was full (770 m³), **the effluents overflowed towards the outlet pipe** that discharged into a small stream leading to the **River Aulne**. The employees noted the situation upon their arrival at the site at 7:45 a.m.[...]. **Aquatic mortality**, attributed to ammonia nitrogen pollution, was noted in the stream. **A drinking water intake** was subsequently closed. As the water network had to remain under pressure, the plant was put back into operation, and a prefectural decree restricted the use of drinking water in 50 communities, **affecting 180,000 people**. Swimming and seashore fishing were prohibited. [...]

In all, **400 m³ of liquid digestate mixed with 200 m³ of rainwater containing 5.29 g/kg of total nitrogen** were released into the environment.

The origin of the event was attributed to **the failure of an automated control function**.



Experience feedback on the consequences of discharges of hazardous or polluting materials from methanation facilities has taught us the following lessons:

- ✓ **Ensure the quality of the installation's design** (conformity, suitability):
 - Tank construction defect ([ARIA 48311](#));
 - Choice of materials ([ARIA 52376](#));
 - Unsuitable retention basins ([ARIA 45391](#));
 - Programming of the automatic controller ([ARIA 55854](#));
- ✓ **Ensure compliance with the operating conditions and their relevance regarding:**
 - Operating procedures ([ARIA 53584](#));
 - Quantities authorised on-site ([ARIA 51523](#));
 - Compliance with organic load limits ([ARIA 50490](#));
 - Rainwater collection capacity ([ARIA 51053](#));
- ✓ **Ensure rigorous monitoring of installations to avoid, in particular:**
 - Corrosion on tank walls ([ARIA 41671](#));
 - Automatic controller faults ([ARIA 55959](#), [54788](#));
 - Clogging ([ARIA 53700](#));
 - Equipment problems: coupling leakage ([ARIA 56244](#)); probe failure ([ARIA 52817](#)), valve incorrectly closed ([ARIA 52565](#)), wear of a distribution auger ([ARIA 51744](#)), ...;
 - Presence of condensate ([ARIA 52237](#)), humidity in sensors ([ARIA 49450](#));
 - Pipe leakage ([ARIA 53892](#));
- ✓ **Particular attention should be given to maintenance operations on:**
 - The manner in which maintenance operations are organised ([ARIA 56206](#)) or whether intervals between them are too long ([ARIA 55532](#));
 - The total absence of biogas when emptying the tank ([ARIA 36683](#), [53990](#));
 - The management of subcontracting ([ARIA 51342](#), [53866](#));
- ✓ **Ensure that operators are trained** ([ARIA 50461](#), [56183](#));
- ✓ Take into account **the meteorological phenomena and their intensification** due to climate change: lightning ([ARIA 51672](#)); cold temperatures ([ARIA 49169](#)); high temperatures ([ARIA 49833](#)); rain/flooding ([ARIA 51523](#));
- ✓ Anticipate **power outages**, particularly for the process ([ARIA 51814](#)) or **electrical malfunctions** ([ARIA 48799](#)) and **Internet network outages** for alarm transmission purposes ([ARIA 53738](#));
- ✓ **Ensure site security to limit malicious intent** ([ARIA 55078](#)).