

Brand i en fabrik för vinylkloridproduktion på en petrokemisk anläggning.

901213 MARS 1800_32

Under ett rutinemässigt testprogram genomfört varje vecka läckte en gasblandning av dikloretan och vinylklorid ut och antändes. Klockan 11:30 inledde två arbetare ett test av isoleringsventiler. Efter tjugo minuter då en reservpump kopplades in uppstod en läcka ovanför dem, sannolikt till följd av långvarig invändig erosion på en rörledning som brast. Sedan man installerat en diafragma i flödet med mindre diameter än planerat hade flödeshastigheten ökat med en faktor två, och turbulensen ökat med en faktor 4,5 vilket lett till oförutsedd erosion. Arbetarna hann sätta sig i säkerhet innan gasblandningen antändes. Företagets interna katastrofplan aktiverades och anläggningen utrymdes. Enheten stängdes av. Man undlät att släcka eldslågan för att undvika att explosiv gas skulle släppa ut. Isoleringsventiler stängdes runt tillflödet, men pga att olyckan inträffade under testprogrammet kunde inte alla ventiler stängas. Trots kylning smälte stora delar av anläggningen i en radie på 20-25 meter kring olycksplatsen. Efter 10 minuter då ytterligare rörledningar brast intensifierades eldslågan. Eldslågan släcktes slutligen av företagets interna brandkår efter 13 timmar, ca klockan 00:45. En närliggande skola evakuerades då ett moln av väteklorid fördes av vindriktningen mot skolan. Släcknings- och kylvatten samlades upp för behandling i fabriken reningsanläggning. Mätningar i närliggande flod avslöjade inte någon förorening.

Inblandade ämnen och mängder

	CAS Nr.	Mängd
dikloretan	75-34-3	34000 kg
vinylklorid	75-01-4	3000 kg
väteklorid	7647-01-0	300-400 kg

Skador:

Människor:	En person vid anläggningen lades in på sjukhus i chocktillstånd. Utanför anläggningen fick en 14-årig flicka sändas till sjukhus. Ett tiotal elever vid en närliggande skola fick genomgå en läkarundersökning på sjukhuset.
Materiella:	Anläggningen skadades.
Miljö/ekologi:	Utsläpp i luft och vatten bevakades i en tid efter olyckan. Inga bestående effekter noterades.
Infrastruktur:	Trafik på närbelägna vägar avstängdes och lokalbefolkningen uppmanades att stanna inomhus. Halter på 10-15ppm väteklorid uppmättes vid en närliggande skola med 50 elever som evakuerades.

Erfarenheter redovisade (Ja/Nej): Ja

Kortfattat om förebyggande åtgärder.

Report Profile

Identification of Report:

country: FA ident key: 1800_032_01

reported under Seveso I directive as major accident reports: SHORT+FULL

Date of Major Occurrence: Time of Major Occurrence

start: 1990-12-13 start: 11:50:00

finish: finish:

Establishment:

name:

address:

industry: 2002 petrochemical, refining, processing

Petrochemical (Vinyl Chloride Production)

Seveso II status: not applicable: Yes **art. 6 (notification):** No

art. 7 (MAPP): No

art. 9 (safety report): No

Date of Report:

short: full:

Authority Reporting:

name:

address:

Authority Contact:

rep_cont_name:

rep_cont_phone:

rep_cont_fax:

Additional Comments:

a) - not applicable -

b) - not applicable -

c) - not applicable -

d) - not applicable -

e) - not applicable -

Short Report

country: FA **ident key:** 1800_032_01

Accident Types:

release: Yes **explosion:** No

water contamination: No **other:** No

fire: Yes

description:

ENVIRONMENTAL AND ATMOSPHERICAL CONDITIONS:... see Appendix Short Report / description of accident types

Substance(s) Directly Involved:

toxic: Yes **explosive:** Yes

ecotoxic: Yes **other:** No

flammable: Yes

description:

The whole amount of the substances involved in the fire was about 40m3 (density = 920 Kg/m3) subdivided in...

see Appendix Short Report / description of substances involved

Immediate Sources of Accident:

storage: No **transfer:** No

process: Yes **other:** No

description:

The accident occurred in the vinyl chloride production plant of a petrochemical industry. The component involved in the release was the piping feeding a flammable mixture to the pyrolysis section during the scheduled testing of a spare pump... see Appendix Short Report / description of immediate sources

Suspected Causes:

plant or equipment: Yes **environmental:** No

human: No **other:** No

description:

CAUSES:... see Appendix Short Report / description of suspected causes

Immediate Effects:

material loss: Yes

human deaths: No

human injuries: Yes **community disruption:** Yes

other: No

ecological harm: No

national heritage loss: No

description:

EFFECTS ON PEOPLE:... see Appendix Short Report / description of immediate effects

Emergency Measures taken:

on-site systems: Yes **decontamination:** No

external services: Yes **restoration:** No

sheltering: Yes **other:** No

evacuation: Yes

description:

INTERNAL TO THE ESTABLISHMENT:... see Appendix Short Report / description of emergency measures taken

Immediate Lessons Learned:

prevention: Yes **other:** No

mitigation: No

description:

MEASURES TO PREVENT ANY RECURRENCE OF SIMILAR ACCIDENTS:... see Appendix Short Report / description of immediate lessons learned

A Occurrence Full Report

country: FA **ident key:** 1800_032_01

1 Type of Accident

remarks: During a weekly test programme, two maintenance operators started to test the isolation valves and the space piston pump. When this spare pump was switched-on a leakage (code 1102) from a piping located above the operators occurred. They qu... see Appendix Full Report A / type of accident

2 Dangerous Substances

remarks: The total establishment and the potential directly involved inventories of dichloroethane and vinyl chloride refer to the amounts released during the accident (about 40m³). The total establishment and the potential directly involved invento... see Appendix Full Report A / dangerous substances

3 Source of Accident

illustration: - not applicable -

remarks: The accident occurred in the vinyl chloride production plant (code 3102) of a petrochemical industry (code 2002). The component involved in the release was the piping (code 4011) feeding a flammable mixture to the pyrolysis section during t... see Appendix Full Report A / source of accident - remarks

4 Meteorological Conditions

precipitation none: fog: rain: hail: snow:

No No No No No

wind speed (m/s):

direction (from):

stability (Pasquill):

ambient temperature (°C):

remarks: The wind directed the gas cloud produced by the fire towards Tavaux.

5 Causes of Major Occurrence

main causes

technical / physical 5104 operation: corrosion/fatigue

- not applicable -

- not applicable -

- not applicable -

- not applicable -

human / organizational 5307 organization: process analysis (inadequate, incorrect)

5308 organization: design of plant/equipment/system (inadequate, inappropriate)

- not applicable -

- not applicable -

- not applicable -

remarks: The piping rupture have been attributed to internal erosion (code 5104) caused by the abrasive action due to the solid particles (4.6 g/l coal particulate) contained in the circulating fluid. Besides, further studies confirmed that the inst... see Appendix Full Report A / causes of major occurrence

6 Discussion about the Occurrence

- not applicable -

Type of Accident country: FA ident key: 1800_032_01

event:

major occurrence 1204 fire: flash fire (burning vapour cloud, subsonic flame front)

initiating event - not applicable -

associated event - not applicable -

event:

major occurrence 1202 fire: pool fire (burning pool of liquid, contained or uncontained)

initiating event 1102 release: fluid release to ground

associated event 1401 other: combustion products into air

Dangerous substances

country: FA **ident key:** 1800_032_01

a) total establishment inventory

CAS number: 75-01-4 **identity:** Vinyl Chloride

name from Seveso I Directive: - not applicable -

name from Seveso II Directive: - not applicable -

category from Seveso II: - not applicable -

other hazards (1): - not applicable -

other hazards (2): - not applicable -

maximum quantity (tonnes): 3

use of substance as: NORMAL FINISHED PRODUCT

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 3 **potential quantity:** 3

c) substance belongs to relevant inventory indirectly involved: No

actual quantity: -1 **indir_pot_quant:** -1

a) total establishment inventory

CAS number: 7647-01-0 **identity:** Hydrogen Chloride

name from Seveso I Directive: - not applicable -

name from Seveso II Directive: - not applicable -

category from Seveso II: - not applicable -

other hazards (1): - not applicable -

other hazards (2): - not applicable -

maximum quantity (tonnes): 35

use of substance as: ABNORMAL PRODUCT

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 0,4 **potential quantity:** 0,4

c) substance belongs to relevant inventory indirectly involved: Yes

actual quantity: 35 **indir_pot_quant:** 35

a) total establishment inventory

CAS number: 75-34-3 identity: Dichloroethane

name from Seveso I Directive: - not applicable -

name from Seveso II Directive: - not applicable -

category from Seveso II: - not applicable -

other hazards (1): - not applicable -

other hazards (2): - not applicable -

maximum quantity (tonnes): 34

use of substance as: STARTING MATERIAL

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 34 potential quantity: 34

c) substance belongs to relevant inventory indirectly involved: No

actual quantity: -1 indir_pot_quant: -1

Source of Accident - Situation country: FA ident key: 1800_032_01

situation

industry

initiating event 2002 petrochemical, refining, processing

associated event - not applicable -

activity/unit

major occurrence 3102 process: chemical continuous reaction

initiating event 3102 process: chemical continuous reaction

associated event - not applicable -

component

major occurrence 4011 general pipework/flanges

initiating event 4011 general pipework/flanges

associated event - not applicable -

B Consequences Full Report

country: FA ident key: 1800_032_01

1 Area concerned

affected

extent of effects installation: Yes

establishment: Yes

off-site; local: Yes

off-site; regional: No

off-site; transboundary: No

illustration of effects - not applicable -

remarks Ambient air monitoring performed by the local mobile chemical emergency interven... see Appendix

Full Report B / area concerned - remarks

2 People

establishment popul. emergency personnel off-site population

total at risk 58 50

immediate fatalities

subsequent fatalities

hospitalizing injuries 1 1

other serious injuries

health monitoring 10

remarks Inside the establishment 1 person was hospitalized by psychological shock due to ... see Appendix

Full Report B / people

3 Ecological Harm

pollution/contamination/damage of:

- **residential area (covered by toxic cloud)** Suspected

- **common wild flora/fauna (death or elimination)** Suspected

- **rare or protected flora/fauna (death or elimination)** Suspected

- **water catchment areas and supplies for consumption or recreation** Suspected

- **land (with known potential for long term ecological harm or** Suspected

preventing human access or activities)

- **marine or fresh water habitat** Suspected

- **areas of high conservation value or given special protection** Suspected

remarks Ambient air monitoring performed by the local mobile chemical emergency interven... see Appendix

Full Report B / ecological harm

4 National Heritage Loss

effects on:

- **historical sites** not applicable - **historic monuments** not applicable

- **historic buildings** not applicable - **art treasures** not applicable

remarks No data available.

5 Material Loss

establishment losses off site losses

costs (direct costs to operator) (social costs)

in ECU ECU

material losses

response, clean up, restoration

remarks During the first phase of the fire (before to put in service the protection mean... see Appendix

Full Report B / material loss

6 Disruption of Community Life

establishment/plant evacuated disabled/unoccupiable destroyed

- **nearby residences/hotels** No No No

- **nearby factories/offices/small shops** No No No

- **schools, hospitals, institutions** Yes No No

- **other places of public assembly** No No No

interruption of utilities etc. no / yes duration

- **gas** No

- **electricity** No

- **water** No

- **sewage treatment works** No

- **telecommunications** No

- **main roads** No about 4.5 hours

- **railways** No

- **waterways** No

- **air transport** No

significant public concern none local level national level

- **off site populations** No Yes No

- **media interest** No No No

- **political interest** No No No

remarks The population has been advised to stay indoors. Traffic in the national high-wa... see Appendix

7 Discussion of Consequences

C Response Full Report

country: FA **ident key:** 1800_032_01

1 Emergency Measures

taken - on site - not applicable - - not applicable -

- not applicable - - not applicable -

- not applicable - - not applicable -

- **off site** - not applicable - - not applicable -

- not applicable - - not applicable -

- not applicable - - not applicable -

still - on site - not applicable - - not applicable -

required

- not applicable - - not applicable -

- not applicable - - not applicable -

- **off site** - not applicable - - not applicable -

- not applicable - - not applicable -

- not applicable - - not applicable -

continuing contamination or danger

-**on site** not applicable

-**off site** not applicable

remarks - not applicable -

2 Seveso II Duties

pre-accident evaluation

Article item not due yet not done done/submitted evaluated

6 notification No No No No

7 policy (MAPP) No No No No

9 safety report No No No No

9, 10, 11 update No No No No

11 internal plan No No No No

11 external plan No No No No

13 informing public No No No No

9, 12 siting policy No No No No

post-accident evaluation

Seveso II duty was actual were actual compared with actual

contingency consequences consequences, the

addressed? addressed? predicted extent was?

Article item

7 policy (MAPP) not applicable not applicable not applicable

9 current safety report not applicable not applicable not applicable

11 internal plan not applicable not applicable not applicable

11 external plan not applicable not applicable not applicable

13 informing public not applicable not applicable not applicable

9, 12 siting policy not applicable not applicable not applicable

evaluation of safety organisation

organisational element element existed did element relate to actual circumstances of

yes / no no / partly / yes adequate?

- written policy objectives No

- specified management No

structure

- specified responsibilities No

- specified working procedures No

- specified procedures for No

assessment/auditing of

management system

- specified procedures for No

review and update of

management policy

- specified general training No

procedures

- specified emergency No

training procedures

evaluation of ecological impact control

organisational element element existed did element relate to actual circumstances of

yes / no no / partly / yes adequate?

- ecological status review No

before incident

- potential ecological No

consequences assessment

- ecological impact review No

after incident

- ecological restoration No

procedures

- subsequent review of No

restoration success

remarks - not applicable -

3 Official Action Taken

legal action

- not applicable -

other official action

- not applicable -

4 Lessons Learned

measures to prevent recurrence

After the accident, studies we... see Appendix Full Report C / lesson learned - prevent

measures to mitigate consequences:

- not applicable -

useful references:

- not applicable -

5 Discussion about Response

- not applicable -

Appendices for the FA / 1800_032_01 report

Appendix Short Report / description of accident types:

ENVIRONMENTAL AND ATMOSPHERICAL CONDITIONS:

The wind directed the gas cloud produced by the fire towards Tavaux.

ACCIDENT CASE HISTORY DESCRIPTION:

During a weekly test programme, at 11:30 two maintenance operators started to test the isolation valves and the space piston pump. At about 11:50 this spare pump was switched-on and, immediately after, a leakage from a piping located above the operators occurred. They quickly escaped towards the control room before the gas was ignited by the pyrolysis furnace. The Internal Emergency Plan was activated. The unit was shut-down and fire protection means were activated while the affected area was evacuated. The fire was not extinguished to avoid formation of an explosive gas cloud; at the same time the protection of structures exposed to intense heat radiation using cooling via fixed monitors and of the pyrolysis furnace by means of a fixed water curtain was necessary. Isolation valves around the unit on fire were closed to reduce the amount of flammable substances potentially involved. However, one of the isolation valves could not be completely closed (because the accident occurred during a test) and therefore the duration of the fire was prolonged. After 10 minutes other pipes were ruptured causing an escalation of the fire, which was finally extinguished after 13 hours (at about 00:45). Damages to the plant were confined to an area of 20*25m radius on a platform at an elevation of 6m. A nearby school was evacuated when a hydrogen chloride concentration of 10*15ppm was measured in the vicinity. Hydrogen chloride concentrations measured indicate that confinement should have been preferred versus the evacuation. Ambient air monitoring performed by the local mobile chemical emergency intervention unit could detect only traces of toxic gases. Used fire fighting water was collected for treatment at the waste-water treatment facilities of the plant. Water quality measurements in samples taken from the waste-water discharge channel and the river revealed no pollution.

Appendix Short Report / description of substances involved:

The whole amount of the substances involved in the fire was about 40m³ (density = 920 Kg/m³) subdivided in:

- Dichloroethane (C.A.S. CODE: 75-34-3): amount involved = 34,000 Kg.
- Vinyl Chloride (C.A.S. CODE: 75-01-4): amount involved = 3,000 Kg.
- Hydrogen Chloride (C.A.S. CODE: 7647-01-0, E.E.C. CODE: 017-002-00-2): amount involved = 300 400 Kg.

The whole amount of hydrogen chloride released into the environment by the combustion of dichloroethane and vinyl chloride has been estimated in 35 tonnes over a period of time of about 12 hours.

Appendix Short Report / description of immediate sources:

The accident occurred in the vinyl chloride production plant of a petrochemical industry. The component involved in the release was the piping feeding a flammable mixture to the pyrolysis section during the scheduled testing of a spare pump. The mixture (dichloroethane [91.5%], vinyl chloride [7.5%] and hydrogen chloride [1.0%]) was at about 12 bar and at a temperature of about 150°160 °C.

Appendix Short Report / description of suspected causes:

CAUSES:

The piping rupture has been attributed to internal erosion caused by the abrasive action due to the solid particles (4.6 g/l coal particulate) contained in the circulating fluid. Besides, further studies confirmed that the installation of a diaphragm with an opening smaller than originally planned (in order to obtain a more accurate measure of the liquid flow) aggravated the erosion (the diameter reduction of the diaphragm from 192mm to 132mm caused an increase of the liquid speed of a factor of 2.1 and of the turbulence effects of a factor of 4.5). In effects, the piping, in a zone downstream 10.60cm the diaphragm, showed a higher erosion than in the other section and therefore, when the spare pump was switched-on, the liquid flow was sufficient to rupture the pipe.

Appendix Short Report / description of immediate effects:

EFFECTS ON PEOPLE:

Inside the establishment 1 person was hospitalized by psychological shock due to the flash fire. Outside the establishment 1 person (a 14 years girl) was hospitalized and 10 pupils of a nearby school were examined by personnel of the hospital of Dole.

MATERIAL LOSS:

During the first phase of the fire (before to put in service the protection means), heat radiation damaged the majority of the devices made with not resistant materials (cables, measurement instruments, shields and cable channel) in a radius of 20.25 metres on a platform at an elevation of 6 meters. Within this zone there has been also the deformation of some structures and the rupture of 12 pipes. No data are available about the cost of the material damages.

COMMUNITY DISRUPTION:

The population has been advised to stay indoors. Traffic in the national high-way N° 73 and other roads of minor importance around the site were interrupted. These precautionary measures were taken up to 16:15. SOLVAY personnel performed toxic gas measurements near the school C.E.S. in the city of Tavaux. Concentrations of about 10.15ppm of hydrogen chloride were measured and the school (50 pupils) was evacuated towards a school in Dole.

Appendix Short Report / description of emergency measures taken:

INTERNAL TO THE ESTABLISHMENT:

Activation of the Internal Emergency Plan. The unit was shut-down and fire protection teams were activated while the affected area was evacuated. The fire was not extinguished to avoid formation of an explosive gas cloud; at the same time the protection of structures exposed to intense heat radiation using cooling via fixed monitors and of the pyrolysis furnace by means of a fixed water curtain was necessary. Isolation valves around the unit on fire were closed to reduce the amount of flammable substances potentially involved. However, one of the isolation valves could not be completely closed (because the accident occurred during a test) and therefore the duration of the fire was prolonged. After 10 minutes other pipes were ruptured causing an escalation of the fire, which was finally extinguished after 13 hours (at about 00:45) by the plant fire brigade (58 people).

EXTERNAL TO THE ESTABLISHMENT:

Activation of the External Emergency Plan. Population has been advised to stay indoors. Traffic in the national high-way N° 73 and other roads of minor importance around the site were interrupted. These precautionary measures were taken up to 16:15. SOLVAY personnel performed toxic gas measurements near the school C.E.S. in the city of Tavaux. Concentrations of about 10.15ppm of hydrogen chloride were measured and the school (50 pupils) was evacuated towards a school in Dole. Hydrogen chloride concentrations measured indicate that confinement should have been preferred versus the evacuation. Ambient air monitoring performed by the local mobile chemical emergency intervention unit could detect only traces of toxic gases. Used fire fighting water was collected for treatment at the waste-water treatment facilities of the plant. Water quality measurements in samples taken from the waste-water discharge channel and the river revealed no pollution.

Appendix Short Report / description of immediate lessons learned:

MEASURES TO PREVENT ANY RECURRENCE OF SIMILAR ACCIDENTS:

After the accident, studies were undertaken to:

- 1- identify materials resistant to erosion;
- 2- define a new pipe routing to reduce the danger of erosion.

Appendix Full Report A / type of accident:

During a weekly test programme, two maintenance operators started to test the isolation valves and the space piston pump. When this spare pump was switched-on a leakage (code 1102) from a piping located above the operators occurred. They quickly escaped towards the control room before the gas was ignited resulting in a flash fire followed by a pool fire (codes 1202 and 1204). During the fire hydrogen chloride gas was released into the environment (code 1401).

Appendix Full Report A / dangerous substances:

The total establishment and the potential directly involved inventories of dichloroethane and vinyl chloride refer to the amounts released during the accident (about 40m3). The total establishment and the potential directly involved inventories of hydrogen chloride refer both to the amount initially released (about 300'400 Kg) and to the amount released in the environment by the fire over a period of time of about 12 hours.

Appendix Full Report A / source of accident - remarks:

The accident occurred in the vinyl chloride production plant (code 3102) of a petrochemical industry (code 2002). The component involved in the release was the piping (code 4011) feeding a flammable mixture to the pyrolysis section during the scheduled testing of a spare pump. The mixture (dichloroethane [91.5%], vinyl chloride [7.5%] and hydrogen chloride [1.0%]) was at about 12 bar and at a temperature of about 150°160°C.

Appendix Full Report A / causes of major occurrence:

The piping rupture have been attributed to internal erosion (code 5104) caused by the abrasive action due to the solid particles (4'6 g/l coal particulate) contained in the circulating fluid. Besides, further studies confirmed that the installation of a diaphragm with an opening smaller than originally planned (in order to obtain a more accurate measure of the liquid flow) aggravated the erosion (codes 5307 and 5308).

Appendix Full Report B / area concerned - remarks:

Ambient air monitoring performed by the local mobile chemical emergency intervention unit could detect only traces of toxic gases. SOLVAY personnel performed toxic gas measurements near the school C.E.S. in the city of Tavaux. Concentrations of about 10'15ppm of hydrogen chloride were measured and the school (50 pupils) was evacuated towards a school in Dole. Water quality measurements in samples taken from the waste-water discharge channel and the river revealed no pollution.

Appendix Full Report B / people:

Inside the establishment 1 person was hospitalized by psychological shock due to the flash fire. Outside the establishment 1 person (a 14 years girl) was hospitalized and 10 pupils of a nearby school were examined by personnel of the hospital of Dole. The school of Tavaux (50 pupils) was evacuated towards a school in Dole. The fire was extinguished by the plant fire brigade (58 people).

Appendix Full Report B / ecological harm:

Ambient air monitoring performed by the local mobile chemical emergency intervention unit could detect only traces of toxic gases. Used fire fighting water was collected for treatment at the waste-water treatment facilities of the plant. Water quality measurements in samples taken from the waste-water discharge channel and the river revealed no pollution.

Appendix Full Report B / material loss:

During the first phase of the fire (before to put in service the protection means), heat radiation damaged the majority of the devices made with not resistant materials (cables, measurement instruments, shields and cable channel) in a radius of 20'25 metres on a platform at an elevation of 6 meters. Within this zone there has been also the deformation of some structures and the rupture of 12 pipes. No data are available about the cost of the material damages.

Appendix Full Report B / disruption of community life:

The population has been advised to stay indoors. Traffic in the national high-way N° 73 and other roads of minor importance around the site were interrupted. These precautionary measures were taken up to 16:15. SOLVAY personnel performed toxic gas measurements near the school C.E.S. in the city of Tavaux. Concentrations of about 10'15ppm of hydrogen chloride were measured and the school (50 pupils) was evacuated towards a school in Dole.

Appendix Full Report C / lesson learned - prevent:

After the accident, studies were undertaken to:

- 1- identify materials resistant to erosion;
- 2- define a new pipe routing to reduce the danger of erosion.