

Explosion och brand i samband med etylenutsläpp på en petrokemisk anläggning.

910330 MARS 1800_33

En etylenläcka upptäcktes inne på raffinaderiområdet klockan 10:25. Läckan kom från en tiotumsledning med etylen vid 45 bars tryck. Företagets interna brandkår larmades omedelbart och området kring läckan utrymdes. Ett fordon utifrån körde genom gasmolnet och fick motorstopp pga syrebrist. Då motorn startades igen exploderade molnet vilket ledde till en bristning i rörledningen. Etylenläckan brann som en riktad jetlåga i riktning mot en lagerbyggnad där man förvarade flytande kolväten som etylacetat och dimetylcyklooktadien, men även termoplastisk kautschuk. Lagerbyggnaden fattade eld. Stötvågen från den första explosionen orsakade dessutom en bristning på ytterligare en etylen-rörledning, vilket ledde till ännu en explosion (VCE). Företagets interna brandkår assisterades av brandkårer från närliggande företag och av räddningstjänsten. Kylning av tankar som ännu inte fattat eld påbörjades. Klockan 15:00 beslöt man att bekämpa brandhärden med skum. Klockan 16:00 hade branden släckts.

Inblandade ämnen och mängder

	CAS Nr.	Mängd
etylen	74-85-1	okänt
dimetylcyklooktadien		12350 kg
etylacetat	141-78-6	7870 kg
termoplastisk kautschuk		1000 ton

Skador:

Människor:	Fyra människor brännskadades, varav en allvarligt.
Materiella:	Fyra brandbekämpningsfordon skadades då ett gasmoln exploderade.
Miljö/ekologi:	Utsläpp i luft och vatten bevakades i en tid efter olyckan. Släckningsvattnet samlades upp för behandling i reningsanläggningen. Inga bestående effekter noterades.
Infrastruktur:	Den externa/lokala katastrofplanen aktiverades och fungerade väl.

Erfarenheter redovisade (Ja/Nej): Nej

Report Profile

Identification of Report:

country: FA ident key: 1800_033_01

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

Date of Major Occurrence: Time of Major Occurrence

start: 1991-03-30 start: 10:25:00

finish: finish: 16:00:00

Establishment:

name:

address:

industry: 2002 petrochemical, refining, processing

Petroleum Refinery

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_033_01

Accident Types:

release: Yes explosion: Yes

water contamination: No other: No

fire: Yes

description:

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

Substance(s) Directly Involved:

toxic: No explosive: Yes

ecotoxic: No other: No

flammable: Yes

description:

- Ethylene (C.A.S. CODE:74-85-1, E.E.C. CODE: 601-010-00-3); amount involved = not known.... see Appendix

Short Report / description of substances involved

Immediate Sources of Accident:

storage: No transfer: Yes

process: Yes other: No

description:

The accident involved the "transethylene" pipeline (10" diameter, operating at a pressure of 45 bar) and a nearby warehouse of a petroleum refinery. The "transethylene" pipeline, located on a pipework together with a second ethylene pipe (6... see Appendix Short Report / description of immediate sources

Suspected Causes:

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

human: No **other:** Yes

description:

CAUSES:

The causes of the pipeline rupture have not been fully identified.

Immediate Effects:

material loss: Yes

human deaths: No

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

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: No **other:** No

mitigation: No

description:

A Occurrence Full Report

country: FA **ident key:** 1800_033_01

1 Type of Accident

remarks: Due to a pipeline rupture an ethylene leakage occurred resulting in an unconfined gas cloud (code 1101). The gas cloud was ignited by a road vehicle resulting in an explosion (code 1307) that caused the rupture of the pipeline and its depla... see Appendix Full Report A / type of accident

2 Dangerous Substances

remarks: No data are available about the amount of ethylene released during the accident. The total establishment and the potential directly involved inventories of ethyl acetate (44 barrels of 200 litres each), dimethylcyclooctadiene (69 barrell of ... see Appendix Full Report A /

dangerous substances

3 Source of Accident

illustration: - not applicable -

remarks: The accident involved the "transethylene" pipeline (codes 3301 and 4011) and

a nearby warehouse (codes 3201 and 4006) of a petroleum refinery (code

2002). The "transethylene" pipeline, located on a pipework together with a

second ethylene p... 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 5501 other: not identified

- not applicable -

- not applicable -

- not applicable -

- not applicable -

human / organizational 5501 other: not identified

- not applicable -

- not applicable -

- not applicable -

- not applicable -

remarks: The causes of the pipeline rupture have not been fully identified (code 5501).

6 Discussion about the Occurrence

- not applicable -

Type of Accident country: FA **ident key:** 1800_033_01

event:

major occurrence - not applicable -

initiating event - not applicable -

associated event - not applicable -

event:

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

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

associated event - not applicable -

Dangerous substances

country: FA ident key: 1800_033_01

a) total establishment inventory

CAS number: identity: Thermoplastic Caoutchouc

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): 1000

use of substance as: NORMAL FINISHED PRODUCT

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 1000 potential quantity: 1000

c) substance belongs to relevant inventory indirectly involved: No

actual quantity: -1 indir_pot_quant: -1

a) total establishment inventory

CAS number: 74-85-1 identity: Ethylene

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: NORMAL FINISHED 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: 141-78-6 identity: Ethyl Acetate

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): 7,87

use of substance as: NORMAL FINISHED PRODUCT

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 7,87 potential quantity: 7,87

c) substance belongs to relevant inventory indirectly involved: No

actual quantity: -1 indir_pot_quant: -1

a) total establishment inventory

CAS number: identity: Dimethylcyclooctadiene

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): 12,35

use of substance as: NORMAL FINISHED PRODUCT

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 12,35 potential quantity: 12,35

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_033_01

situation

industry

initiating event - not applicable -

associated event - not applicable -

activity/unit

major occurrence 3301 transfer: pipeline/pipework transfer

initiating event - not applicable -

associated event - not applicable -

component

major occurrence 4011 general pipework/flanges

initiating event - not applicable -

associated event - not applicable -

situation

industry

initiating event 2002 petrochemical, refining, processing

associated event - not applicable -

activity/unit

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

initiating event 3301 transfer: pipeline/pipework transfer

associated event - not applicable -

component

major occurrence 4006 free placement (unconfined pile, stack,etc; if bagged or in cylinders,
more...F1!)

initiating event 4011 general pipework/flanges

associated event - not applicable -

B Consequences Full Report

country: FA **ident key:** 1800_033_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 In the Original Report there is no evidence of significant effects outside the e... 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 1

other serious injuries 3

health monitoring

remarks 4 people were burned by the fire: one, seriously injured, was hospitalized using... 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 As the whole amount of the polluted water used to extinguish the fire was collec... see Appendix

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 The plant and 4 fire fighting vehicles were damaged by the explosion and the sub... see Appendix

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 The External Emergency Plan was activated but in the Original Report there is no... see Appendix

7 Discussion of Consequences

C Response Full Report

country: FA ident key: 1800_033_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

- not applicable -

measures to mitigate consequences:

- not applicable -

useful references:

- not applicable -

5 Discussion about Response

- not applicable -

Appendices for the FA / 1800_033_01 report

Appendix Short Report / description of accident types:

ACCIDENT CASE HISTORY DESCRIPTION:

A person of the "Movement Service" detected on the "transethylene" pipeline (10" diameter, operating at a pressure of 45 bar) an ethylene leakage inside the refinery. Immediately, he alerted the personnel in the proximity of the leakage to abandon the site and called in the company fire brigade, that intervened immediately after. Not withstanding the alert, a vehicle of an external company passed through the gas cloud, and its motor stopped due to the high concentration of ethylene in air. The driver, trying to put again in operation his vehicle, created a spark which ignited the flammable gas cloud resulting in an explosion that caused the rupture of the "transethylene" pipeline and its displacement. This originated a jet-fire, fed by the ethylene escaping through the ruptured pipeline, directed towards a warehouse containing tens of barrels of liquid hydrocarbons (ethyl acetate and dimethylcyclooctadiene) and sacks of thermoplastic caoutchouc. A fire started in the warehouse. The shock wave produced by the explosion caused also the displacement of a second ethylene pipeline (diameter 6", operating at a pressure of 90 bar) located under the 10" pipe on the piperack. The displacement caused its fall and rupture, resulting in a second unconfined vapour cloud explosion. The company fire brigade was assisted by the fire brigades of nearby companies and the local fire brigade in extinguishing the fire. 4 fire fighting vehicles were damaged by the explosion of the gas cloud but, after about 2 hours, 2 of them were already operating. 2.5 hours later a third one was operating too. The plants administration offices (120m away from the fire) and the laboratory were evacuated. The operations with road tankers (carried out about 200m away) were stopped. The cooling of the tanks nearby the warehouse (about 50m away) was activated. At 15:00 it was decided to use foam in fire fighting operations and at about 16:00 the fire was extinguished (even if caoutchouc was continuing to smoke). 4 people were burned by the fire: one, seriously injured, was hospitalized using a helicopter; the others three (slightly injured) received first aids in the surgery of the site. The whole amount of the polluted water used to extinguish the fire was collected in storage vessels in the waste water treatment. The smoke developed by the fire was not toxic.

Appendix Short Report / description of substances involved:

- Ethylene (C.A.S. CODE:74-85-1, E.E.C. CODE: 601-010-00-3): amount involved = not known.
- Dimethylcyclooctadiene: amount involved = 12,350 Kg (69 barrels of 200 litres each).
- Ethyl Acetate (C.A.S. CODE: 141-78-6): amount involved = 7870 Kg (44 barrels of 200 litres each).
- Thermoplastic Caoutchouc: amount involved = 1,000,000 Kg.

Appendix Short Report / description of immediate sources:

The accident involved the "transethylene" pipeline (10" diameter, operating at a pressure of 45 bar) and a nearby warehouse of a petroleum refinery. The "transethylene" pipeline, located on a pipework together with a second ethylene pipe (6" diameter, operating at a pressure of 90 bar), passed nearby a warehouse where dimethylcyclooctadiene (69 barrels of 200 litres each) and ethyl acetate (44 barrels of 200 litres each) were stored together with caoutchouc (about 1,000 tonnes).

Appendix Short Report / description of immediate effects:

EFFECTS ON PEOPLE:

4 people were burned by the fire: one, seriously injured, was hospitalized using a helicopter; the others three (slightly injured) received first aids in the surgery of the site.

MATERIAL LOSS:

4 fire fighting vehicles were damaged by the explosion of the gas cloud.

ECOLOGICAL HARM:

The whole amount of the polluted water used to extinguish the fire was collected in storage vessels in the waste water treatment. When the Original Report was prepared, this water had to be treated. Anyway, as a preventive measure, some floating barriers have been placed in order to avoid any spreading of the polluted water. No ecological harm has been detected in the environment.

Appendix Short Report / description of emergency measures taken:

INTERNAL TO THE ESTABLISHMENT:

The company fire brigade assisted by the fire brigades of nearby companies and the local fire brigade extinguished the fire after about five and half hours. 4 fire fighting vehicles were damaged by the explosion of the gas cloud but, after about 2 hours, 2 of them were already operating. 2.5 hours later a third one was operating too. The plants administration offices (120m away from the fire) and the laboratory were evacuated. The operations with road tankers (carried out about 200m away) were stopped. The cooling of the tanks nearby the warehouse (about 50m away) was activated. At 15:00 it was decided to use foam in fire fighting operations and at about 16:00 the fire was extinguished (even if caoutchouc was continuing to smoke).

The whole amount of the polluted water used to extinguish the fire was collected in storage vessels in the waste water treatment.

EXTERNAL TO THE ESTABLISHMENT:

The External Emergency Plan was activated (rapid arrival on-site of external intervention teams and medical services, good cooperations among the company personnel,

external rescue teams and intervention teams from nearby establishments).

Appendix Full Report A / type of accident:

Due to a pipeline rupture an ethylene leakage occurred resulting in an unconfined gas cloud (code 1101). The gas cloud was ignited by a road vehicle resulting in an explosion (code 1307) that caused the rupture of the pipeline and its displacement. This originated a jet-fire (code 1203) directed towards a warehouse containing barrels of liquid hydrocarbons and sacks of caoutchouc. A fire started in the warehouse (code 1201). The smoke developed by the fire was not toxic.

Appendix Full Report A / dangerous substances:

No data are available about the amount of ethylene released during the accident. The total establishment and the potential directly involved inventories of ethyl acetate (44 barrels of 200 litres each), dimethylcyclooctadiene (69 barrels of 200 litres each) and thermoplastic caoutchouc refer to the amounts stored in the warehouse involved in the fire.

Appendix Full Report A / source of accident - remarks:

The accident involved the "transethylene" pipeline (codes 3301 and 4011) and a nearby warehouse (codes 3201 and 4006) of a petroleum refinery (code 2002). The "transethylene" pipeline, located on a pipework together with a second ethylene pipe (6" diameter, operating at 90 bar), passed nearby a warehouse where dimethylcyclooctadiene (69 barrels of 200 litres each) and ethyl acetate (44 barrels of 200 litres each) were stored together with caoutchouc (about 1,000 tonnes).

Appendix Full Report B / area concerned - remarks:

In the Original Report there is no evidence of significant effects outside the establishment. As the whole amount of the polluted water used to extinguish the fire was collected in storage vessels in the waste water treatment and the smoke developed by the fire was not toxic, no ecological harms had been detected in the environment.

Appendix Full Report B / people:

4 people were burned by the fire: one, seriously injured, was hospitalized using a helicopter; the others three (slightly injured) received first aids in the surgery of the site.

Appendix Full Report B / ecological harm:

As the whole amount of the polluted water used to extinguish the fire was collected in storage vessels in the waste water treatment and the smoke developed by the fire was not toxic, no ecological harms had been detected in the environment.

Appendix Full Report B / material loss:

The plant and 4 fire fighting vehicles were damaged by the explosion and the subsequent fire but no data are available about the cost of the material losses.

Appendix Full Report B / disruption of community life:

The External Emergency Plan was activated but in the Original Report there is no evidence of significant effects outside the establishment.