

Brand i en kemifabrik

860903 MARS 1800_14

En explosiv blandning av luft och styrenångor i ett tryckkärl antändes, troligen av statisk elektricitet. Den brinnande gasblandningen släpptes ut genom en säkerhetsventil som delvis smältes av värmen. En brand spred sig snabbt i lokalen och hotade två lagerkärn för styren med risk för ett stort utsläpp av styren. Räddningstjänstens första insats var att kyla de två lagerkärnen. Man evakuerade även 60 människor som bodde strax sydväst om anläggningen.

Inblandade ämnen och mängder

	CAS Nr.	Mängd
Styren	100-42-5	20 kg
Polyester		30 kg

Skador:

Människor:	Inga skador rapporterade.
Materiella:	Produktionsanläggningen skadades. Kostnaden uppskattas till mellan 0,60-0,75 MECU
Miljö/ekologi:	Inga skador rapporterade.
Infrastruktur:	Kommunen blockerade avloppsledningarna med hjälp av uppblåsbara barriärer. Man evakuerade även 60 människor som bodde strax sydväst om anläggningen.

Erfarenheter redovisade (Ja/Nej): Ja

Endast förebyggande åtgärder relevanta för fabriken anges.

Report Profile

Identification of Report:

country: FA ident key: 1800_014_01

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

Date of Major Occurrence: Time of Major Occurrence

start: 03/09/1986 start: 10:00:00

finish: finish:

Establishment:

name:

address:

industry: 2001 general chemicals manufacture

Organic Chemical (Production of imitation marble)

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_014_01

Accident Types:

release: No **explosion:** Yes

water contamination: No **other:** No

fire: Yes

description:

Municipality blocked the drains by using inflatable barriers placed at the outflow. The firefighting water was collected using sludge suction equipments and taken to Kommune-kemi.... see Appendix Short Report / description of accident types

Substance(s) Directly Involved:

toxic: No **explosive:** Yes

ecotoxic: No **other:** No

flammable: Yes

description:

The explosion occurred in a pressure pot (with a capacity of about 50 litres) containing a gelcoat (mixture of 60% polyester and 40% styrene).... see Appendix Short Report / description of substances involved

Immediate Sources of Accident:

storage: Yes **transfer:** No

process: Yes **other:** No

description:

The accident occurred in a pressure pot containing gelcoat (mixture of 60% polyester and 40% styrene) of an organic chemical industry for the production of imitation marble used in manufacturing articles, i.e. gutters, etc. The accident occ... see Appendix Short Report / description of immediate sources

Suspected Causes:

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

human: No **other:** No

description:

INITIATING EVENT AND CONSEQUENCES:... see Appendix Short Report / description of suspected causes

Immediate Effects:

material loss: Yes

human deaths: No

human injuries: No **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: 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:** Yes

mitigation: No

description:

INTERNAL TO THE ESTABLISHMENT:... see Appendix Short Report / description of immediate lessons learned

A Occurrence Full Report

country: FA **ident key:** 1800_014_01

1 Type of Accident

remarks: An air/styrene vapours explosive mixture, contained in a small pressure vessel holding gelcoat, was ignited resulting in an internal overpressure and to the ejection of burning gases through the safety valve (code 1307).

The burning gases p... see Appendix Full Report A / type of accident

2 Dangerous Substances

remarks: The total establishment and the potential directly involved inventories of styrene and polyester refer to the amount involved in the accident (equivalent to the whole capacity, about 50 litres, of the small pressure pot containing gelcoat [... see Appendix Full Report A / dangerous substances

3 Source of Accident

illustration: - not applicable -

remarks: The accident occurred in a pressure pot (codes 3201 and 4004) containing gelcoat (mixture of 60% polyester and 40% styrene) of an organic chemical industry for the production of imitation marble (code 2001) used in manufacturing articles, e... 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: Favourable wind and weather conditions.

5 Causes of Major Occurrence

main causes

technical / physical 5109 operation: electrostatic accumulation

- not applicable -

- not applicable -

- not applicable -

- not applicable -

human / organizational 5302 organization: management attitude problem

5307 organization: process analysis (inadequate, incorrect)

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

inappropriate)

- not applicable -

- not applicable -

remarks: Based on the available information, it has been concluded that a flammable/explosive

mixture of air and styrene vapours in a pressure pot containing gelcoat (mixture of 60%

polyester and 40% styrene) was ignited, probably due to static elec... see Appendix Full

Report A / causes of major occurrence

6 Discussion about the Occurrence

- not applicable -

Type of Accident country: FA ident key: 1800_014_01

event:

major occurrence 1201 fire: conflagration (a general engulfment fire)

initiating event 1307 explosion: VCE (vapour cloud explosion; supersonic wave front)

associated event - not applicable -

Dangerous substances

country: FA ident key: 1800_014_01

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): 0,02

use of substance as: NORMAL FINISHED PRODUCT

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 0,02 potential quantity: 0,02

c) substance belongs to relevant inventory indirectly involved: No

actual quantity: -1 indir_pot_quant: -1

a) total establishment inventory

CAS number: identity: Polyester

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): 0,03

use of substance as: NORMAL FINISHED PRODUCT

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 0,03 potential quantity: 0,03

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_014_01

situation

industry

initiating event 2001 general chemicals manufacture

associated event - not applicable -

activity/unit

major occurrence 3201 storage: process-associated (stockholding, etc. on-site of manufacture)

initiating event 3201 storage: process-associated (stockholding, etc. on-site of manufacture)

associated event - not applicable -

component

major occurrence 4004 container; pressurised (bullet, sphere, cylinder, etc.)

initiating event 4004 container; pressurised (bullet, sphere, cylinder, etc.)

associated event - not applicable -

B Consequences Full Report

country: FA ident key: 1800_014_01

1 Area concerned

affected

extent of effects installation: Yes

establishment: Yes

off-site; local: No

off-site; regional: No

off-site; transboundary: No

illustration of effects - not applicable -

remarks 60 people were evacuated from their houses located to the south-east of the fact... see Appendix

Full Report B / area concerned - remarks

2 People

establishment popul. emergency personnel off-site population

total at risk 29 60

immediate fatalities

subsequent fatalities

hospitalizing injuries

other serious injuries

health monitoring

remarks 60 people were evacuated from their houses located to the south-east of the fact... 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 DKR ECU DKR

material losses 5500000

response, clean up, restoration

remarks The production hall was damaged by the fire. The cost of the damages has been ev... see Appendix

Full Report B / material loss

6 Disruption of Community Life

establishment/plant evacuated disabled/unoccupiable destroyed

- nearby residences/hotels Yes No No

- nearby factories/offices/small shops Yes No No

- schools, hospitals, institutions Yes No No

- other places of public assembly Yes 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 60 people were evacuated from their houses located to the south-east of the fact... see Appendix

7 Discussion of Consequences

C Response Full Report

country: FA ident key: 1800_014_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

INTERNAL TO THE ESTABLISHMENT:... 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_014_01 report

Appendix Short Report / description of accident types:

Municipality blocked the drains by using inflatable barriers placed at the outflow. The firefighting water was collected using sludge suction equipments and taken to Kommune-kemi.

ENVIRONMENTAL AND ATMOSPHERIC CONDITIONS:

Favourable wind and weather conditions.

The accident occurred during lunch time and nobody was present. Based on the investigations, it seems that an air/styrene vapours explosive mixture, contained in a small pressure vessel holding gelcoat, was ignited, resulting in an internal overpressure and to the ejection of burning gases through the safety valve. The burning gases partially melted the safety valve and initiated a fire which spread very rapidly over the building. As two storage vessels containing styrene were located in the affected area, a large release of styrene was threatened. This led to a temporary evacuation of the plant and warning of local external population. 60 people were evacuated from their houses located to the south-east of the factory.

Appendix Short Report / description of substances involved:

The explosion occurred in a pressure pot (with a capacity of about 50 litres) containing a gelcoat (mixture of 60% polyester and 40% styrene).

- Styrene (C.A.S. CODE: 100-42-5, E.E.C. CODE: 601-026-00-0): amount involved = 20 kg.

- Polyester: amount involved = 30 kg.

Appendix Short Report / description of immediate sources:

The accident occurred in a pressure pot containing gelcoat (mixture of 60% polyester and 40% styrene) of an organic chemical industry for the production of imitation marble used in manufacturing articles, i.e. gutters, etc. The accident occurred during lunch time and nobody was present.

Appendix Short Report / description of suspected causes:

INITIATING EVENT AND CONSEQUENCES:

Based on the available information, it has been concluded that an explosive mixture of air/styrene vapours in the pressure pot containing gelcoat (mixture of 60% polyester and 40% styrene) was ignited, probably due to static electricity. The burning gases were released through the safety valve installed on the pot and partially melted the valve itself, initiating a fire which spread very rapidly over the building.

CAUSES:

When the gelcoat should be applied it was pressed out from the pressure pot through a hand operated valve by compressed air. As styrene has a vapour pressure of 6 mbar at 20°C, a flammable/explosive mixture with air may be expected in the pressure pot during operation but it not was not considered. The liquid gelcoat was in the pot placed in a plastic bucket, providing a possible source of static electricity.

Appendix Short Report / description of immediate effects:

EFFECTS ON PEOPLE:

60 people were evacuated from their houses located to the south-east of the factory.

MATERIAL LOSS:

The production hall was damaged by the fire. The cost of the damages have been evaluated in about 5^6 million DKR (about 0.6^0.75 MECU).

WARNING: Följande stycke står i den originalfil jag mottagit. Uppenbart en annan olycka.

CAUSES:

Caused by the release of nitric acid through a leak of a flange in the nitric acid pipeline, the flange's iron screws corroded and its connection opened. The use of flange's iron screws was due to insufficient process analysis and component design. During chlorine unloading of a rail tank into the storage tank (located in a closed building) of the cellulose bleaching section of the plant, the steel-reinforced transfer hose burst, resulting in the emission of chlorine into the environment (code 1101). EFFECTS ON PEOPLE:

Inside the establishment 1 person was injured by the chlorine release.

COMMUNITY DISRUPTION:

The population external to the establishment was alerted.

OTHER:

No material losses occurred except the chlorine released during the accident. The epichlorhydrine production plant was completely destroyed. Outside the establishment the windows' glasses of the nearby houses were ruptured due to the shock wave generated by the explosion. No data are available about the cost of the material damages. The main problem after the incident were the large amounts of white asbestos scattered around and outside the establishment. Sufficiently protected fire brigade personnel took care of the removal of the asbestos on the days immediately after the explosion. (1) the fire water was contaminated with gasoline due to violation of procedures (back-flow through a nose, connecting a hydrant and a drum) (2) no safety advicxe during contract negotiations for renting the mobile pump. The Internal Emergency Plan was activated (code 7100). Gaz de France put in operation the safety resources (personnel and materials [code 7201]) available at Beynes (Yvelines). The release was halted with the assistance of a specialized contractor (code 7205) called in by the manufacturer, who covered the escape source with sludge and brought the bar to its original position by increasing the loading on it (code 7501). The External Emergency Plan was activated and the Authorities were alerted (code 7200). The Fire Brigade was

mobilized but its intervention was not necessary (code 7201). The Police (code 7203) kept curious people away at a safe distance of 300m (code 7207). No emergency measures are still required, neither on-site nor off-site (code 7703).

SLUT på främmande text.

Appendix Short Report / description of emergency measures taken:

INTERNAL TO THE ESTABLISHMENT:

When the fire brigade arrived, first priority was given to the cooling of 2 gelcoat storage vessels inside the building to prevent the release of toxic styrene vapours.

EXTERNAL TO THE ESTABLISHMENT:

Municipality blocked the drains by using inflatable barriers placed at the outflow. Due to the risk of release of toxic gases, 60 people were temporarily evacuated from their houses located to the south-east of the factory. 29 people of the emergency teams were mobilized.

Appendix Short Report / description of immediate lessons learned:

INTERNAL TO THE ESTABLISHMENT:

Due to the heating caused by the fire, the gelcoat in the 2 storage vessels was polymerized and, therefore, cutting of these vessels before transportation to the waste treatment facility was necessary. The cutting operation had to be performed under water jets to avoid the risk of a new fire.

MEASURES TO PREVENT ANY RECURRENCE OF SIMILAR ACCIDENTS:

After the accident, the following measures were established:

- 1- if solvents, which may form an explosive mixture with pressurized air are being used in the pressure vessel, an inert gas should be used as a propellant;
- 2- all components of the equipment should be properly earthed.

Appendix Full Report A / type of accident:

An air/styrene vapours explosive mixture, contained in a small pressure vessel holding gelcoat, was ignited resulting in an internal overpressure and to the ejection of burning gases through the safety valve (code 1307). The burning gases partially melted the safety valve and initiated a fire which spread very rapidly over the building (code 1201).

Appendix Full Report A / dangerous substances:

The total establishment and the potential directly involved inventories of styrene and polyester refer to the amount involved in the accident (equivalent to the whole capacity, about 50 litres, of the small pressure pot containing gelcoat [mixture of 60% polyester and 40% styrene]). No data are available about the capacity of the others storage vessels in the building.

Appendix Full Report A / source of accident - remarks:

The accident occurred in a pressure pot (codes 3201 and 4004) containing gelcoat (mixture of 60% polyester and 40% styrene) of an organic chemical industry for the production of imitation marble (code 2001) used in manufacturing articles, e.g. gutters, ecc. The accident occurred during lunch time and nobody was present.

Appendix Full Report A / causes of major occurrence:

Based on the available information, it has been concluded that a flammable/explosive mixture of air and styrene vapours in a pressure pot containing gelcoat (mixture of 60% polyester and 40% styrene) was ignited, probably due to static electricity (code 5109). The possibility, under normal operating conditions, of the formation of an explosive mixture of styrene vapours and air during the pressing out of the gelcoat from the pressure pot was not considered (codes 5302, 5307 and 5308).

Appendix Full Report B / area concerned - remarks:

60 people were evacuated from their houses located to the south-east of the factory because the release of toxic styrene was threatened. The toxic release, fortunately, did not happen and, therefore, no significant effects occurred outside the establishment.

Appendix Full Report B / people:

60 people were evacuated from their houses located to the south-east of the factory. 29 people of the emergency teams were mobilized during the accident. No data are available about the number of the factory's workers involved.

Appendix Full Report B / ecological harm:

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

Appendix Full Report B / material loss:

The production hall was damaged by the fire. The cost of the damages has been evaluated in about 5*6 millions DKR (about 0.6*0.75 MECU).

Appendix Full Report B / disruption of community life:

60 people were evacuated from their houses located to the south-east of the factory but, fortunately, the toxic release of styrene did not occur.

Appendix Full Report C / lesson learned - prevent:

INTERNAL TO THE ESTABLISHMENT:

Due to the heating caused by the fire, the gelcoat in the 2 storage vessels was polymerized and, therefore, cutting of these vessels before transportation to the waste treatment facility was necessary. The cutting operation had to be performed under water jets to avoid the risk of a new fire.

After the accident, the following measures were established:

- 1- if solvents, which may form an explosive mixture with pressurized air are being used in the pressure vessel, an inert gas should be used as a propellant;
- 2- all components of the equipment should be properly earthed.