Watercourse pollution resulting from the release of liquid manure from a pig farm

02/04/2021

Taulé (FINISTÈRE)

France

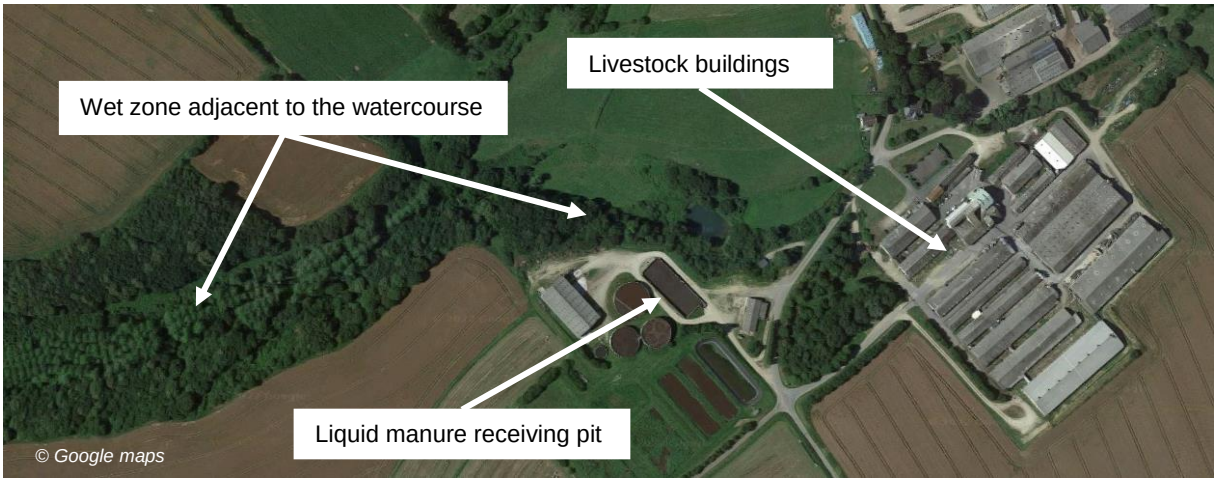
Farming operation
Effluents
Piping
Disconnection
Overflow
Environmental impact

INSTALLATIONS CONCERNED

The subject of this report is a pig farm that had been granted operating authorisation in 1993 (Prefectoral order completed in 2004) for a capacity of 20,975 animals distributed among two sites located 500 m from one another. The overall establishment is a classified facility for environmental protection (French regulation ICPE) requiring authorisation under ICPE section 3660 (intensive animal farming)[1]. It is subject to European directive No. 2010/75/EU of 24 November 2010 on industrial emissions (the Industrial Emissions Directive or IED)[2].

The accident concerned the buildings of the “farrowing” section and the equipment in the biological treatment station dealing with liquid manure (slurry) effluents. The liquid manure, a liquid mixture of pig excrement and urine, can be spread out, raw, or undergo various treatments: receiving, centrifugation, aeration, decanting with composting for the solid elements and tertiary treatment for the liquid part with slurry spraying of fields. It should be noted that another site, specific to fattening operations, is located approximately 500 m away.

The livestock buildings are equipped with pre-tanks, located under the floor grates where the animals are housed. These pre-tanks are designed to collect the excrement. The pre-tanks are connected to the pits, then to a pit receiving all the effluents from both operating sites at the effluent treatment station. Transfers are mainly performed via a network of underground pipes. Depending on the configuration of the buildings, the transfer operation is performed by a pumping lorry equipped with a manual pump (manual connection to the fixed transfer network) or by gravity via removable piping.



[1] Intensive pig units with more than 2,000 places for production pigs (over 30 kg) and/or with more than 750 places for sows fall under section 3660 of the ICPE nomenclature.
[2] At the European level, the IED defines an integrated approach to the prevention and reduction of pollution emissions by the industrial and agricultural installations that fall within its scope.

THE ACCIDENT, ITS CHRONOLOGY, EFFECTS AND CONSEQUENCES

The accident:

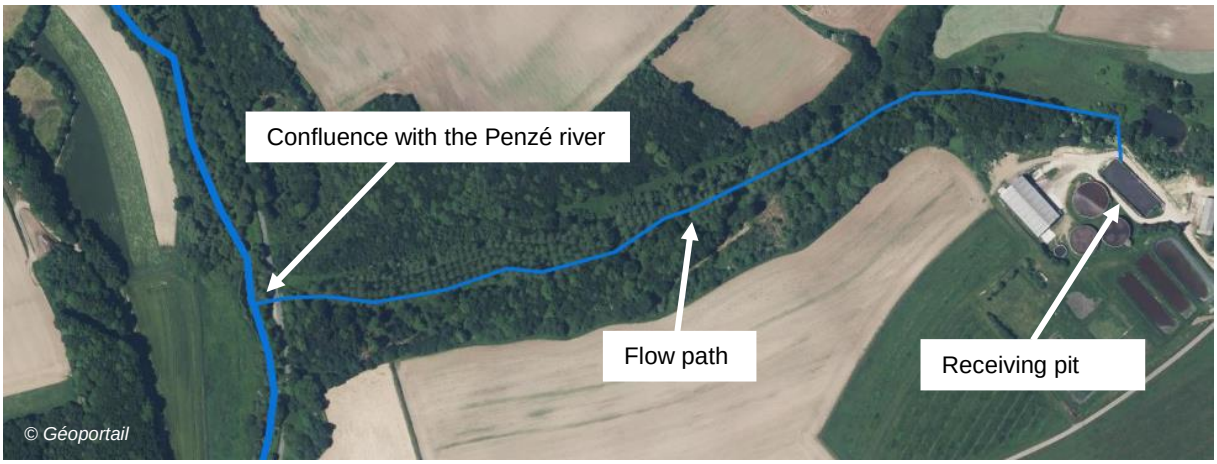
On 2 April 2021, at around 3:30 p.m., the driver who was making trips back and forth between the slurry receiving pit and the various fields being sprayed, noticed that the pit was overflowing. This pit had a total capacity of 2,808 m³.

Having been warned by the driver, the operator asked his crews to search for the overflow source, reduce the level in the receiving pit, stop the influx of effluents from the 2nd site and increase the spreading rate. The overflowing liquid manure made its way to the stream located just 30 m below the pit via openings in the site's berm enclosure. The operator estimated the release to be between 50 and 100 m³.


© Operator

The distance between the effluent receiving pit and the confluence of the PENZÉ river is approximately 820 m. The confluence is located approximately 1.5 km from the sea.

To limit the site's environmental impact, the operator has installed a filter (straw) upstream of the confluence with PENZÉ.



Consequences of this accident:

Fishermen and people close to the port of Penzé observed foaming, abnormal colouration in the watercourses, and a powerful smell characteristic of liquid manure (an ammonia smell). The following day, the French Office for Biodiversity (OFB), accompanied by two approved associations for fishing and protection of aquatic environments (AAPPMA) and the French Fishing Federation, went to the site to assess the environmental impact along the PENZÉ (1.5 km between the confluence with the stream involved and the sea) and the KERJEAN tributary (over approximately 1 km). Amongst the several hundred dead fish collected or remaining on the river bed, mortality of endangered and red-listed species was also noted: brook lamprey[3] (*Lampetra planeri*), brown trout[4] (*Salmo trutta*) and Atlantic salmon (*Salmo salar* - not found dead in the environment by the OFB on 03/04/2021 but collected by fishermen and displayed). The brook lamprey and the brown trout are protected species at the national (Orders of 08/12/1988 and 23/04/2008) and European levels (Annex II of the EU Habitats Directive).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On the sections exposed to the accidental discharge, the examination of the biological and physiochemical parameters conducted in June 2021 showed that, although the biological

[3] https://inpn.mnhn.fr/espece/cd_nom/66333/
[4] https://inpn.mnhn.fr/espece/cd_nom/67772

status remained “good” according to the IPR (*Indice Poissons Rivière*, i.e. Fish River Index), the populations of brown trout and lampreys were less rich downstream of the confluence than upstream (3 times and 10 times less numerous, respectively).

European scale of industrial accidents:

By applying the rating rules applicable to the 18 parameters of the scale officially adopted in February 1994 by the Member States' Competent Authority Committee for implementing the "SEVESO" Directive for hazardous substances, and in light of available information, this accident can be characterised by the following four indices:

Hazardous substances released	☐ ☐ ☐ ☐ ☐ ☐
Human and social consequences	☐ ☐ ☐ ☐ ☐ ☐
Environmental consequences	■ ■ ■ ■ ■ ■
Economic consequences	☐ ☐ ☐ ☐ ☐ ☐

The parameters associated with these indices and their rating scale are available on the website: https://www.aria.developpement-durable.gouv.fr/in-case-of-accident/european-scale-of-industrial-accidents/?lang=en

Hazardous materials released: liquid manure is not a hazardous substance in the sense of the SEVESO Directive; level 0 of the scale.

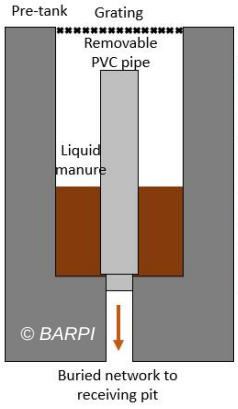
Human and social consequences: as no human and social consequences (e.g. no deprivation of drinking water) were reported, level 0 of the scale.

Environmental consequences (Env11): as the proportion (P) of protected species (brook lamprey and brown trout) destroyed as a result of the release is greater than 50%; level 6.

Economic consequences: BARPI does not have sufficient information to classify the accident according to this parameter. By default, level 0.

THE ORIGIN, CAUSES AND CIRCUMSTANCES SURROUNDING THIS ACCIDENT

On the morning of the release, an employee emptied pre-tanks under a building equipped with 14 pre-tanks. To perform this operation, he had removed the PVC pipe blocking the drain opening in the bottom of the pre-tank to allow the effluent to flow by gravity to the receiving pit via an underground network. However, as the piping was plugged, the employee attempted to clear the transfer network using a “snake” connected to a high-pressure cleaning pump. At the same time, since early morning and in preparation for sowing corn, a driver had been performing slurry spreading operations. Every 15 minutes, he would travel and forth between the liquid manure receiving pit and the fields, with a spraying rate of approximately 100 m³/h. Due to the obstruction in the network, the farm manager asked the employees of the fattening site (located 500 m away) to supply the receiving pit so that the slurry spreading operations could continue. The driver was not worried by the increase in the pit’s level. At around 3:30 p.m., he noticed the overflow on his way back to the pit and alerted his manager. In the meantime, the pipe had become unplugged, and the slurry had spilt into the receiving pit.



Removable PVC pipe

The operator located the origin of the unexpected discharge of slurry into the pit at the drain of the building’s two pre-tanks for which the unplugging operation was performed. The removable PVC pipes used to keep the pre-tanks separate from the underground network leading to the receiving pit were no longer in position. During the unplugging operation, an influx of air was created upstream of the pipe, causing the pipe to shift out of place; the connector (male/male) on the orifice showed a risk of becoming disconnected. Although there is a guillotine valve close to these 2 pits to close off the network, it is not automated.

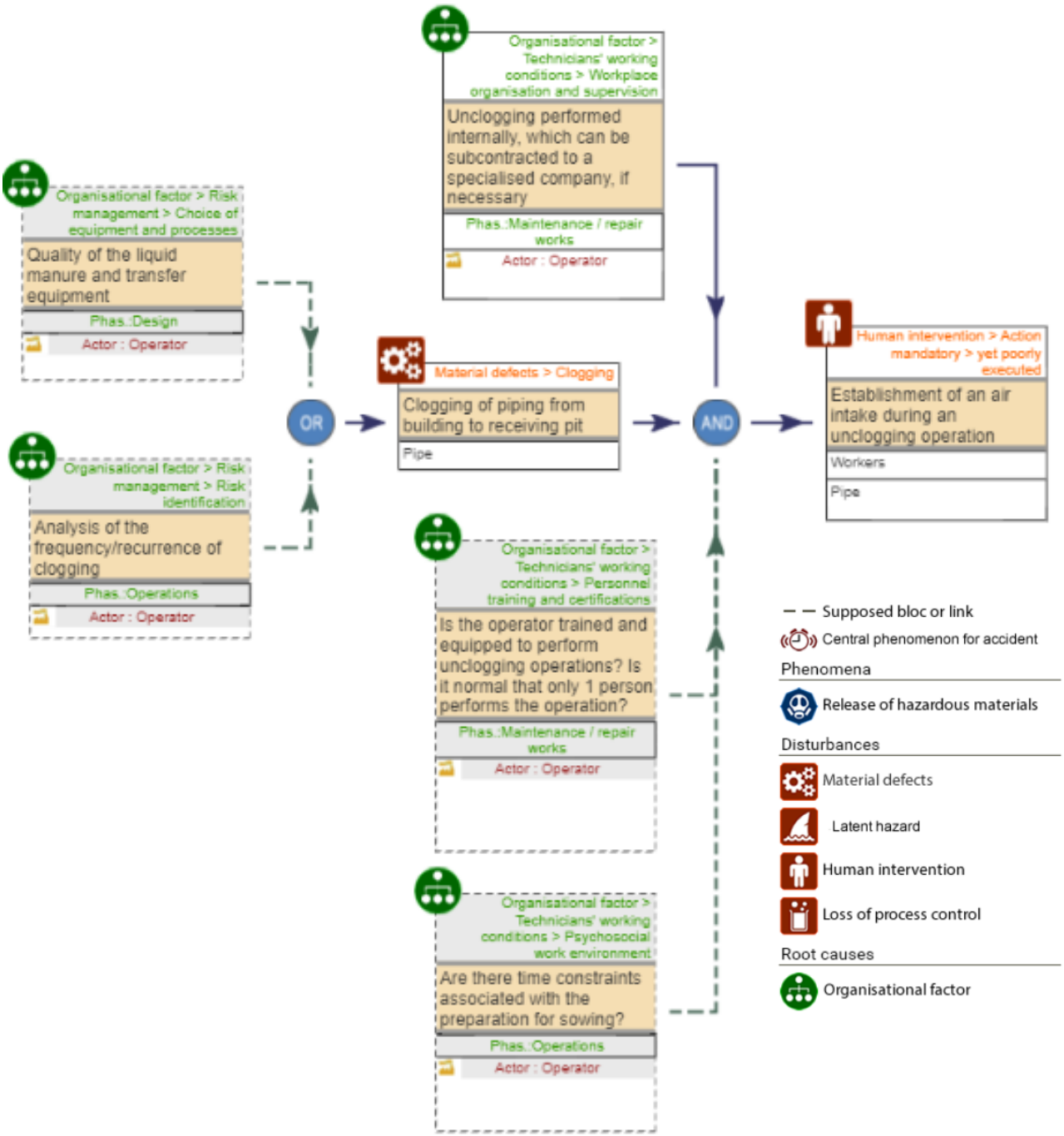
It was estimated that 300 m³ of excess slurry was released into the receiving pit. The PVC pipes used to close off the pre-tanks were put

back in place, putting an end to the transfer operation to the pit and thus causing it to overflow at about 5pm.

For each of the sections detailed below, BARPI presents its analysis of the disturbances (or initial causes) and root causes of the accident in the form of a graphic model. An overall graphic model of the accident is presented at the end of this section. Disturbances designate the set of direct malfunctions contributing to the event. They can be observed and are often of a technical or individual nature. The root causes, located upstream from the disturbances, are associated with human, organisational and managerial factors.

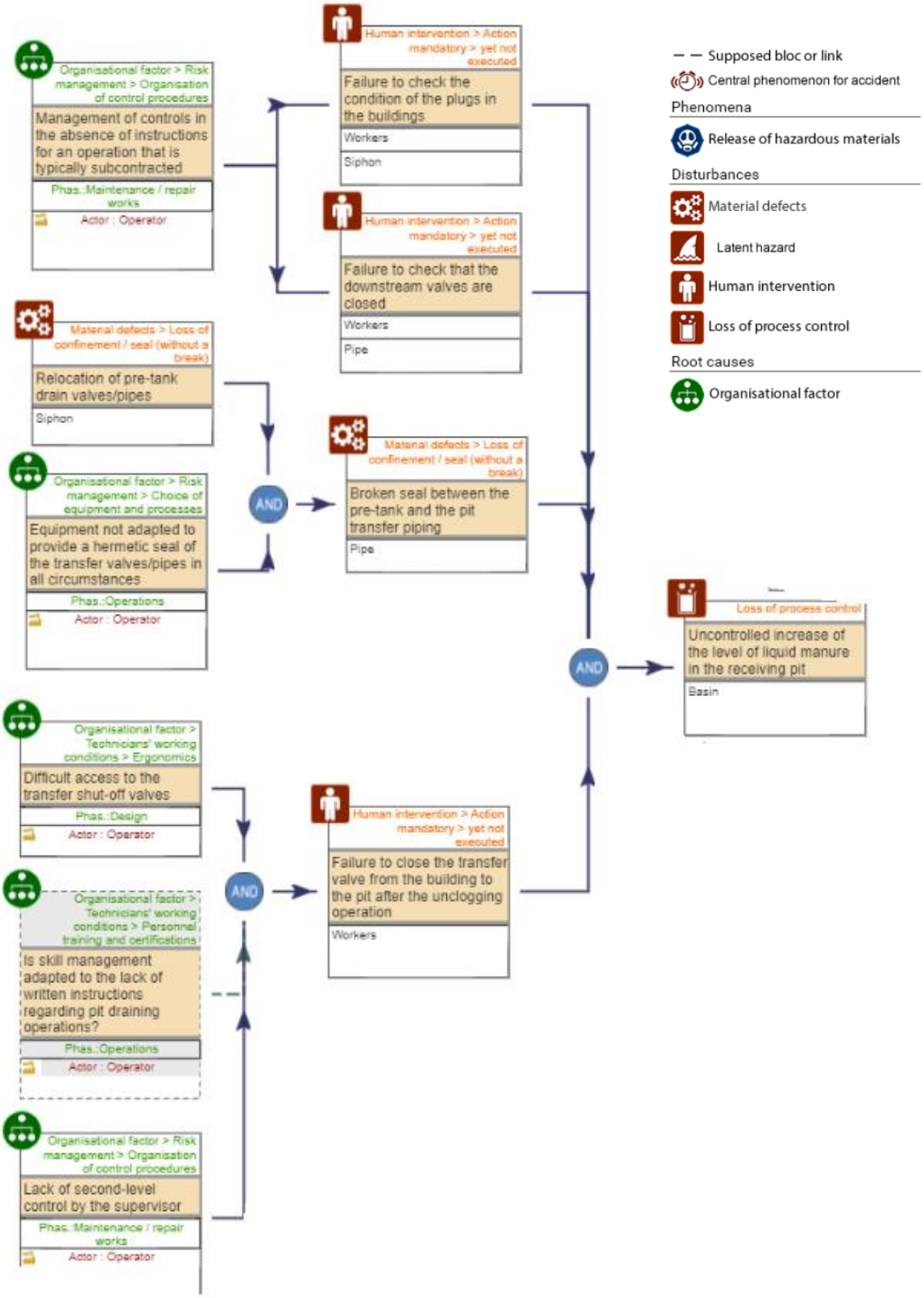
Origin of the discharge from the pre-tanks

The operation to unplug the pipe was performed by an employee. The operator plans to call upon a specialised company if the employees cannot resolve the situation in the future. The blocks and links shown with dashed lines are assumptions made by BARPI in its accident analysis. They are to be considered points for reflection, and their root causes are to be sought.



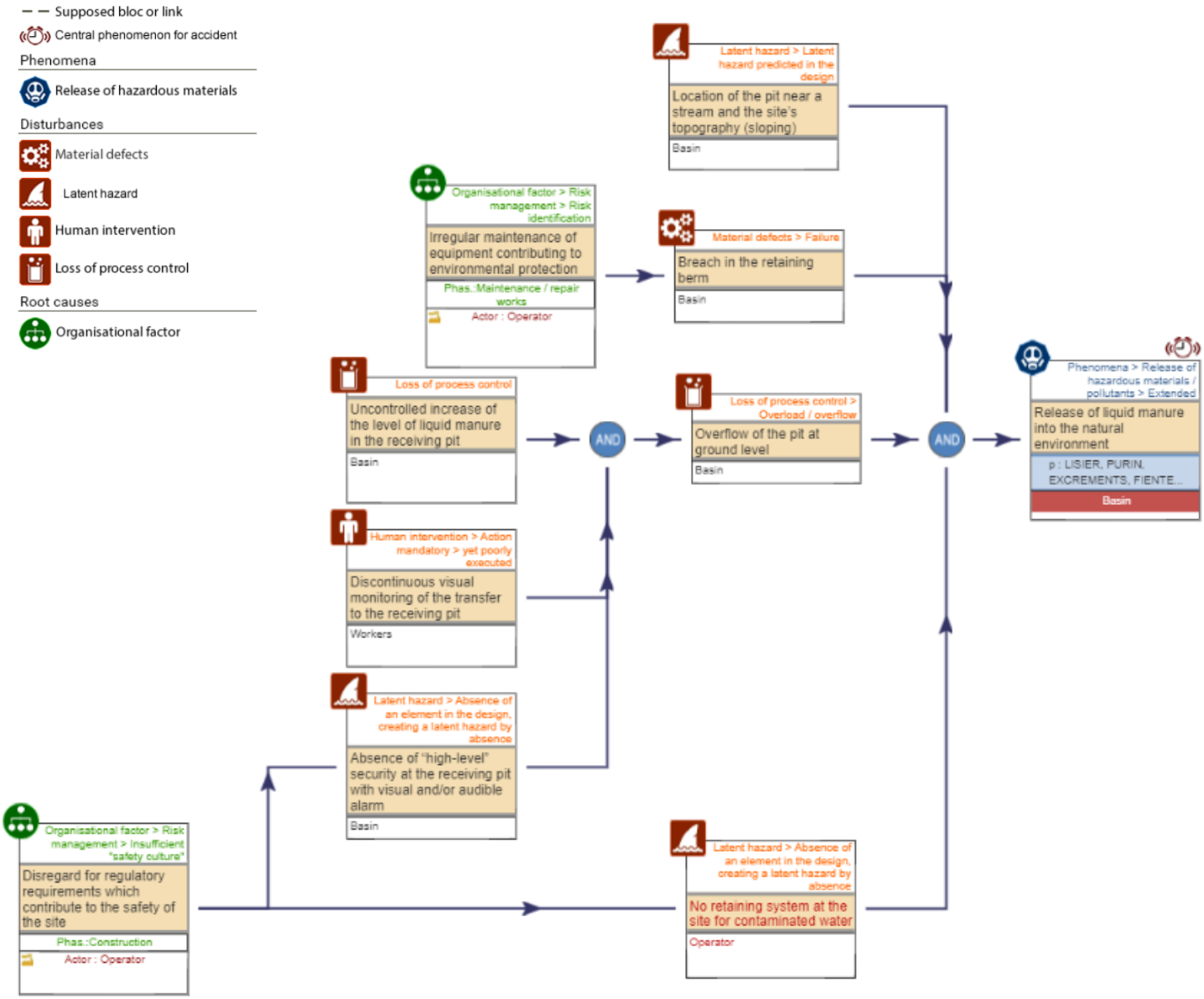
Uncontrolled increase in the receiving pit's level:

The increase in the pit's level was caused by the untimely drainage of the 2 pre-tanks. The inflow of 300 m^3 of slurry was made possible by unsuitable equipment (removable PVC pipes with male/male connections for emptying pre-tanks and a guillotine valve that was not easily accessible and not servo-controlled) and the absence of control/verification of the correct positioning of this equipment following a sensitive operation (unplugging of a pipe).



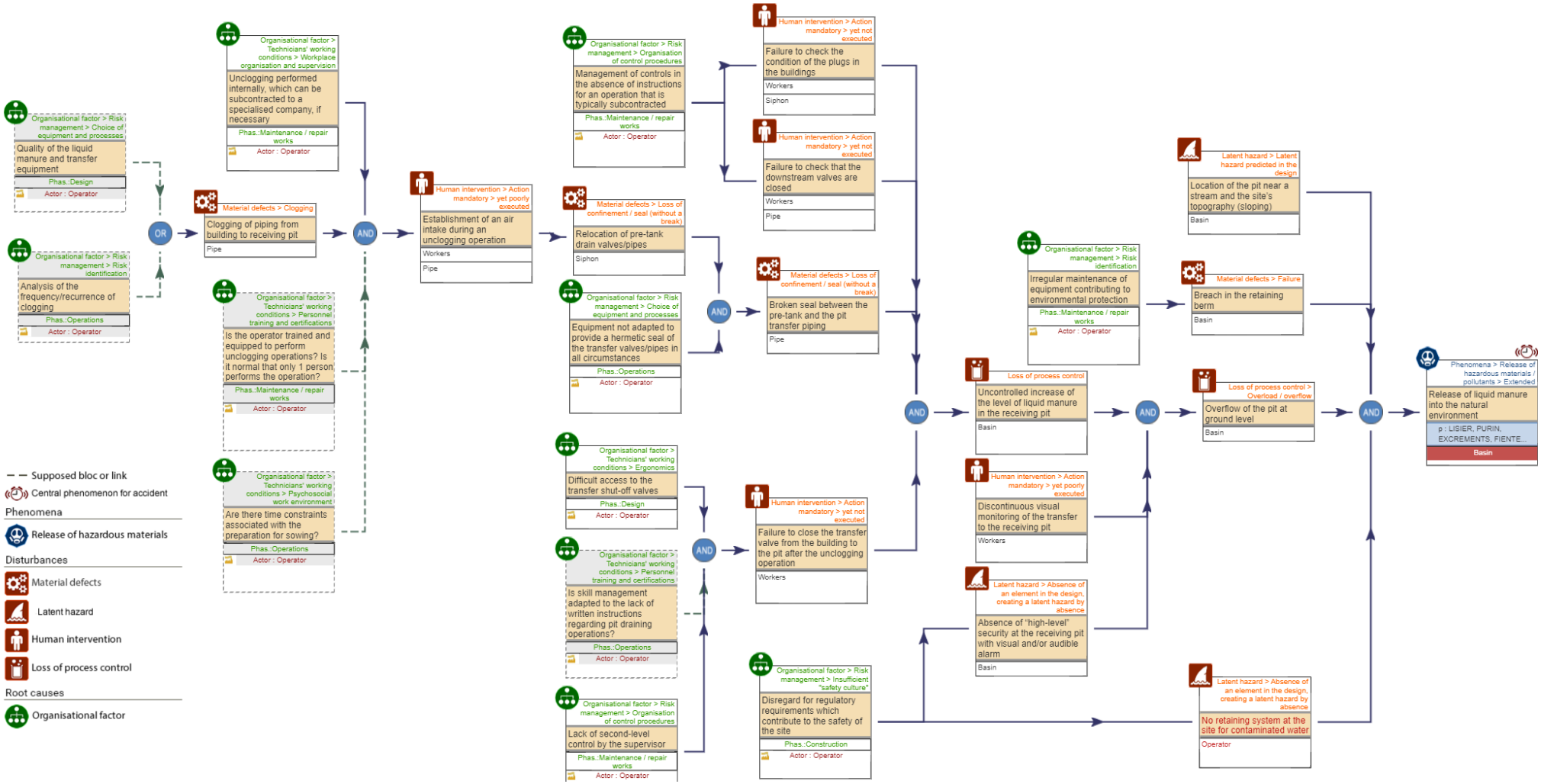
Overflow of the receiving pit and environmental impact

The overflow of the receiving pit leading to the discharge of liquid manure (slurry) into the natural environment is a consequence of an uncontrolled increase in its level. The overflow, and the subsequent impact on the natural environment, was rendered possible by the lack of mitigation/recovery measures for the degraded situation, some of which were regulatory obligations and attributable to poor maintenance of the only existing barrier (a breached retaining berm).



The following page shows the entire graphic model and provides an understanding of the causal links between the emptying of the pre-tanks, the uncontrolled increase in the receiving pit's level, its overflowing and the impact on the natural environment.

Graphic modelling of the disturbances and root causes of the accident:



ACTIONS TAKEN

The operator implemented emergency measures in the days following the accident:

- filling in of the drainage ditch leading to the stream below the retaining pit;
- creation of a ditch with an additional berm to eliminate direct run-off into the environment.

Following the event, an order was issued to implement emergency measures, and the Prefect issued a formal notice requiring the operator to undertake the following steps:

- conduct an impact study of the pollution in the aquatic environment to define possible measures to restore and monitor the environment;
- create a retaining basin with a sectional valve at the edges of the receiving pit;
- create a stormwater balancing tank upstream of the watercourse;
- cover the receiving pit;
- conduct a study of the risks of accidental water pollution from its two sites;
- establish written environmental management and internal organisation procedures.

In response, the operator plans to:

- modify the shut-off/communication system between the pre-tanks and the underground network with the receiving pit. The PVC pipes that exited their seating have been replaced, in all the buildings, by a custom-made plug consisting of a cone and stainless steel piping;
- servo-control of shut-off valves on the transfer network with level measurement in the receiving pit (valves held in the closed position when not in transfer mode);
- create an additional ditch below the farrowing building and the other site;
- create a run-off water collection and transfer network to a new retaining pond for each site (no connection between the stormwater and slurry networks).

From an operational point of view, the operator has:

- dedicated and expanded employee training to transfer operations and the risks associated with effluents;
- drafted procedures for actions to be taken before, during and after transfer operations (liquid manure operations at night, during the weekend and without human surveillance are prohibited);
- specified the following measures:
    - inspection of safety devices;
    - verification that pumps are switched off and valves are closed after each transfer operation at the end of each workday;
    - weekly check of the structural integrity and outlets of the retaining ponds.

LESSONS LEARNT

The analysis of this accident reminds us of the importance of good effluent management in controlling risks. Accidental discharges of liquid manure have significant environmental consequences, especially when they reach waterways. Risk analysis is essential to locate the weak points in the natural environment, the potential discharge sources and the technical and organisational safety barriers to be implemented to prevent them. These barriers must be checked, maintained and reviewed over time to remain efficient.

Below, and short of being exhaustive, BARPI lists the various places likely to cause accidental pollution on a farm and a few measures and checks to be implemented. This list, although it can be applied to various types of farms, must be adapted to the specific characteristics of each site and its environment:

Equipment and locations where there is a risk of accidental release	Technical and organisational measures
Storage facilities and treatment plant	• siting in line with the topography of the site and the sensitivity of the natural environment; • regular inspection of the civil engineering; • cover of pits; • implementation of high-level security measures; • installation of easily accessible shut-off valves linked to the high-level safety system; • guaranteeing the watertightness of the connection of the pre-tank plugs; • ergonomics of interventions: make the valves or pipes easily accessible or to be put in place; • conduct effluent transfers under human supervision and during the day; • conduct checks on safety equipment before, during and after transfer operations and at the end of each day.
Piping	• inspection of their condition; • subcontract complex unclogging operations; • verification of the resistance, tightness and suitability of pre-tank fittings and plugs; • protection of overhead pipes and verification that no effluents are coming up through buried pipes; • in case of breakage or leakage, protection and sealing of the manholes and the stormwater network and identification of the installation's drains.
Berms and ditches	• checking of their overall condition (in all seasons and after climatic events - rain, floods, droughts); • knowledge of the topography of the site and the various low points and outlets.
Run-off management	• creation of a retention area with a shut-off valve; • checking the condition of gutters and manholes.
Irrigation equipment (not involved in the accident presented in this report)	• monitoring of the condition and maintenance of pipes; • verification of the orientation of the spread and the topography of the site; • verification of the quality of the effluent treated.