

## Disposal of wood treatment product

22<sup>nd</sup> April, 2008

Lannilis - Finistère

France

Toxic releases  
Wood treatment  
Water pollution  
Organization and  
human failure

### THE FACILITIES INVOLVED

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The plant was specialised in a full set of wood-related activities: selling, storing, cutting, planing, gluing and treating for parasites. A workforce of 120 was employed onsite. From a topographical perspective, the facility was located on a dome formation outside of any flood zone.

The site was subjected to regulations for Classified Facilities. An operating permit had been granted for these activities on 6<sup>th</sup> November, 1984 (under heading number 2415). Groundwater quality was being monitored for regulatory compliance, with results transmitted every six months to the Classified Facilities Inspectorate.

The presence of dust in the aisles, in addition to worn slabs in some spots, deteriorated curbs and objects found on the bottom of retention basins, were all cited as areas requiring improvement regarding site maintenance, as recorded by the Inspectorate prior to the accident.

A major works program was undertaken on the site in 2005 and 2006, involving: placement of a protective awning above the wood treatment activities, improved layout of the treated wood drying zone, and an asbestos testing station.

#### The industrial process used:

In order to protect the wood from humidity, mushrooms and insects, an autoclave-based treatment with a vacuum phase and another pressurised phase was applied to impregnate the wood down to its core with preservatives. At the end of this process, the wood was recognisable by its green colour.



The wood treatment autoclave - Source: SDIS 29 (Departmental Fire Services)

The wood treatment liquid was composed of an active product (containing, among other compounds, propiconazole, tebuconazole and copper carbonate) diluted to 3.4% in water.

The pertinent safety data sheet indicated the following information and hazards:

- ⤴ bluish colour turning greenish, completely soluble due to the presence of copper carbonate in the product;
- ⤴ risk of severe ocular lesions in case of exposure to eyes;
- ⤴ noxious if ingested;
- ⤴ highly toxic for aquatic organisms, capable of causing deleterious long-term impacts on the aquatic environment.

## THE ACCIDENT, ITS CHRONOLOGY, EFFECTS AND CONSEQUENCES

Around 9:30 am, during the autoclave's first use, its door suddenly opened while the treatment product was still under pressure (11 bar). Given the door's size and the presence of pressure, the product spewed out in a single wave, with a large volume flowing over the retention basin edge. The quantity dispersed then separated into two volumes.

One portion of the liquid headed towards the wood storage zones, which had been built with concrete flooring, while the remainder flowed towards offsite storage and material handling zones. These zones were all equipped with manholes connected to the facility's stormwater drainage network, which itself fed the city's storm drain system.

### Consequences of this accident:

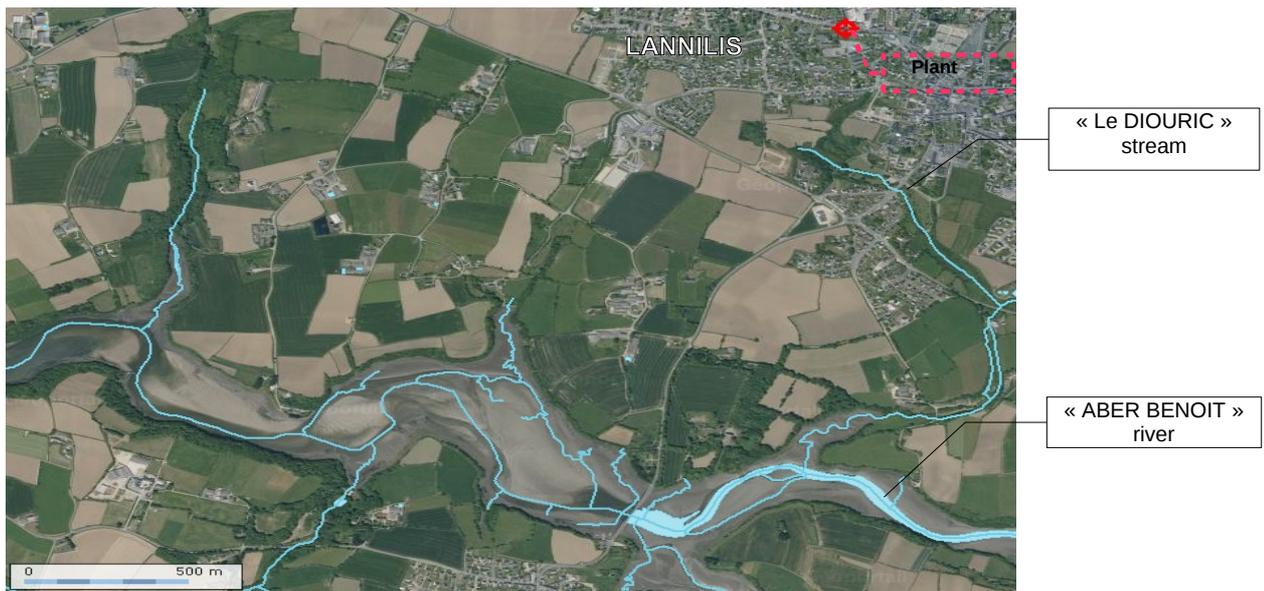
#### Hazardous substances released:

At the time of the accident, the autoclave, with a 44-m<sup>3</sup> capacity, contained wood and 41 m<sup>3</sup> of treatment product. The volume of liquid dispersed was estimated at 39 m<sup>3</sup>, given the fact that the wood had only absorbed approx. 5%.

Of these 39 m<sup>3</sup>:

- ⤴ 17.5 m<sup>3</sup> were re-pumped directly by the operator into the retention basins and then returned to the storage tank;
- ⤴ 8.5 m<sup>3</sup> were pumped, on April 22<sup>nd</sup> and 23<sup>rd</sup>, by a specialised company at various points in the storm drain network: manholes, gutters, sumps, etc.;
- ⤴ a portion was captured using an absorbent (sawdust) dispersed by some 10 plant employees onto the wood storage surfaces and the intermediate aisles;
- ⤴ the remaining volume reached the site's stormwater pipe network (extending about 100 m), then made its way into the Lannilis municipal storm drain system (a 700-m stretch) and ultimately to the natural environment, at the outlet on the "Le DIOURIC" stream, which discharged into the "ABER BENOIT" River 2 km further downstream.

The quantity of wood preservative flowing into the site's stormwater drainage network was estimated at between 8 and 12 m<sup>3</sup>. Cleaning of Lannilis' municipal storm drains allowed recovering a small portion of this volume. In all, the quantity reaching "Le DIOURIC" watercourse was on the order of 6 to 10 m<sup>3</sup>, as the product dilution in water made this quantity impossible to recover.



Hydrographic profile - Source: Géoportail

**Environmental impacts:**

Subsequent to this event, the Le DIOURIC stream turned a blue colour that drew the attention of a group of hikers. High mortality rates among the aquatic fauna (crabs, worms) were observed over a 300 to 400-m stretch of river, where the municipal drain outlet was located. In contrast, no aberrant mortality was detected in the ABER BENOIT River; nonetheless, traces of copper sulphate were discovered and removed by scraping.



Bluish discoloration of "Le DIOURIC" - source : SDIS 29



Fish mortality - source : SDIS 29

**The 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 on handling hazardous substances, and in light of information available, this accident can be characterised by the four following indices :

Dangerous materials released		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Human and social consequences		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Environmental consequences		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Economic consequences		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The parameters composing these indices and their corresponding rating protocol are available from the following Website: <http://www.aria.developpement-durable.gouv.fr>.

The "Dangerous materials released" index was rated a "4", due to the 41 m<sup>3</sup> of phytosanitary product discharged from the autoclave ('Parameter Q1'), as the substance composing this product was assigned a 20-tonne Seveso threshold (given its extreme toxicity for the aquatic environment, according to the product safety data sheet).

The "environmental consequences" index was scored a "3" in recognition of the fact that the product flow covered more than 2 km along both the Le DIOURIC and ABER BENOIT Rivers ('Environment 14').

The "human and social consequences" index was left at "0" since this accident did not result in any deaths, injuries or need to evacuate local residents.

The "economic consequences" index was not scored given the lack of information available relative to this indicator.

**THE ORIGIN, CAUSES AND CIRCUMSTANCES SURROUNDING THIS ACCIDENT**

According to the investigation, the untimely opening of the autoclave door had apparently been caused by human error on the part of a technician. One of the two mechanical safety devices on the equipment had been displaced.

Moreover, a hydraulic jack hose used to lock the equipment was found in a poor state of repair.

## ACTIONS TAKEN

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### Actions taken to mitigate the environmental impact:

Once the site's alarm had sounded, personnel at the wood treatment company began to:

- ✦ pump the spilled product into the site's various retention facilities;
- ✦ spread sawdust on the floor;
- ✦ install barriers made of sawdust, wood chips and sand around the site's storm drain manholes.

Over the ensuing days, these measures were strengthened as follows:

- ✦ 23<sup>rd</sup> April: pumping by a specialist subcontractor of the plant's stormwater pipes, manholes, gutters and sump bottoms;
- ✦ 24<sup>th</sup> April: cleaning of Lannilis' municipal storm drain network by a specialised firm;
- ✦ 25<sup>th</sup> April: Scouring operations along the entire length of the DIOURIC stream.

In conjunction with these actions, the mayors of the municipalities of Lannilis and nearby Treglonou enacted several administrative orders to ban fishing and harvesting watercress in the DIOURIC stream. A temporary order restricting fishing, collecting and transporting any of the shellfish, fish or crustaceans found in the ABER BENOIT was also issued as a Prefectural decree dated 22<sup>nd</sup> April, 2008.

This decision caused consternation within the local oyster industry, even though a portion of their production had remained protected at other more distant sites. These producers filed a complaint with the gendarmerie, along with fishermen associations, on the grounds of operator failure to report the incident in a timely manner. As a case in point, fire-fighters were only alerted at the beginning of the afternoon even though the accident had occurred around 9:30 am.

### Administrative monitoring:

The Classified Facilities Inspectorate visited the site on 25<sup>th</sup> April and observed that the cleaning of Lannilis' stormwater drains had been completed. The municipality's Public Works staff, assisted by fire-fighters and wood treatment company personnel, was also proceeding with cleaning operations on the DIOURIC stream.

Inspectorate officers however made note of shortcomings in the way the operator was running the plant. The Prefecture thus issued an injunction requiring the operator to comply with the following measures within 2 weeks' time:

- ✦ improved layout of floors, collectors, buffer collection tanks and discharge basins, pipes, etc. to prevent, under any circumstances, a direct or indirect spill, even accidentally, of toxic or polluting substances spreading to the natural environment;
- ✦ implementation of precautions in order to avoid, in the event of an accident, conveying any treatment product outside the plant premises.

In addition, this Prefectural injunction ordered the operator to:

- ✦ completely empty the plant site of all liquid waste and fouled sawdust;
- ✦ conduct an evaluation of the extent and consequences of the resultant pollution (in the form of an ecosystem assessment or any equivalent approach);
- ✦ update once again its previous hydrogeological study.

On 14<sup>th</sup> May, 2008, the Inspectorate conducted another site inspection and noted that all prescribed works had been satisfactorily completed. Inspectors also observed improved site organisation as regards the application of measures intended to avoid any discharge, even accidental, of treatment products into the external environment.

### Waste treatment:

All liquid waste produced during this accident was handled by a specialist subcontractor. A company based in Brest was commissioned to dispose of solid waste. The sludge generated by cleaning operations on the DIOURIC stream (approx. 10 m<sup>3</sup>) were analysed prior to being shipped to an appropriate treatment facility.

### Site operations:

Subsequent to this accident, the operator stopped all use of the site's autoclave and agreed not to resume autoclave operations until its modification, along with site renovations and a general reorganisation of the plant's activity.

Modifications to treatment process equipment entailed:

- ✦ changing the door;
- ✦ introducing mechanical safety devices plus complementary electrical safety features;
- ✦ expanding the equipment retention facilities;
- ✦ improving communications between the various retention functions beneath the autoclave;
- ✦ installing a sealed deflector to the left of the autoclave door in order to channel the product back to the retention facility in the event of splattering.

Site modifications were focused on:

- ⤴ installing shutoff valves on 2 stormwater drain outlets, in addition to the provision of printed instructions;
- ⤴ creating an additional retention basin with a 2.2-m<sup>3</sup> capacity;
- ⤴ reconfiguring the treated wood drying zone so as to yield a 7-m<sup>3</sup> retention basin doubling as a loading / unloading zone.

Lastly, as regards revisions to the operational organisation, it was decided that:

- ⤴ the technician's log attached to the autoclave pipe would be updated and kept current;
- ⤴ the technician responsible for the accident would repeat the training sequence;
- ⤴ instructions would be displayed on all workstations throughout the installation.

### Environmental impacts:

The various media capable of being polluted were the following:

- ⤴ groundwater;
- ⤴ surface watercourses (Le DIOURIC and ABER BENOIT rivers);
- ⤴ fish populations, with impacts on shellfish farming activities in particular.

Air impacts were not taken into account because the wood treatment product was not readily airborne.

The ground areas outside the site were not polluted since the product had been well channelled into the stormwater drainage network before flowing into the two watercourses.

A consultant was commissioned by the operator, at the behest of the Classified Facilities Inspectorate, to assess the level of both groundwater and surface water pollution. As for the aquatic fauna, various public bodies contributed expert appraisals.

#### Groundwater:

A sampling campaign was conducted about 2 weeks before the accident, as part of the groundwater self-monitoring plan imposed on the operator, thereby providing a benchmark status report on the environment.

Subsequent to release of the consultant's findings, traces of wood treatment product were detected around 2 of the 3 piezometers installed after the accident. The pollutant contents recorded were below threshold values for untreated water yet higher than regulatory drinking water values. Only an extensive monitoring program over time would allow drawing conclusions regarding the long-term pollution impact.

In July 2008, due to a lack of data recordings, the consultant was unable to issue a conclusion on the suitability of this water supply for use in vegetable gardens and suggested adding piezometers to the network set up north of the site. The operator wound up adopting this suggestion.

#### Surface watercourses:

Immediately following the accident, a deterioration was noticed in the quality of Le DIOURIC water. In contrast, according to the consultant, water quality had improved substantially between 25<sup>th</sup> April and 29<sup>th</sup> May, 2008, at which time all pollutant contents were below their regulatory thresholds.

#### Aquatic environment:

A specialised body performed a site inspection during the afternoon of 23<sup>rd</sup> April, in recording a number of observations on the upstream part of the ABER BENOIT, more precisely at the level of the Trouz ar C'Hant cove, where Le DIOURIC flows into the estuary. Many mounds of dead polychaete (bristle worms) could be identified in the Le DIOURIC riverbed.



A polychaete (bristle worm) - All rights reserved

On 24<sup>th</sup> April, the mounds of dead polychaete were less voluminous and had apparently been washed away by the tides. Moreover, live polychaete were found in the upper part of the foreshore, which served to demonstrate that:

- ⤴ The pollution wave arrived as the tide was going out;
- ⤴ The foreshore in this downstream part of the ABER BENOIT was already dry;
- ⤴ The impact was thus quite rapid and limited to just the Le DIOURIC runoff zone;
- ⤴ The next incoming tide would not have caused any new impact, given that the product had been diluting since the morning hours.

A specialised body was commissioned on 6<sup>th</sup> May by the various State agencies to provide scientific and technical justification for:

- ⤴ the interpretation of results obtained from the water and shellfish analyses regarding the acute and chronic toxicity of substances contained in the wood treatment product;
- ⤴ a proposed protocol calling for additional sampling of shellfish, water and sediments in order to establish the requisite conditions for reopening the zone.

The findings of this body were issued on 14<sup>th</sup> May, 2008.

Relative to the interpretation of water and shellfish analyses, experts concluded that "according to available data, contamination levels during the first few days following the spill were not capable of inducing, under very conservative hypotheses, exposure levels exceeding the benchmark values defined for propiconazole and tebuconazole (i.e. the two wood treatment product components)".

Given the tendency of both tebuconazole and propiconazole to accumulate in living tissue, it seemed an opportune time for the expert body to verify the existence of a bioaccumulation effect in the farmed shellfish as well as the fish caught in the ABER BENOIT, prior to initiating a contamination monitoring campaign.

Lastly, the body indicated its intention to conduct sampling at various distances from the pollution source (e.g. 100 m, 500 m, 1 km, 2 km, 2.5 km). At each selected point, 5 samples composed of 5 individual specimens of the same species had to be extracted for analysis.

## LESSONS LEARNT

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This accident has demonstrated the benefit of reinforcing actions aimed at preventing and containing accidental water pollution. The inventory of toxic products and their management, storage and implementation conditions all demand constant attention. The consequences of this event were "limited", but they could have been much worse had the pollution reached a drinking water supply source.

Moreover, while "simple" human errors are easily identifiable, their occurrence still must not overshadow organisational deficiencies, which necessitate extensive re-evaluation by the site operator (supervision, work instructions, training, intervention procedures, etc.).

The ARIA database contains over 7,000 accident records indicating the presence of surface water pollution.

When confronted with such an event, several means of improvement may be adopted, including:

- installation and maintenance of retention basins at the level of production workshops and the transfer and storage zones;
- design, implementation, monitoring and maintenance of containers and pipelines for storing or transporting hazardous fluids or effluents;
- production and regular update of water and sewer network plans;
- ban on establishing direct links between the various effluent collection networks undergoing mandatory treatment and the receiving body of water;
- effective treatment of runoff stormwater on potentially polluted soils;
- introduction of containment basins;
- installation inside the sewer network, miscellaneous collector pipes and other strategic points in the system of specific devices that enable the earliest detection possible of any abnormal presence of a pollutant, before it spills into the natural environment, in order to suggest an appropriate facility for its storage or treatment;
- a plugging device on the internal runoff water collection network placed upstream of the outlet into the combined collection system or stormwater drains.