

Fire outbreak in a wood recycling plant
22 August 2008
Saint-Cyprien (Loire)
France

Fire
 Atmospheric releases
 PCB / dioxins
 Waste
 Soil pollution
 Health impact

THE FACILITIES INVOLVED

This accident took place at an industrial site that had been devoted to copper and lead recovery since the 1970's. Authorisation was granted in July 1981 to extend operations to include metal recovery by means of burning (using combustion furnaces) and destruction of electrical transformers. In July 1989, the site operator added radiator milling to its scope of activities.

Findings issued by the classified facilities inspectorate on the state of pollution at the site led to commissioning, by a 1997 Prefectural order, a comprehensive soil analysis.

In June 2006, the site was taken over by a new operator and an official permit was awarded in July of the same year for the activity of milling and storing recycled timber (headings 2260 / milling and 1530 / storage, under the nomenclature of classified facilities).

The site's environment :

The site was set in a rural locale. It was bordered on the south by a gas depot and sand blasting operation. To the north and east were agricultural fields for the most part and the west side contained derelict land. The nearest dwellings were 300 m away.

The water table was flowing relatively close to the surface in a north-easterly direction. Some 20 pools used as cattle watering holes were found in the sector, in addition to the MELBIEF and MALTAVERNE streams and Veauchette ponds.

The LOIRE River ran just 1 km east of the site.

THE ACCIDENT, ITS CHRONOLOGY, EFFECTS AND CONSEQUENCES

The accident :

On 22 August 2008, a fire broke out around 4 am at a wood storage zone (containing pallets), spanning 2,000 m² of land area with heights in some spots reaching 10 m. Emergency response units quickly arrived at the scene with over 60 fire-fighters deployed. An impressive column of smoke drifted towards the agricultural areas.



Several days were needed to bring the fire under control, as winds fanned the flames. Also, fire-fighters were forced to change strategy at the end of August, following a pollution incident at the Veauchette ponds due to the fire extinction water. Fire sources had to be isolated from the rest of the stockpile, which led to mixing wood with earth.



The wood stockpile was allowed to gradually burn through the beginning of December 2008. Heavy rains in November 2008 gave rise to many instances of flooding in the Loire and Haute-Loire Departments: this had the effect of lowering the wood combustion rate.

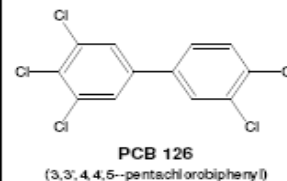
From 15 September to 17 October 2008, an organisation specialised in air quality monitoring was commissioned to conduct air measurements both onsite and offsite. Several pollutants were monitored (e.g. VOC, PAH, SO₂, NO₂...), with emphasis on dioxins and PCBs. Results of this measurement campaign were released on 18 November 2008.

Subsequent to the observation of major atmospheric emissions of both dioxins and polychlorobiphenyls (PCBs) onsite, the local Veterinary Department extracted a series of milk samples on 26 November 2008 from a neighbouring farm. Contamination was shown to be present, in light of results exceeding the regulatory threshold values for marketing foodstuffs (European regulation 1881/2006/EC); the farm had to be cordoned off.

What exactly are PCBs?

Also referred to as "askarel", PCBs are synthetic molecules:

- with a similar composition to that of dioxins (especially for the PCB-DL, with a toxic action mechanism similar to that of dioxins and furans)
 - previously used in industry for their insulating properties (electrical transformers, condensers, lubricating oils, inks, etc.)
 - prohibited on the market, since 1987
- Substance classified as "likely carcinogen".
Hepatitis and dermatology-related problems have been known to occur in populations experiencing heavy exposure.



What are the critical challenges for the environment?

A **residual background** of dioxins and PCBs within the environment.

PCBs **only decompose very slightly** and remain difficult to destroy. Present in both soil and sediment, these contaminants continue to accumulate throughout the food chains in animal fat.

90% of total exposure to PCBs is accounted for today through food sources (very little through air or water).

Regulations issued regarding dioxin and PCB contents in food:

- Regulation EC No. 1881/2006
- Recommendation No. 144/06/COL, dated 11 May 2006

Maximum contents of dioxins, furans and dioxin-like PCBs in foods (WHO-PCDD/F-PCB-TEQ):

- Meats and fat BV/OV: **4.5 pg/g fat**
- Milk and dairy products: **6 pg/g fat**
- Eggs and egg products: **6 pg/g fat**
- Fish and fishing products: **8 pg/g flesh**

Unit of measurement: 1 picogram (1 pg) = 0.000 000 000 001 g (1 picogram/g = 1 nanogram/kg)

Sources: DDPP 42 Protection Authority, Loire Department Prefecture Website

This oversight was then gradually extended to the milk and fat produced by farm cattle over a zone encompassing 42 towns and villages. In all, 914 farms underwent examination within the zone. A series of sanitation protocols were adopted, and a total of 2,353 animals wound up being slaughtered (cows, sheep, pigs and horses).

Historical overview of the accident :

2008

22 August : Fire outbreak at the company's premises (former site devoted to transformer destruction); in-depth visit by the classified facilities inspection authorities with the Regional Office for Environment, Planning and Housing (DREAL).

28 August : Detailed inspection of the site conducted by DREAL staff.

29 August : Emergency shutdown on the grounds of an ICPE (environmental protection) order calling for water and soil analyses under windy conditions; reported pollution sighting at the Veauchette ponds.

3 September : Announced suspension of all site activity.

During September : New strategy unveiled to extinguish the fire by limiting pollution entering the Veauchette ponds, subsequent to the use of large quantities of water.

15 September : Intervention of an independent organisation to conduct onsite air measurements.

18 November : Publication of the air analysis results.

26 November : Initial sampling at a farm site (results known on 9 December 2008).

During December : Complete extinction of the fire.

Based on a proposal submitted by DREAL staff and after the inspection pursuant to the ICPE order:

8 December : Prefectural order mandating the removal of all waste and polluted soil, along with a study focusing on compatibility of the local environment with potential land uses and activities.

24 December : Issuance of a Prefectural decree ordering sampling in groundwater and surface water sources, soils, plant life, as well as stripping of the affected site and its network of ditches.

2009

January : Investigations performed at several farms within a 1-km radius.

February and March : Continued investigations over a zone lying between 1 and 2 km.

April and May : Subsequent to modelling work, extension of the investigation zone to the 2-5 km range.

25 May to 3 July : Sampling campaign targeting animal products covering 40 towns and villages.

25 June : First slaughter of contaminated animals.

29 June : Release of a draft Prefectural order mandating land use modifications, with a specialised public-sector body assigned to secure the site (through waste disposal).

July : Removal of wastes (wood and cleaning sludge) from the burned parcel.

5 August : Inspection by DREAL staff to sign off on the completion of restoration works.

21 October : Based on the DREAL proposal, Prefectural notification order relative to : groundwater monitoring ; execution of a study on the compatibility of the local environment with land uses ; and stripping of the burned parcel until reaching a residual PCB content of 1 mg/kg, with the removal of polluted earth through appropriate channels.

2010

18 January : Prefectural notification for the definitive shutdown of activities at installations dedicated to the recovery of metals that had not been extracted for at least 3 years.

4 February : Order relative to a deposit amount of €4,000 for the groundwater monitoring campaign (conducted during summer 2009), subsequent to the October 2009 official notification.

23 February : The recycling company enters into bankruptcy proceedings.

24 February : Site visit by the Classified Facilities Inspectorate, none of the follow-up works mandated in the October 2009 order had been completed.

16 April : Prefectural order relative to a deposited sum of €1,920,000 for noncompliance with the October 2009 order.

24 June : last slaughter of animals.

Consequences of this accident :

This accident resulted in multiple consequences :

Hazardous substances released :

Air samples collected near the site during the fire revealed significant concentrations of dioxins, furans and PCBs. Sampling carried out following the accident yielded atypical PCB values in soils as well as in surface water and groundwater, which correlated with the previous activities performed at the same site (involving electrical transformers).

Environmental and health-related consequences :

The tremendous quantities of fire extinction water used on the blaze was responsible for a high rate of mortality among fish population in the Veauchette ponds at the end of August 2008.

During the first quarter of 2009, a campaign was launched to analyse farm products, initially targeting all farms lying within a 1-km radius around the burned parcel. Results from these investigations did not match findings of the analyses on milk and fat at 14 of the 19 farms tested.

Over time, investigations were extended to a radius of 2 kilometres (March 2009), then out to 5 km (April 2009).

In July 2009, a specialised body noted in a report that beyond the 2-km radius, it becomes difficult to determine the precise origin of soil contamination, meaning that beyond a 2-km distance, no scientific justification can be made for correlating animal contamination with the fire.

On the other hand, the dioxin and PCB results obtained on milk and fat samples stemming from contaminated animals indicate similarities for a large proportion of samples (particularly the PCB/dioxin ratio found in fats).

Data interpreted by this independent body apparently showed the fire's major impact, covering a 1-km radius with effects decreasing steadily out to 2 km.

On 25 May 2009, the monitoring zone was expanded, by means of Prefectural order, to include 40 towns and villages, and then eventually to 42 municipalities in August 2009.

Economic consequences :

a) Animal slaughter :

The cost of investigative work (including analyses), the destruction steps applicable to contaminated products and animals, plus the compensation sums awarded was collectively valued at nearly €4.5 million (end of January 2011).



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b) Removal of wastes from the site :

A deposit amount of €100,000 was entrusted to the site operator as part of the June 2009 Prefectural order to dispose of all remaining wastes (wood and cleaning sludge) on the burned parcel.

c) Pollution clean-up of the site :

This clean-up work consisted of :

- stripping the parcel over a depth varying from 30 to 150 cm, in recognition of the pollution gradient, amounting to a total volume of 7,600 m³ of earth to be removed (or 12,000 tonnes);
- disposing of all soils whose PCB contents lie below 50 mg/kg at a Class 2 dumpsite, along with loading and transporting of these soils, which required 600 lorry rotations at a specially designated site in the Allier Department (central France) or at a dumpsite for inert wastes, depending on the contents involved;
- treating the soils at a specialised facility whenever PCB contents exceeded 50 mg/kg, making these soils ineligible for landfill disposal. The quantity of soils undergoing specific treatment was supposed to be limited to just the most heavily polluted zones and represent a total of 60 tonnes;
- restoring the site to its prior condition upon completion of these clean-up works (replacement with good quality soil and necessary earthworks);
- conducting a study to assess compatibility of the local environment with land uses (sampling and analyses in various settings, inventory of water resources, evaluation of the site's hydrology and hydrogeology), and given these studies' specific scope the set of analyses left to be performed in the investigated zone.

The monetary amount eventually entrusted to the operator to execute these various works and/or studies was set at €1.92 million, as stipulated in the 16 April 2010 Prefectural order.

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:



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 assigned a "1" as a default rating, due to the smoke release containing PCB that spread into the environment.

The "Environmental consequences" index was scored a "6", as the polluted land area spanned a 2-km radius centred at the point of fire outbreak; this area amounts to roughly 1,250 hectares (parameter 'Environment 13').

The "Economic consequences" index was assigned a "5" since sanitation operations were estimated at a cost of nearly €4.5 million ('Parameter €17').

The "Human and social consequences" index was left blank due to a lack of data on this indicator.

THE ORIGIN, CAUSES AND CIRCUMSTANCES SURROUNDING THIS ACCIDENT

The fire :

The blaze was discovered around 4 am by the site caretaker, whose house was located just opposite the wood storage zone. Local fire-fighters were notified immediately thereafter.

The source of the fire however has remained unconfirmed. It appeared that the fire broke out on a crushing machine. During the follow-up investigation, the classified facilities inspection authorities noted that according to employee accounts, the crusher was turned off around 5 pm the previous day. Plant workers had not noticed anything in particular that could have triggered combustion of the wood stockpile.

The local gendarmerie at Andrézieux-Bouthéon carried out an investigation to determine the causes of this accident.

PCB pollution :

Several elements are undoubtedly at the origin of this pollution event :

- Various operators have successively set up operations at the Saint Cyprien site, and their activities would have possibly included unloading, storing and draining materials at the exact spot (parcel no. 132) where the fire broke out, consuming electrical transformers containing askarel;
- The pollution clean-up work imposed in 2001 upon a former operator was most likely left incomplete and moreover only applied to parcels adjacent to no. 132, since this parcel was not selected for the simplified risk study conducted by the former operator;
- The location of the wood milling unit on parcel no. 132, as opposed to one of the neighbouring parcels, as stipulated in the authorisation documents.

ACTIONS TAKEN

Administrative impacts :

During its site visit on 22 August 2008, the classified facilities inspectorate noted that the wood could have been contaminated or treated using chemical products. The volume of wood stored onsite also exceeded the authorised limit according to the corresponding activity code. A Prefectural emergency decree, issued on 29 August 2008, prescribed analyses of both the site's groundwater and soils in adjacent agricultural zones.

The Loire Departmental Prefect also mandated the following, by means of Prefectural orders issued on 29 August, 3 September, 8 December and 24 December 2008 :

- investigations on soils, groundwater and surface water resources in order to measure the consequences of this fire on the environment ;
- cleaning of the contaminated zones ;
- suspension of all site activity ;
- clarification of the company's administrative situation ;
- deposit of the amount earmarked for waste disposal ;
- role of a specialised organisation in the waste disposal process ;
- deposit of the amount earmarked for pollution clean-up works.

These decrees, and particularly the administrative sanctions that followed (with the issuance of Prefectural orders serving as official notifications on 29 May and 12 June 2009, plus the allocated sum announced in the 23 June 2009 order), set the stage for a specialised body to intervene in the disposal of wastes remaining on parcel no. 132 in July 2009 (order adopted on 29 June 2009).

To identify the environmental contamination and its source, the inspectorate commissioned an expert to characterise the state of the various media occupying this sector. An initial model was developed by taking into account the very active phase of the fire over a several-day period beginning on 22 August 2008.

This study confirmed a large-scale impact in terms of dioxins and furans on the burned parcel, in addition to pointing out a substantial impact for parcels lying close to the fire outbreak and strong residual background for those located within a wider perimeter (on the order of a few kilometres).

The classified facilities inspectorate has been heavily solicited after the accident : a dozen or so inspections by DREAL staff were carried out over the period from August 2008 to April 2011. Dozen of work meetings were also necessary.

In addition, the Veterinarian Services were also strongly engaged :

- numerous meetings for crisis management ;
- accommodation and supervision of the crisis unit ;
- a hundred or so interviews with farmers whose animals were contaminated ;
- a thousand or so tests performed, as part of sanitation protocols.

Health-related aspects :

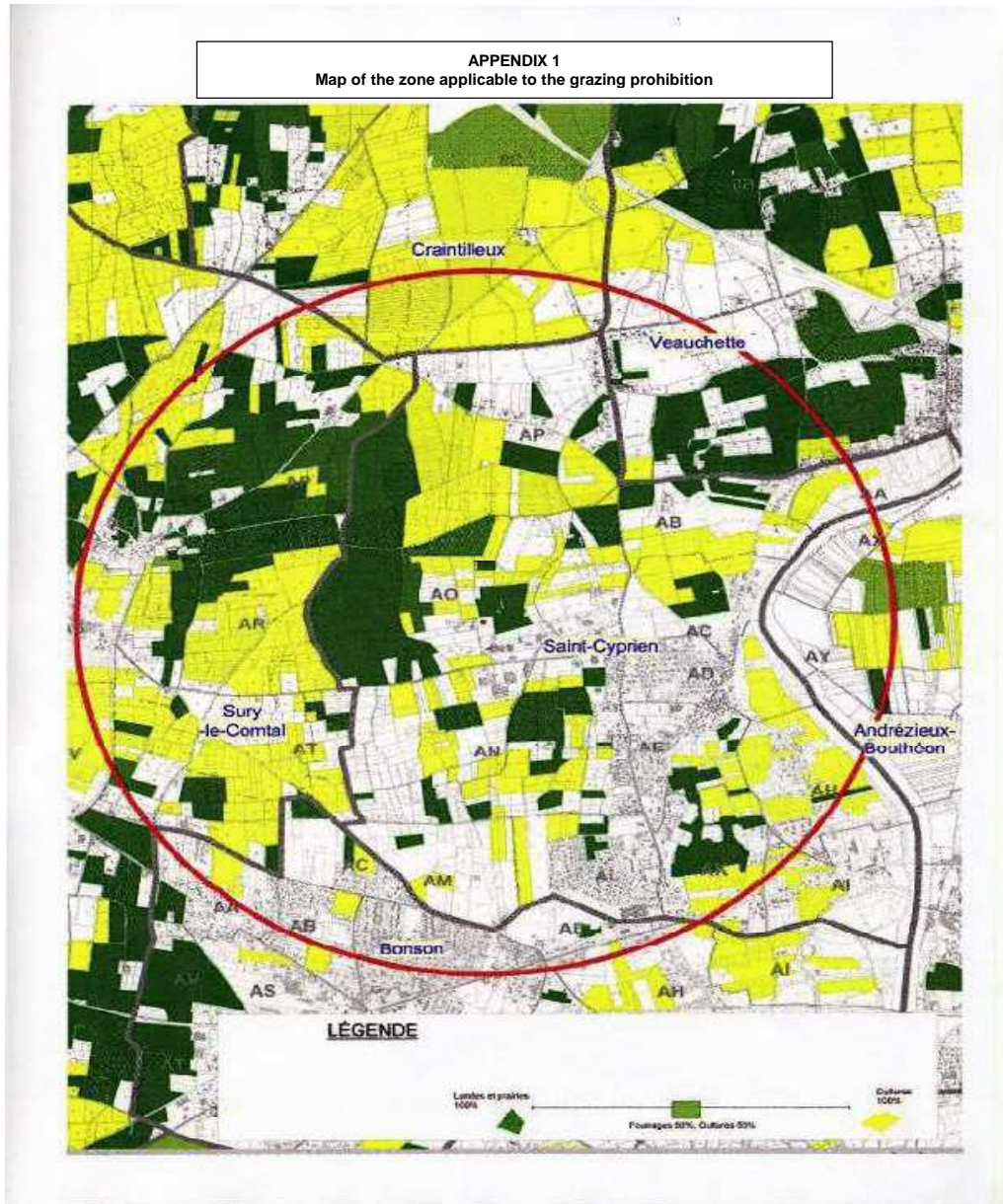
An initial appraisal of 10 samples of milk and fat conducted within a zone situated more than 5 km from the site revealed that samples from the 10 dairy farms displayed PCB contents compliant with standards, yet 7 of the 10 breeding farms produced noncompliant sample results.

A series of administrative decrees were adopted in order to limit the consumption of products from local farmyards or cattle, in addition to prohibiting grazing on local pastureland.

Moreover, a number of orders were gradually enacted during 2009 for the purpose of prohibiting the consumption of local products or restricting their use, as presented below in chronological order:

- 30 January 2009, isolating products intended for human consumption that had been potentially contaminated by dioxin-like PCBs;

- 17 April 2009, prohibiting the consumption of all meat products from farmyards and cattle raised within a 2-km radius around the site;
- 25 May 2009, prescribing monitoring measures over the zone potentially contaminated by dioxin-like PCBs;
- 28 May 2009, prohibiting the feeding of cattle with water directly drawn from the the MALTAVERNE stream, over its stretch downstream of the accident site and until reaching the confluence with the LOIRE River;
- 2 June 2009, isolating products intended for human consumption that had been potentially contaminated by dioxin-like PCBs (from game hunting);
- 25 June 2009, prohibiting any kind of farming practice over a 200-m strip around the accident site;
- 11 September 2009, prohibiting the consumption of game, over a zone extending 5 km;
- 8 December 2009, prescribing a set of measures relative to the grazing and watering conditions for animals on farms within the 2-km zone, encompassing the villages of Saint-Cyprien, Sury-le-Comtal, Craintilleux, Veauchette, Andrézieux-Bouthéon and Bonson.



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Between August 2008 and October 2011, 2,353 animals were slaughtered (mainly cows). The animal corpses generated bone meal that was treated by a local cement plant as well as fats capable of containing PCBs, which were subsequently shipped to a treatment plant in Belgium. 186,937 litres of raw milk were discarded. Once skimmed, the milk was poured out, and the cream was treated at a specialised centre. 320 tonnes of fodder, along with nearly 700 kg of products intended for butcher shops, were incinerated.

Ultimately, a total of 960 animals were slaughtered within the 1-km radius zone, 186 within the second kilometre, 591 between 2 and 5 kilometres out, and another 518 in the monitoring zone beyond 5 km from the original site.

The French Agency for Food Safety (AFSSA) was solicited on several occasions to provide input on measures to adopt that would ensure limiting the risks of food chain contamination. The Agency issued its opinion on 7 July, 2009 relative to soil contamination from dioxins and dioxin-like PCBs, as well as to the potential use of these soils in connection with eventual repercussions on the sanitary quality of certain agricultural products. The Agency released an additional opinion on 20 April 2010 regarding pig farming activities in the area.

An opinion dated 1st June 2010 was also issued relative to an accidental contamination of foodstuffs by dioxins and PCBs at Saint-Cyprien (Loire Department).

Monitoring plan :

A monitoring plan was implemented following an instruction of the Directorate General of Food (DGAL) on the central area of 2 km. It revealed two new positive cases in 2010/2011, which resulted in a new slaughter of about 70 cattle. This monitoring plan was renewed in 2011.

Crisis communication measures :

From the outset, managing the consequences from this fire gave rise to multiple exchanges, for starters between the Mayor of Saint-Cyprien, a subcontractor specialised in atmospheric pollution, the Deputy Prefect of Montbrison, local Fire and Emergency Services (SDIS 42), local gendarmerie, Departmental Health and Social Affairs Office (DDASS), Departmental Public Works and Agriculture Agency (DDEA) and, lastly, the Regional Office for Industry, Research and the Environment (DRIRE, subsequently became DREAL). This first set of meetings (held on 11 September, 15 October and 18 November 2008) were intended to provide regular updates on the initial consequences identified from pollution of: air, surface and groundwater resources, and soils.

During the meeting of 18 November 2008, the subcontracted organisation presented the results of air measurement analyses on PCBs and dioxins. These follow-up meetings were extended to include Veterinarian Services, Civilian Population Protection Services and the agricultural profession, as represented by the Chamber of Agriculture and National Farmers' Trade Union Federation (FNSEA), and then reached out to the Loire-Forez Metropolitan Council (CALF) and the Loire Departmental Council. The Loire Prefecture organised a total of 18 meetings between December 2008 and October 2010.

Moreover, the Prefecture and/or State agencies communicated via the press, during television interviews and with local newspapers, as well as through the Prefecture's Website, which featured a page dedicated to the PCB crisis. On this same Website, the main set of reports, studies, analysis results and orders restricting uses were made available for public consultation. The area's mayors and farming profession relayed information to the local level.

From a health protection standpoint, communication tools, established for the most part by the Departmental Health and Social Services Office, were disseminated to the various municipalities, village physicians in areas concerned by atmospheric fallout, in addition to their availability on the Prefecture's Website. These documents contained recommendations for limiting PCB ingestion.

Treatment of fire-related wastes :

Crushed wood stockpiles and sludge stemming from ground clean-up operations constituted the bulk of onsite wastes. Transport of these wastes to specialised treatment facilities took place between 10 and 31 July 2009. Afterwards, a dedicated basin was created for cleaning vehicle wheels. In addition to its function of preventing pollution from spreading beyond the plant boundary, this basin was intended to reduce the incidences of dirtying the public street system.

Airborne dust represented one of the major risks for personnel on this jobsite. To prevent dust from becoming airborne during lorry loading with a power shovel, hydraulic sprinkling was designed into the process, with a 10-m³ tank installed for this very purpose.

In all, 70 lorry rotations were necessary to dispose of the waste stored onsite (1,678 tonnes of wood and 8.14 tonnes of cleaning sludge). An additional transport operation was devoted to polluted individual protection gear as well as the water and cover used on the cleaning basin.

Fate of the recycling company :

On 23 February 2010, the recycling company filed for bankruptcy with the Saint-Etienne Commercial Court. In a correspondence dated 26 March 2010, the court-appointed liquidator informed the appropriate agency that the ongoing procedure against the bankrupt company would not yield any financial return.

The company was actually bought on 12 May 2009 by another firm ; however, the business sales contract excluded the Saint Cyprien site from the buyout arrangement.

Treatment of polluted soils :

Some 7,600 m³ of soil had to be removed, i.e. the equivalent of 12,000 tonnes. Given the cost of pollution clean-up work reaching approx. €2 million and due to the fact that the Saint Cyprien site was now considered devoid of management, only the intervention of a public-sector body could ensure appropriate safety measures and effective site management over the long run.

On 10 December 2010, the Ministry of Sustainable Development gives its consent to the Loire Departemental Prefect for a public body to be commissioned to :

- conduct a hydrogeological and hydrological study of the sector of the site ;
- define more precisely the areas in which the concentration thresholds proposed by the AFSSA are exceeded ;
- to propose a management plan of the site pollution and of all parcels impacted and presenting a health risk.

In a second phase, remediation work will be conducted.

LESSONS LEARNT

Even though the operator had benefitted from the administrative approvals granted to predecessors, the most recent activities performed on the site pertained strictly to the administrative authorisation. As such, a "simple facility" subjected to administrative approvals might have been the cause of major environmental nuisances: PCB pollution, slaughtering of farm animals, etc.

The expert evaluations performed by specialised organisations could take time and in some instances prove difficult to reconcile with the speed of decision-making processes. In the case of Saint Cyprien, farmers grew impatient when faced with a lack of explanation given the stringent measures being imposed. Incompressible timetables sometimes have the effect of delaying modelling work, as exemplified by waiting for soil analysis results. Moreover, very significant divergences in the measurements recorded by certified laboratories may raise interpretation problems.

A sanitation agency has been requested to define the concentration thresholds of PCDD/F and PCB in soils that are capable of leading to animal product contamination.

The absence of environmental sampling dating from the time of the accident was also highlighted as a constraint in the analytical working procedure. Various hypotheses could have been verified had the fodder from 2008 been sampled or had a background reference from the sector been available. In a similar situation, a good reflex might be to very quickly take samples within the accident zone.

This accident demonstrates the consequences capable of being induced by soil pollution on burned parcels.

Oversight of the Saint-Cyprien accident underscores the need for effective coordination between the various administrative departments operating at the State and local levels. The administrative agencies responsible for inspecting classified facilities dealing with waste treatment and with the warehousing and storage of chemical products must remain highly reactive in such cases and never hesitate calling in a third-party specialist.

In particular, tools such as geographic information systems (GIS) are essential in managing this type of crisis that affects an area accounting for 42 municipalities. Access to GIS data managed by different administrative bodies (especially DREAL/DDPP/DDT) should be facilitated and the participation of GIS experts is essential for this type of crisis management.

The decree and order issued on 19 June 2009 (instituting a compensation measure and establishing the protocols for estimating the number of farm animals slaughtered and foodstuffs and products destroyed upon administrative request for a contamination incident involving agricultural products) have made it possible for the State to acknowledge the heaviest impact of pollution, namely the compensation to be paid out for destroying contaminated animals and feed.

In addition, the method of sanitation protocols has been implemented for the first time on this scale with highly positive results. Without it, the slaughter of 2 to 3 times more animals was likely.

In closing, the Agricultural Modernisation Law No. 2010-874 enacted 27 July 2010 authorises, in Article 26, the creation of a national fund for managing agricultural risks (FNGRA), which replaced the previous national funds for managing agricultural disasters (FNGCA). This fund is intended to participate in the financing of management systems for coping with hazards related to climate, health, phytosanitary products and the environment within the agricultural sector.