

Gasutsläpp (styren och etylbensen) till följd av en okontrollerad reaktion i en styrenfabrik.

861007 MARS 1800_22

En okontrollerad värmeutvecklande reaktion inträffade i två reaktorer till följd av ett brott i strömförsörjningen (07:15). Den kondensor som kylde reaktorgaserna kunde inte startas och försök att bromsa polymeriseringsreaktionen misslyckades. Efter en dryg timme, klockan 08:20, hade trycket i reaktorerna ökat så mycket att kärlden sprack och gasen slapp ut i omgivningen. En felaktig indikator i kontrollrummet kan ha fördröjt upptäckandet. Produktionen stängdes av och de som utsatts för gaserna evakuerades. Gasen skingrades i atmosfären.

Inblandade ämnen och mängder

	CAS Nr.	Mängd
styren	100-42-5	1000-2500 kg
etylbenzen	100-41-4	50-125 kg
polystyren	9003-53-6	okänt

Skador:

Människor: 30 människor lades in på sjukhus pga utsläppet.
Materiella: Inga rapporterade.
Miljö/ekologi: Inga rapporterade.
Infrastruktur: Inga rapporterade.

Erfarenheter redovisade (Ja/Nej): Ja

Förebyggande åtgärder relevanta för fabriken.

Report Profile

Identification of Report:

country: FA ident key: 1800_022_01

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

Date of Major Occurrence: Time of Major Occurrence

start: 07/10/1986 start: 08:00:00

finish: finish:

Establishment:

name:

address:

industry: 2001 general chemicals manufacture

Organic Chemical (Styrene Polymerization Production Plant)

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_022_01

Accident Types:

release: Yes **explosion:** No

water contamination: No **other:** No

fire: No

description:

ACCIDENT CASE HISTORY DESCRIPTION:... see Appendix Short Report / description of accident types

Substance(s) Directly Involved:

toxic: Yes **explosive:** Yes

ecotoxic: No **other:** No

flammable: Yes

description:

- Styrene (C.A.S. CODE: 100-42-5, C.E.E. CODE: 601-026-00-0); amount involved = 1,000`2,500 Kg... see

Appendix Short Report / description of substances involved

Immediate Sources of Accident:

storage: No **transfer:** No

process: Yes **other:** No

description:

The accident occurred during normal operation in the styrene polymerization production plant of an organic chemical industry. There were two different process lines in the production plant.

Suspected Causes:

plant or equipment: Yes **environmental:** Yes

human: No **other:** No

description:

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

Immediate Effects:

material loss: No

human deaths: No

human injuries: Yes **community disruption:** No

other: Yes

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: No **restoration:** No

sheltering: No **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: Yes

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_022_01

1 Type of Accident

remarks: The loss of the power supply to the polymerization unit caused an uncontrolled exothermic reaction. The pressure in the reactors rose causing the rupture of the bursting disks and the release of the reactor's contents (codes 1101 and 1102).

2 Dangerous Substances

remarks: The total establishment and the potential directly involved inventories of styrene and ethylbenzene refer to the amounts released during the accident.

The amount of styrene had been estimated between 1,000 and 2,500 Kg whilst the amount of... see Appendix Full Report A / dangerous substances

3 Source of Accident

illustration: - not applicable -

remarks: The accident occurred during normal operation in the styrene polymerization production plant of an organic chemical industry (code 2001). There were two different process lines in the production plant (code 3102). The components

involved in... 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: - not applicable -

5 Causes of Major Occurrence

main causes

technical / physical 5105 operation: instrument/control/monitoring-device failure

5106 operation: runaway reaction

5205 environment: utilities failure (electricity, gas, water, steam air, etc.)

- 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 accident occurred due to the loss of power supply (code 5205) that led to an uncontrolled exothermic polymerization in the two reactors (code 5106). As, due to the loss of power supply, the condenser could not be started and the injecti... see Appendix Full Report A / causes of major occurrence

6 Discussion about the Occurrence

- not applicable -

Type of Accident country: FA ident key: 1800_022_01

event:

major occurrence 1102 release: fluid release to ground

initiating event 1102 release: fluid release to ground

associated event - not applicable -

event:

major occurrence 1101 release: gas/vapour/mist/etc release to air

initiating event 1101 release: gas/vapour/mist/etc release to air

associated event - not applicable -

Dangerous substances

country: FA ident key: 1800_022_01

a) total establishment inventory

CAS number: 9003-53-6 identity: Styrene Polymer

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): -1

use of substance as: ABNORMAL PRODUCT

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: -1 potential quantity: -1

c) substance belongs to relevant inventory indirectly involved: No

actual quantity: -1 indir_pot_quant: -1

a) total establishment inventory

CAS number: 100-42-5 identity: Styrene

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): 2,5

use of substance as: STARTING MATERIAL

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 2,5 potential quantity: 2,5

c) substance belongs to relevant inventory indirectly involved: No

actual quantity: -1 indir_pot_quant: -1

a) total establishment inventory

CAS number: 100-41-4 identity: Ethylbenzene

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): 0,125

use of substance as: STARTING MATERIAL

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 0,125 potential quantity: 0,125

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_022_01

situation

industry

initiating event 2001 general chemicals manufacture

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 4001 reaction vessel; non-pressurised

initiating event 4001 reaction vessel; non-pressurised

associated event - not applicable -

B Consequences Full Report

country: FA **ident key:** 1800_022_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 Outside the establishment 30 people were hospitalized due to the release's effec... see Appendix

Full Report B / area concerned - remarks

2 People

establishment popul. emergency personnel off-site population

total at risk

immediate fatalities

subsequent fatalities

hospitalizing injuries 30

other serious injuries

health monitoring

remarks Outside the establishment 30 people were hospitalized due to the release's effec... 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 In the Original Report there is no evidence of significant ecological harms.... 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 In the Original Report there is no evidence of significant material losses.... 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 No 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
- 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 A strong smell was detected in the city of Le Havre.... see Appendix Full Report B / disruption o

7 Discussion of Consequences

C Response Full Report

country: FA ident key: 1800_022_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, the follow... see Appendix Full Report C / lesson learned - prevent

measures to mitigate consequences:

After the accident, the follow... see Appendix Full Report C / lesson learned - mitigate

useful references:

- not applicable -

5 Discussion about Response

- not applicable -

Appendices for the FA / 1800_022_01 report

Appendix Short Report / description of accident types:

ACCIDENT CASE HISTORY DESCRIPTION:

At 07:15, due to the loss of power supply, an uncontrolled exothermic polymerization occurred in two reactors. The condenser (necessary to cool the reactors gases) could not be started and the injection of ethylbenzene to limit the polymerization was unsuccessful. The pressure in the reactors increased and, even if at 08:15 the power supply was still available, at 08:20 it caused the rupture of the bursting disks (set at 3.5 bar) and the release of the reactor's contents. After the accident, on June 22, 1986 the Prefect ordered the suspension of productions until a decision should be taken about a new authorization to operate and asked company to improve the procedures related to installation surveillance, storage and manipulation of dangerous substances.

Appendix Short Report / description of substances involved:

- Styrene (C.A.S. CODE: 100-42-5, C.E.E. CODE: 601-026-00-0): amount involved = 1,000`2,500 Kg.

- Ethylbenzene (C.A.S. CODE: 100-41-4): amount involved = 50`125 Kg.

- Styrene Polymer (C.A.S. CODE: 9003-53-6): amount involved = not known.

Appendix Short Report / description of suspected causes:

CAUSES:

The accident occurred due to the loss of power supply that led to an uncontrolled exothermic polymerization in the two reactors. As, due to the loss of power supply, the condenser could not be started and the injection of ethylbenzene to limit the polymerization was unsuccessful, a pressure and temperature increase occurred causing the rupture of the bursting disks and the release of the reactor's contents. A false indication in the control room (due to the malfunction of the instrumentation) probably caused a delay in taking action.

Appendix Short Report / description of immediate effects:

EFFECTS ON PEOPLE:

Outside the establishment 30 people were hospitalized due to the release's effects.

OTHER:

A strong smell was detected in the city of Le Havre.

Appendix Short Report / description of emergency measures taken:

INTERNAL TO THE ESTABLISHMENT:

The unit was shut-down.

EXTERNAL TO THE ESTABLISHMENT:

The people intoxicated by the release were evacuated.

Appendix Short Report / description of immediate lessons learned:

MEASURES TO PREVENT ANY RECURRENCE OF SIMILAR ACCIDENTS:

After the accident, the following measures were established:

- 1- revision of the power supply system in order to avoid common failures;
- 2- installation of a redundant sensor to follow the evolution of the polymerization;
- 3- installation of a redundant bank in the condenser;
- 4- further studies on a more effective inhibitory injection.

MEASURES TO MITIGATE THE EFFECTS OF THE ACCIDENT:

After the accident, the following measures were established:

- 1- further studies on the safe disposal of vented material should the rupture disk burst;
2. further studies on the removal of the reaction mass, if necessary.

Appendix Full Report A / dangerous substances:

The total establishment and the potential directly involved inventories of styrene and ethylbenzene refer to the amounts released during the accident. The amount of styrene had been estimated between 1,000 and 2,500 Kg whilst the amount of ethylbenzene between 50 and 125 Kg. No data are available about the amount of styrene polymer involved in the accident.

Appendix Full Report A / source of accident - remarks:

The accident occurred during normal operation in the styrene polymerization production plant of an organic chemical industry (code 2001). There were two different process lines in the production plant (code 3102). The components involved in the accident were the two polymerization reactors (code 4002).

Appendix Full Report A / causes of major occurrence:

The accident occurred due to the loss of power supply (code 5205) that led to an uncontrolled exothermic polymerization in the two reactors (code 5106). As, due to the loss of power supply, the condenser could not be started and the injection of ethylbenzene was unsuccessful (codes 5307, 5308), the pressure increase caused the rupture of the bursting disks. A false indication in the control room (due to the malfunction of the instrumentation [code 5105]) probably caused a delay in taking action.

Appendix Full Report B / area concerned - remarks:

Outside the establishment 30 people were hospitalized due to the release's effects. A strong smell was detected in the city of Le Havre.

Appendix Full Report B / people:

Outside the establishment 30 people were hospitalized due to the release's effects. A strong smell was detected in the city of Le Havre.

Appendix Full Report B / ecological harm:

In the Original Report there is no evidence of significant ecological harms.

Appendix Full Report B / material loss:

In the Original Report there is no evidence of significant material losses.

Appendix Full Report B / disruption of community life:

A strong smell was detected in the city of Le Havre.

Appendix Full Report C / lesson learned - prevent:

After the accident, the following measures were established:

- 1- revision of the power supply system in order to avoid common failures;
- 2- installation of a redundant sensor to follow the evolution of the polymerization;
- 3- installation of a redundant bank in the condenser;
- 4- further studies on a more effective inhibitory injection.

Appendix Full Report C / lesson learned - mitigate:

After the accident, the following measures were established:

- 1- further studies on the safe disposal of vented material should the rupture disk burst;
2. further studies on the removal of the reaction mass, if necessary.