Explosion och brand på ett oljeraffinaderi.

920901 MARS 1992_12

Olyckan inträffade i en destillationsanläggning på ett oljeraffinaderi vid uppstart under ett skiftbyte (07:20). En explosion uppstod då ångor av propan och butan antändes. Orsaken till läckan är inte säkert identifierad, men orsakades troligen av en rostig rörledning. Gasmolnet hann sprida sig under 1-1,5 minuter innan det antändes. Den påföljande branden kunde begränsas till den omedelbara närheten av läckan. Branden bekämpades av företagets interna brandkår, i samarbete med grannföretagets brandkår och räddningstjänsten. Totalt 150 personer var engagerade i släckningsarbetet. Branden var släckt efter 4 timmar.

Inblandade ämnen och mängder

	CAS Nr.	Mängd
lätta kolväten:		totalt 5400 kg
propan	74-98-6	
butan	106-97-8	

Skador:

Människor:	14 människor avled av explosionen. Av dessa omkom en omedelbart, medan 13 avled på sjukhus på grund av sviterna, främst brännskador. Ytterligare 30 personer fick sjukhusvård för brännskador.
Materiella:	Svåra skador på anläggningen.
Miljö/ekologi:	Inga effekter rapporterade.
Infrastruktur:	Trafiken omdirigerades.

Erfarenheter redovisade (Ja/Nej): Ja

Mycket kortfattat anges förebyggande åtgärder.

Report Profile

Identification of Report:

country: FA **ident key:** 1992_012_01

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

Date of Major Occurrence: Time of Major Occurrence

start: 1992-09-01 **start:** 07:20:00

finish: finish:

Establishment:

name:

address:

industry: 2002 petrochemical, refining, processing

Petroleum Refining

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:** 1992_012_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:

- Light Naphtha, Propane (C.A.S. CODE: 74-98-6) and Butane (C.A.S. CODE: 106-97-8): amount involved = 5,400 kg

(no data are available about the single amounts of the substances involved in the accident).

Immediate Sources of Accident:

storage: No **transfer:** No

process: Yes **other:** No

description:

The accident occurred at the naphta stabilizer tower of the crude distillation unit in a petroleum refinery.

The accident occurred during the start-up procedure of the unit and the operating conditions at that moment

were: pressure = 7 Kg/c... 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: Yes

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: 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:

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:** 1992_012_01

1 Type of Accident

remarks: Due to the ignition of an unconfined vapour cloud of hydrocarbons (light naphta, propane and butane), an explosion (code 1307) occurred in the crude distillation unit of a petroleum refinery. The possible source of hudrocarbons release (cod... see Appendix Full Report A / type of accident

2 Dangerous Substances

remarks: The total establishment and the potential directly involved inventories of light naphtha, propane and butane refer to the amount involved in the accident. No data are available about the single amounts of light naphta, propane and butane.

3 Source of Accident

illustration: - not applicable -

remarks: The accident occurred at the naphta stabilizer tower (code 4007) of the

crude distillation unit (code 3104) in a petroleum refinery (code 2002). The

possibile source of hydrocarbons release was the rupture of a 10" pipe

(code 4011) at the b... 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): 1

direction (from): ESE

stability (Pasquill):

ambient temperature (∞C): 20

remarks: Calm weather conditions. The direction of the wind (with a speed of 1 m/sec) was from East

South East. The relative humidity was about 76.3%.

5 Causes of Major Occurrence

main causes

technical / physical 5102 operation: component/machinery failure/malfunction

- not applicable -

- not applicable -

- not applicable -

- not applicable -

human / organizational - not applicable -

- not applicable -

- not applicable -

- not applicable -

- not applicable -

remarks: The explosion was caused by the ignition of an unconfined vapour cloud of hydrocarbons

(light naphta, propane and butane). When the Original Report was prepared the causes of

the hydrocarbons release were not fully identified (the results o... see Appendix Full

Report A / causes of major occurrence

6 Discussion about the Occurrence

- not applicable -

Type of Accident **country:** FA **ident key:** 1992_012_01

event:

major occurrence 1307 explosion: VCE (vapour cloud explosion; supersonic wave front)

initiating event 1102 release: fluid release to ground

associated event - not applicable -

event:

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

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

associated event - not applicable -

Dangerous substances

country: FA **ident key:** 1992_012_01

a) total establishment inventory

CAS number: 74-98-6 **identity:** Propane

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): 5,4

use of substance as: NORMAL FINISHED PRODUCT

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 5,4 **potential quantity:** 5,4

c) substance belongs to relevant inventory indirectly involved: No

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

a) total establishment inventory

CAS number: identity: Light Naphtha

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): 5,4

use of substance as: NORMAL FINISHED PRODUCT

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 5,4 **potential quantity:** 5,4

c) substance belongs to relevant inventory indirectly involved: No

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

a) total establishment inventory

CAS number: 106-97-8 **identity:** Butane

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): 5,4

use of substance as: NORMAL FINISHED PRODUCT

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 5,4 **potential quantity:** 5,4

c) substance belongs to relevant inventory indirectly involved: No

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

Source of Accident - Situation **country:** FA **ident key:** 1992_012_01

situation

industry

inititating event - not applicable -

associated event - not applicable -

activity/unit

major occurrence - not applicable -

inititating event - not applicable -

associated event - not applicable -

component

major occurrence 4011 general pipework/flanges

inititating event 4011 general pipework/flanges

associated event - not applicable -

situation

industry

inititating event 2002 petrochemical, refining, processing

associated event - not applicable -

activity/unit

major occurrence 3104 process: physical operations (mixing, melting crystallizing, etc.)

inititating event 3104 process: physical operations (mixing, melting crystallizing, etc.)

associated event - not applicable -

component

major occurrence 4007 machinery/equipment (pump, filter, column seperator, mixer, etc.)

inititating event 4007 machinery/equipment (pump, filter, column seperator, mixer, etc.)

associated event - not applicable -

B Consequences Full Report

country: FA **ident key:** 1992_012_01

1 Area concerned

affected

extent of effects installation: Yes

establishment: No

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 1

subsequent fatalities 13

hospitalizing injuries 20

other serious injuries

health monitoring

remarks 14 people were killed by the explosion (1 person died immediately, the others 13... 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 US$ ECU US$

material losses 1,5E+07

response, clean up, restoration

remarks The cost of the material losses (damages to equipments, pipings, instrumentation... 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 The traffic was deviated away from the refinery vicinity.... see Appendix Full Report B / disrupt

7 Discussion of Consequences

C Response Full Report

country: FA **ident key:** 1992_012_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 it was esta... 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 / 1992_012_01 report

Appendix Short Report / description of accident types:

ACCIDENT CASE HISTORY DESCRIPTION:

The accident occurred at 7:20 a.m., during the shift change. The explosion was caused by the ignition of a vapor cloud of hydrocarbons (light naphtha, propane and butane). The possible source of the hydrocarbons release was the rupture of a 10" pipe at the bottom of the Naphtha Stabilizer Tower. For about 1^1.5 minutes the cloud spread in a large area of the unit and was then ignited by some sources of ignition, exploding. The cloud explosion was then followed by a fire that was confined to the point where the leakage occurred and was totally extinguished at 11.20 a.m. There was an immediate information to Fire Brigade Hellenic Refineries of Aspropyrgos (ELDA) and the MOTOR OIL Refinery (there is an agreement among the three Refineries to help one each other in case of accident). Five minutes later, the fire vehicles started arriving to Refinery Installations. Totally, there were 23 fire vehicles and 150 firemen plus the personnel of PETROLA HELLAS S.A. One man was killed by the explosion and 33 people hospitalized with burns on their skin. When the Original Report was prepared 14 people had died (the other 13 died in the hospitals beacuse of the burns).

Appendix Short Report / description of immediate sources:

The accident occurred at the naphta stabilizer tower of the crude distillation unit in a petroleum refinery. The accident occurred during the start-up procedure of the unit and the operating conditions at that moment were: pressure = 7 Kg/cm2 and temperature = 110¯C. When the accident occurred the personnel of the previuos shift had already left.

Appendix Short Report / description of suspected causes:

CAUSES:

The explosion was caused by the ignition of an unconfined vapor cloud of hydrocarbons (light naphtha, propane and butane). When the Original Report was prepared the causes of the hydrocarbons release were not fully identified (the results of the analysis will be transmitted as soon as they will be available) but, probably, the possible source was the rupture of a 10" pipe at the bottom of the naphta stabilizer tower.

Appendix Short Report / description of immediate effects:

EFFECTS ON PEOPLE:

Inside the establishment 14 people were killed by the explosion (1 person died immediately, the others 13 died in the hospital because of the burns) and 33 people were injured by the explosion (13 out of 33 died in the hospitals because of the burns).

MATERIAL LOSS:

The cost of the material losses (damages to equipments, pipings, instrumentation, electrical cables of the distillation unit, glass windows of the surrounding buildings) has been evaluated in about 15,000,000 US Dollars.

COMMUNITY DISRUPTION:

The traffic was deviated away from the Refinery vicinity.

MAP OF THE ACCIDENT AREA AND MAX. DENSITY OF POPULATION:

The location of the establishment is shown on a map (scale 1:10.000) attached to the Original Report.

Appendix Short Report / description of emergency measures taken:

INTERNAL TO THE ESTABLISHMENT:

Immediate activation of the emergency plans which worked out as foreseen. Transfer of the woundeds to the hospital and removal of the personnel not involved in fire fighting. Manual shut-down of all the units. Extinction of the fire.

EXTERNAL SERVICES:

There was an immediate information to Fire Brigade Hellenic Refineries of Aspropyrgos (ELDA) and the MOTOR OIL Refinery (there is an agreement among the three Refineries to help one each other in case of accident). Five minutes later, the fire vehicles started arriving to Refinery Installations. Totally, there were 23 fire vehicles and 150 firemen plus the personnel of PETROLA HELLAS S.A.

EXTERNAL TO THE ESTABLISHMENT:

Deviation of the traffic away from the refinery vicinity.

Appendix Short Report / description of immediate lessons learned:

MEASURES TO PREVENT ANY RECURRENCE OF SIMILAR ACCIDENTS:

After the accident it was established to carry out improved safety audits. On the basis of the results and of the experience gained by the inspection of the equipment and HAZOP analysis of the plant, it was decided to tighten inspection intervals.

INTERNAL TO THE ESTABLISHMENT:

The affected refinery equipments were checked and, where necessary, they had been repaired or replaced.

Appendix Full Report A / type of accident:

Due to the ignition of an unconfined vapour cloud of hydrocarbons (light naphta, propane and butane), an explosion (code 1307) occurred in the crude distillation unit of a petroleum refinery. The possible source of hudrocarbons release (codes 1101 and 1102) was the rupture of a 10" pipe. For about 1^1.5 minutes the cloud spread in a large area of the unit and was then ignited. The cloud explosion was then followed by a fire (code 1202) that was confined to the point where the leakage occurred.

Appendix Full Report A / source of accident - remarks:

The accident occurred at the naphta stabilizer tower (code 4007) of the crude distillation unit (code 3104) in a petroleum refinery (code 2002). The possibile source of hydrocarbons release was the rupture of a 10" pipe (code 4011) at the bottom of the tower. The accident occurred during the start-up procudere of the unit and the operating conditions at that moment were: pressure=7 Kg/cm2 and temperature=110¯C. The location of the establishment is shown on a map (scale 1:10000).

Appendix Full Report A / causes of major occurrence:

The explosion was caused by the ignition of an unconfined vapour cloud of hydrocarbons (light naphta, propane and butane). When the Original Report was prepared the causes of the hydrocarbons release were not fully identified (the results of the analysis will be transmitted as soon as they will be available) but, probably, the possible source was the rupture of a 10" pipe at the bottom of the naphta stabilizer tower (code 5102).

Appendix Full Report B / area concerned - remarks:

In the Original Report there is no evidence of significant effects outside the establishment. Other parts of the refinery were not involved in the accident.

Appendix Full Report B / people:

14 people were killed by the explosion (1 person died immediately, the others 13 died in the hospital because of the burns). 33 people were injured by the explosion (13 out 33 died in the hospital because of the burns). On site, there were about 150 firemen from the other two refineries and Fire Brigades, plus the personnel of the PETROLA HELLAS S.A..

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 cost of the material losses (damages to equipments, pipings, instrumentation, electrical cables of the distillation unit, glass windows of the surrounding buildings) has been evaluated in about 15,000,000 US Dollars.

Appendix Full Report B / disruption of community life:

The traffic was deviated away from the refinery vicinity.

Appendix Full Report C / lesson learned - prevent:

After the accident it was established to carry out improved safety audits. On the basis of the results and of the experience gained by the inspection of the equipment and HAZOP analysis of the plant, it was decided to tighten inspection intervals.

The affected refinery equipments were checked and, where necessary, they had been repaired or replaced.