

Brand på en naturgasanläggning.

891205 MARS 1989_23

På en station för lagring av flytande naturgas uppstod en läcka på grund av en ventil som inte var vederbörligen stängd. En operatör hade inte kontrollerat tillräckligt noggrant. Den utsläppta gasen drogs in i luftintaget till en brännare där den antändes. Elden leddes tillbaka till den tank gasen kom ifrån. Resultatet blev en eldboll på 45x25 m. Räddningstjänsten tillkallades tillsammans med polis och ambulans. Branden släcktes.

Inblandade ämnen och mängder

	CAS Nr.	Mängd
flytande naturgas främst metan	74-82-8	okänt

Skador:

Människor: Två operatörer fick brännskador på händer och ansikte.

Materiella: Mindre skador på anläggningen.

Miljö/ekologi: Inga effekter rapporterade.

Infrastruktur: Inga.

Erfarenheter redovisade (Ja/Nej): Ja

Mycket kortfattat anges förebyggande åtgärder.

Report Profile

Identification of Report:

country: FA ident key: 1989_023_01

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

Date of Major Occurrence: Time of Major Occurrence

start: 1989-12-05 start: 13:00:00

finish: finish:

Establishment:

name:

address:

industry: 2002 petrochemical, refining, processing

Gas Processing (Natural Gas Liquefaction and Storage)

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:** 1989_023_01

Accident Types:

release: Yes **explosion:** Yes

water contamination: No **other:** No

fire: Yes

description:

ENVIRONMENT AND ATMOSPHERICAL CONDITIONS:... see Appendix Short Report / description of accident types

Substance(s) Directly Involved:

toxic: No **explosive:** Yes

ecotoxic: No **other:** No

flammable: Yes

description:

- Liquefied Natural Gas [mainly Methane] (C.A.S. CODE: 74-82-8, E.E.C. CODE: 601-001-00-4): amount involved = not known.

Immediate Sources of Accident:

storage: Yes **transfer:** No

process: Yes **other:** No

description:

The accident occurred in a peak saving station for natural gas of a gas processing industry. The station included a natural gas liquefaction unit, a LNG storage and a LNG compression/vaporization-water bath Thurley vaporizer-facilities. The... see Appendix Short Report / description of immediate sources

Suspected Causes:

plant or equipment: No **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: 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: No

description:

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

Immediate Lessons Learned:

prevention: Yes **other:** No

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:** 1989_023_01

1 Type of Accident

remarks: During the cooling down exercise of pipes and pumps between the storage tanks and vaporizers, a jet of LNG (code 1101) from an open drain valve entered into one of the air inlet for a vaporizer. The gas was ignited by a pilot flame, flashed... see Appendix Full Report A / type of accident

2 Dangerous Substances

remarks: No data are available about the amount of Liquefied Natural Gas (LNG) involved in the accident. Methane is the main component of LNG. From the Original Report is not fully clear if LNG is a starting material or a finished product.

3 Source of Accident

illustration: - not applicable -

remarks: The accident occurred in a peak saving station for natural gas of a gas processing industry (code 2002). The peak saving station included a natural gas liquefaction unit, a LNG storage and a LNG compression/vaporization-water bath Thurley v... 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): 340⁻

stability (Pasquill): C

ambient temperature (°C): 7

remarks: Ambient temperature = 7⁻C. Atmospheric Stability Class = C. Wind direction = 340⁻ with a speed of ?? m/s.

5 Causes of Major Occurrence

main causes

technical / physical - not applicable -

- not applicable -

- not applicable -

- not applicable -

- not applicable -

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

5307 organization: process analysis (inadequate, incorrect)

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

5401 person: operator error

- not applicable -

remarks: The LNG jet was caused because the drain lines were opened and venting when the pump was started. The operators did not make sure that the drain valves were closed (codes 5401 and 5303). The process was not adequately analyzed because it wa... see Appendix Full Report A / causes of major occurrence

6 Discussion about the Occurrence

- not applicable -

Type of Accident country: FA **ident key:** 1989_023_01

event:

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

initiating event - not applicable -

associated event - not applicable -

event:

major occurrence 1205 fire: fireball (burning mass rising in air, often after BLEVE)

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

associated event - not applicable -

Dangerous substances

country: FA ident key: 1989_023_01

a) total establishment inventory

CAS number: 74-82-8 identity: Methane- Liquefied Natural Gas

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

Source of Accident - Situation country: FA ident key: 1989_023_01

situation

industry

initiating event - not applicable -

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 4011 general pipework/flanges

initiating event 4011 general pipework/flanges

associated event - not applicable -

situation

industry

initiating event 2002 petrochemical, refining, processing

associated event - not applicable -

activity/unit

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

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

associated event - not applicable -

component

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

initiating event 4007 machinery/equipment (pump, filter, column separator, mixer, etc.)

associated event - not applicable -

B Consequences Full Report

country: FA ident key: 1989_023_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 i... see Appendix

Full Report B / area concerned - remarks

2 People

establishment popul. emergency personnel off-site population

total at risk 5 40

immediate fatalities

subsequent fatalities

hospitalizing injuries 2

other serious injuries

health monitoring

remarks Two operators received burns to their hands and face because of the fire-ball. F... 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. Thi... see Appendix

Full Report B / ecological harm

4 National Heritage Loss

effects on:

- historical sites not applicable - historic monuments not applicable

- **historic buildings** not applicable - **art treasures** not applicable

remarks No data available.

5 Material Loss

establishment losses off site losses

costs (direct costs to operator) (social costs)

in ECU ECU

material losses

response, clean up, restoration

remarks No data are available about the cost of the minor material damages to the plant ... 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:** 1989_023_01

1 Emergency Measures

taken - on site - not applicable - - not applicable -

- not applicable - - not applicable -

- not applicable - - not applicable -

- **off site** - not applicable - - not applicable -

- not applicable - - not applicable -

- not applicable - - not applicable -

still - on site - not applicable - - not applicable -

required

- not applicable - - not applicable -

- not applicable - - not applicable -

- **off site** - not applicable - - not applicable -

- not applicable - - not applicable -

- not applicable - - not applicable -

continuing contamination or danger

-on site not applicable

-off site not applicable

remarks - not applicable -

2 Seveso II Duties

pre-accident evaluation

Article item not due yet not done done/submitted evaluated

6 notification No No No No

7 policy (MAPP) No No No No

9 safety report No No No No

9, 10, 11 update No No No No

11 internal plan No No No No

11 external plan No No No No

13 informing public No No No No

9, 12 siting policy No No No No

post-accident evaluation

Seveso II duty was actual were actual compared with actual

contingency consequences consequences, the

addressed? addressed? predicted extent was?

Article item

7 policy (MAPP) not applicable not applicable not applicable

9 current safety report not applicable not applicable not applicable

11 internal plan not applicable not applicable not applicable

11 external plan not applicable not applicable not applicable

13 informing public not applicable not applicable not applicable

9, 12 siting policy not applicable not applicable not applicable

evaluation of safety organisation

organisational element element existed did element relate to actual circumstances of

yes / no no / partly / yes adequate?

- written policy objectives No

- specified management No

structure

- specified responsibilities No

- specified working procedures No

- specified procedures for No

assessment/auditing of

management system

- specified procedures for No

review and update of

management policy

- specified general training No

procedures

- specified emergency No

training procedures

evaluation of ecological impact control

organisational element element existed did element relate to actual circumstances of

yes / no no / partly / yes adequate?

- ecological status review No

before incident

- potential ecological No

consequences assessment

- ecological impact review No

after incident

- ecological restoration No

procedures

- subsequent review of No

restoration success

remarks - not applicable -

3 Official Action Taken

legal action

- not applicable -

other official action

- not applicable -

4 Lessons Learned

measures to prevent recurrence

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

measures to mitigate consequences:

- not applicable -

useful references:

- not applicable -

5 Discussion about Response

- not applicable -

Appendices for the FA / 1989_023_01 report

Appendix Short Report / description of accident types:

ENVIRONMENT AND ATMOSPHERICAL CONDITIONS:

Ambient temperature = 7 °C. Atmospheric Stability Class = C. Wind direction = 340° with a speed of ?? m/s.

ACCIDENT CASE HISTORY DESCRIPTION:

The accident occurred in a peak saving station used to store liquefied natural-gas (LNG). The station included a natural gas liquefaction unit, a LNG storage and a LNG compression/vaporization/water bath Thurley vaporizer-facilities. During peak demands, LNG was pumped up to 82 barg to 8 vaporisers from which the gas was injected into the transmission line to 72 barg. As a routine exercise to verify the availability of the site to export gas, the equipment had to be brought to a "1- hour" stand-by condition and LNG used to cool down pipes and pumps between the storage tanks and vaporisers. The Thurley vaporiser consisted of a large steel water tank, the water being heated by 6 gas burners. The air supply for the burners was coming from a single local fan via ductwork (up to 24" diameter). The LNG passed through tubes inside the water bath, evaporating and warming up to 20 °C. The LNG inlet to the vaporiser was controlled by a motorised hand indicated control (HIC) valve from the control room. An additional emergency shut-down (ESD) valve could be operated locally or remotely. Between these valves there were four drain valves and a relief valve. The drain valves were 0.5 m and 1.5 m above the ground level. The lower level drain valves were the ones normally used.

On December 5, an availability exercise was carried out and five of the 8 vaporisers had to be brought to a "1- hour" stand-by condition. Two operators were working on A, B and C vaporisers and other two on E and F vaporisers. The shift engineer was present to start-up the LNG pumps and open the main valve. Vaporisers A, B and C were cooled down according to the normal procedure (admission of small amounts of LNG and low level drain valves opened to accelerate the cooling) and vaporisers E and F were being closed when the pumps were started resulting in a jet of LNG from one of the open drain valves. 30 seconds later there was an explosion and fire-ball. Two operators received burns to their hands and face. The fire-ball was approximately 40m x 25 m.

Appendix Short Report / description of immediate sources:

The accident occurred in a peak saving station for natural gas of a gas processing industry. The station included a natural gas liquefaction unit, a LNG storage and a LNG compression/vaporization-water bath Thurley vaporizer-facilities. The accident occurred during a routine exercise to verify the availability of the site to export gas by bringing equipment to a "1-hour" stand-by condition.

Appendix Short Report / description of suspected causes:

CAUSES:

The LNG jet occurred because the drain lines were opened and venting when the pump was started. The operators did not make sure that the valves were closed. The released natural gas was drawn into one of the air intake to a vaporiser burner and was ignited by a pilot flame, flashing back and igniting the gas that was present in the area following the cooling down exercise. Even if it was not known, due to an inadequate process analysis, the cooling down exercise involving the release of LNG from 5 vaporisers resulted in the presence of sufficient gas in the area to cause an explosion when ignited.

Appendix Short Report / description of immediate effects:

EFFECTS ON PEOPLE:

Two operators received burns to their hands and face because of the fire-ball. Approximately, 40 rescue personnel were involved in the accident (7 fire tenders, 2 fire chiefs, 3 ambulances and 4 police cars attended) but nobody was injured.

MATERIAL LOSS:

The accident caused minor structural damages to the plant (paint damages, cracked gauge glass).

Appendix Short Report / description of emergency measures taken:

INTERNAL TO THE ESTABLISHMENT:

The internal emergency teams were called and the operators put out small residual fires.

EXTERNAL SERVICES:

External fire-fighting services (7 fire tenders, 2 fire chiefs) were called. Also external ambulance services (3 cars) and police intervention (4 cars) were requested.

Appendix Short Report / description of immediate lessons learned:

MEASURES TO PREVENT ANY RECURRENCE OF SIMILAR ACCIDENTS:

After the accident, the following measures were established:

1- the system of work adopted for cooling down the pipework, valves and pumps to be modified and the drain valves not to be opened to accelerate cooling so that no gas is released to the atmosphere during this operation;

2- the air intake to the vaporiser burners was relocated out of the classified Zone 1.

Another site in the country that was using a similar system had also been modified.

Appendix Full Report A / type of accident:

During the cooling down exercise of pipes and pumps between the storage tanks and vaporizers, a jet of LNG (code 1101) from an open drain valve entered into one of the air inlet for a vaporizer. The gas was ignited by a pilot flame, flashed back and ignited the gas that was present, resulting in an explosion (code 1307) and in a fire-ball (code 1205).

Appendix Full Report A / source of accident - remarks:

The accident occurred in a peak saving station for natural gas of a gas processing industry (code 2002). The peak saving station included a natural gas liquefaction unit, a LNG storage and a LNG compression/vaporization-water bath Thurley vaporizer facilities (codes 3104 and 3201). The components involved were the vaporizers and the associated pipeworks (codes 4007 and 4011). The location of the peak saving station is shown on a map attached to the Original Report.

Appendix Full Report A / causes of major occurrence:

The LNG jet was caused because the drain lines were opened and venting when the pump was started. The operators did not make sure that the drain valves were closed (codes 5401 and 5303). The process was not adequately analyzed because it was not known that, following the cooling down procedure, in the area there was the presence of sufficient gas to cause an explosion if ignited. Also, the location of the air intake to the vaporizer burners was not adequate (codes 5307 and 5308).

Appendix Full Report B / area concerned - remarks:

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

Appendix Full Report B / people:

Two operators received burns to their hands and face because of the fire-ball. From the Original Report it is not fully clear if they were hospitalized or not. Approximately, 40 rescue personnel were involved (7 fire tenders, 2 fire chiefs, 3 ambulances and 4 police cars attended).

Appendix Full Report B / ecological harm:

In the Original Report there is no evidence of significant ecological harms. This is due to the low ecotoxic risk of the Liquefied Natural gas.

Appendix Full Report B / material loss:

No data are available about the cost of the minor material damages to the plant (paint damages, cracked gauge glass) caused by the accident.

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 following measures were established:

1- the system of work adopted for cooling down the pipework, valves and pumps to be modified and the drain valves not to be opened to accelerate cooling so that no gas is released to the atmosphere during this operation;

2- the air intake to the vaporiser burners was relocated out of the classified Zone 1.

Another site in the country that was using a similar system had also been modified.