

Gasutsläpp och brand på ett oljeraffinaderi.

940522 MARS 1994_14

En högtrycksreaktor sprack och släppte ut sitt innehåll, en gasblandning bestående av 70% vätgas och 30% kolväten av olika slag. Sprickan var 13 cm lång och 5,5 cm bred. Tankens var 23 meter hög och hade en diameter på 1m. Gasen antändes och en brand spred sig. Anläggningen nödstoppades och tillflöden av brännbara ämnen ströps. Företagets interna brandkår släckte branden. Olyckans orsaker ansågs vara flera. Reaktorn drevs under omständigheter den inte hade konstruerats för, och där fanns konstruktionfel i reaktorn som dessutom korroderat.

Inblandade ämnen och mängder

	CAS Nr.	Mängd
gaser, främst vätgas och kolväten		okänt

Skador:

Människor: Inga.
Materiella: Inga.
Miljö/ekologi: Inga effekter rapporterade.
Infrastruktur: Inga.

Erfarenheter redovisade (Ja/Nej): Ja

Kortfattat anges förebyggande åtgärder.

En referens ges också: Case report in Safety Digest of American Petroleum institute, Publication 758 Section 2 1979 Chapter 5 is similar to this incident. Also "Chemical Reaction Hazards - A Guide" Editors Barton and Rogers published by IChemEng 1993 and IChemSymposium Series No. 85 "Protection of Exothermic Reactors and Pressurised Storage Vessels". Hydro cracking and thermal cracking of parafins at the temperatures experienced in this reactor are widely reported in standard text books.

Report Profile

Identification of Report:

country: FA ident key: 1994_014_01

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

Date of Major Occurrence: Time of Major Occurrence

start: 1994-05-22 start: 17:05:00

finish: 1994-05-22 finish: 17:20:00

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: 1994_014_01

Accident Types:

release: Yes explosion: Yes

water contamination: No other: No

fire: Yes

description:

During the isomerization of wax in a lube oil plant, the high pressure reactor ruptured, releasing its contents. The released gas (hydrogen and gaseous hydrocarbons) was ignited and a fire developed in the plant area where operators and en... see Appendix Short Report / description of accident types

Substance(s) Directly Involved:

toxic: No explosive: Yes

ecotoxic: No other: No

flammable: Yes

description:

- Refinery Treatment Gas (containing hydrogen and gaseous hydrocarbons [which were methane, ethane and others]): amount involved = not known.

Immediate Sources of Accident:

storage: No transfer: No

process: Yes other: No

description:

The accident occurred in a lube oil plant of a petroleum refinery. The component involved was a wax isomerisation reactor. It was 23 metres high, 1 metre diameter and with thickness walls of 55 mm. Operating conditions in the reactor were 6... see Appendix Short Report / description of immediate sources

Suspected Causes:

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

human: Yes **other:** No

description:

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

Immediate Effects:

material loss: Yes

human deaths: No

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

other: No

ecological harm: No

national heritage loss: No

description:

MATERIAL LOSS:

Rupture of reactor wall. The fire damaged the reactor, the pipeworks, the instruments and adjacent vessels and structures.

Emergency Measures taken:

on-site systems: Yes **decontamination:** Yes

external services: No **restoration:** No

sheltering: No **other:** No

evacuation: No

description:

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

Immediate Lessons Learned:

prevention: Yes **other:** Yes

mitigation: No

description:

After the accident, the plant was shut-down and the reactor purged. Its contents was removed and the reactor was prepared to open it to allow an internal examination.... see Appendix Short Report / description of immediate lessons learned

A Occurrence Full Report

country: FA **ident key:** 1994_014_01

1 Type of Accident

remarks: Rupture of reactor under pressure, releasing gaseous contents, spontaneous ignition and jet fire.

2 Dangerous Substances

remarks: Following the reactor rupture, refinery treatment gas was released. The composition of the refinery treatment gas was about 70% hydrogen and 30%

gaseous hydrocarbons (that is methane, ethane and others). No data are available about the tota... see Appendix Full Report A / dangerous substances

3 Source of Accident

illustration: - not applicable -

remarks: The accident occurred in a lube oil plant (code 3102) of a petroleum refinery (code 2002). The component involved during the initiating and the associated events was the wax isomerization reactor (code 4002), operating at 64 barg and at tem... 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: none applicable

5 Causes of Major Occurrence

main causes

technical / physical 5104 operation: corrosion/fatigue

- not applicable -

- not applicable -

- not applicable -

- not applicable -

human / organizational 5303 organization: organized procedures (none, inadequate, inappropriate, unclear)

5304 organization: training/instruction (none, inadequate, inappropriate)

5307 organization: process analysis (inadequate, incorrect)

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

5310 organization: manufacture/construction (inadequate, inappropriate)

remarks: The accident occurred both to operating outside the design specifications (codes 5401, 5303 and 5304) and to manufacturing defects or corrosion in the wax isomerization reactor (codes 5310 and 5104). The temperature indicators on reactor h... see Appendix Full Report A / causes of major occurrence

6 Discussion about the Occurrence

- not applicable -

Type of Accident country: FA ident key: 1994_014_01

event:

major occurrence 1203 fire: jet flame (burning jet of fluid from orifice)

initiating event 1301 explosion: pressure burst (rupture of pressure system)

associated event - not applicable -

Dangerous substances

country: FA **ident key:** 1994_014_01

a) total establishment inventory

CAS number: identity: Tetraethyl Lead

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): 140

use of substance as: STARTING MATERIAL

b) substance belongs to relevant inventory directly involved: No

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: identity: Nickel Powder & Compounds

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): 70

use of substance as: STARTING MATERIAL

b) substance belongs to relevant inventory directly involved: No

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: identity: Hydrogen Sulphide

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): 25

use of substance as: ON-SITE INTERMEDIATE

b) substance belongs to relevant inventory directly involved: No

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: identity: Hydrogen

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): 4

use of substance as: ON-SITE INTERMEDIATE

b) substance belongs to relevant inventory directly involved: No

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: identity: Highly Flammable Liquids

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): 1432600

use of substance as: NORMAL FINISHED PRODUCT

b) substance belongs to relevant inventory directly involved: No

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: identity: Flammable Gases

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): 35810

use of substance as: NORMAL FINISHED PRODUCT

b) substance belongs to relevant inventory directly involved: No

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: identity: Cobalt Powder & Compounds

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): 670

use of substance as: STARTING MATERIAL

b) substance belongs to relevant inventory directly involved: No

actual quantity: -1 potential quantity: -1

c) substance belongs to relevant inventory indirectly involved: No

actual quantity: -1 indir_pot_quant: -1

Source of Accident - Situation country: FA ident key: 1994_014_01

situation

industry

initiating event 2002 petrochemical, refining, processing

associated event 2002 petrochemical, refining, processing

activity/unit

major occurrence 3102 process: chemical continuous reaction

initiating event 3102 process: chemical continuous reaction

associated event 3102 process: chemical continuous reaction

component

major occurrence 4002 reaction vessel; pressurised

initiating event 4002 reaction vessel; pressurised

associated event 4002 reaction vessel; pressurised

B Consequences Full Report

country: FA ident key: 1994_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 Damage limited to reactor itself and adjacent equipment upto a distance of 20 me... see Appendix

Full Report B / area concerned - remarks

2 People

establishment popul. emergency personnel off-site population

total at risk 8 20

immediate fatalities

subsequent fatalities

hospitalizing injuries

other serious injuries

health monitoring

remarks People at risk were those at work either in close proximity to reactor, e.g. on ... 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 a significant ecological harm.... 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 None.

5 Material Loss

establishment losses off site losses

costs (direct costs to operator) (social costs)

in ECU British Pounds ECU British Pounds

material losses 4000000 0

response, clean up, restoration 3600000 0

remarks Material losses include value of lost sales for 1 year of product from this inst... 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 Yes No No

- media interest No No No

- political interest No No No

remarks In the Original Report there is no evidence of significant effects outside the e... see Appendix

7 Discussion of Consequences

C Response Full Report

country: FA ident key: 1994_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

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

measures to mitigate consequences:

- not applicable -

useful references:

very little published informat... see Appendix Full Report C / lesson learned - references

5 Discussion about Response

- not applicable -

Appendices for the FA / 1994_014_01 report

Appendix Short Report / description of accident types:

During the isomerization of wax in a lube oil plant, the high pressure reactor ruptured, releasing its contents. The released gas (hydrogen and gaseous hydrocarbons) was ignited and a fire developed in the plant area where operators and engineers were working.

Appendix Short Report / description of immediate sources:

The accident occurred in a lube oil plant of a petroleum refinery. The component involved was a wax isomerisation reactor. It was 23 metres high, 1 metre diameter and with thickness walls of 55 mm. Operating conditions in the reactor were 64 barg and 430-480 °C.

Appendix Short Report / description of suspected causes:

CAUSES:

The accident occurred because of:

- 1- operating outside the design specifications;
- 2- manufacturing defects in the reactor;
- 3- corrosion of the reactor;
- 4- pre-existing conditions in reactor (possibly from previous excursions outside the design specifications).

Appendix Short Report / description of emergency measures taken:

INTERNAL TO THE ESTABLISHMENT:

Operators shut-down the plant and shut-off the fuel supply. 4 people of the company fire brigade provided to extinguish the fire. The decontamination of plant started.

Appendix Short Report / description of immediate lessons learned:

After the accident, the plant was shut-down and the reactor purged. Its contents was removed and the reactor was prepared to open it to allow an internal examination.

MEASURES TO PREVENT ANY RECURRENCE OF SIMILAR ACCIDENTS:

After the accident, it was found that the temperature indicators on reactor had maximum readings below expected temperatures. Besides, no high temperature trips were fitted.

Appendix Full Report A / dangerous substances:

Following the reactor rupture, refinery treatment gas was released. The composition of the refinery treatment gas was about 70% hydrogen and 30% gaseous hydrocarbons (that is methane, ethane and others). No data are available about the total establishment and the directly involved inventories of these substances.

Appendix Full Report A / source of accident - remarks:

The accident occurred in a lube oil plant (code 3102) of a petroleum refinery (code 2002). The component involved during the initiating and the associated events was the wax isomerization reactor (code 4002), operating at 64 barg and at temperatures of 430-480 °C. The reactor was 23 metres high, 1 metre diameter and with thickness walls of 55 mm.

Appendix Full Report A / causes of major occurrence:

The accident occurred both to operating outside the design specifications (codes 5401, 5303 and 5304) and to manufacturing defects or corrosion in the wax isomerization reactor (codes 5310 and 5104). The temperature indicators on reactor had maximum readings below expected temperatures and, besides, no high temperature trips were fitted (codes 5307 and 5308).

Appendix Full Report B / area concerned - remarks:

Damage limited to reactor itself and adjacent equipment upto a distance of 20 metres. Split in reactor was 13 cm long, 55 mm wide (wall was originally 55 thick).

Appendix Full Report B / people:

People at risk were those at work either in close proximity to reactor, e.g. on platform where fire occurred or in workshop and control room. Emergency personnel includes plant operators who took first action to tackle fire and shut off gas supply to fire.

Appendix Full Report B / ecological harm:

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

Appendix Full Report B / material loss:

Material losses include value of lost sales for 1 year of product from this installation. Restoration cost is cost of replacement equipment.

Appendix Full Report B / disruption of community life:

In the Original Report there is no evidence of significant effects outside the establishment.

Appendix Full Report C / lesson learned - prevent:

After the accident, the plant was shut-down and the reactor purged. Its contents was removed and the reactor was prepared to open it to allow an internal examination.

MEASURES TO PREVENT ANY RECURRENCE OF SIMILAR ACCIDENTS:

After the accident, it was found that the temperature indicators on reactor had maximum readings below expected temperatures. Besides, no high temperature trips were fitted.

Appendix Full Report C / lesson learned - references:

very little published information on runaway exotherm in continuous reactors. Case report in Safety Digest of American Petroleum institute, Publication 758 Section 2 1979 Chapter 5 is similar to this incident. Also "Chemical Reaction Hazards - A Guide" Editors Barton and Rogers published by IChemEng 1993 and IChemSymposium Series No. 85 "Protection of Exothermic Reactors and Pressurised Storage Vessels". Hydro cracking and thermal cracking of parafins at the temperatures experienced in this reactor are widely reported in standard text books.