

Explosion på en fabrik för ammoniakproduktion.

890223 MARS 1800_29

En mindre läcka upptäcktes vid en fläns på rörledningen i en ammoniaksyntes-loop. Företaget kallade in en extern specialist för att laga ventilen på rörledningen under drift. Under lagningsarbetet läckte en gasstråle med en blandning av vätgas och kvävgas om 250 bars tryck ut och exploderade. Två arbetare omkom. Skälet att välja lagning under drift var dels att läckan ansågs liten, och dels att man sökte undvika kostnader och besvär i samband med ett produktionsstopp i ett komplext system. Efter olyckan stod produktionen still under en längre tid.

Inblandade ämnen och mängder

	CAS Nr.	Mängd
väte	1333-74-0	okänt
kväve	7727-37-9	okänt

Skador:

Människor:	Två arbetare dödades vid explosionen.
Materiella:	Ventiler och rörledningar förstördes. Ett längre produktionsstopp blev nödvändigt.
Miljö/ekologi:	Inga effekter rapporterade.
Infrastruktur:	Inga.

Erfarenheter redovisade (Ja/Nej): Ja

Mycket kort nämns några förebyggande åtgärder.

Report Profile

Identification of Report:

country: FA ident key: 1800_029_01

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

Date of Major Occurrence: Time of Major Occurrence

start: 1989-02-23 start: 10:00:00

finish: finish:

Establishment:

name:

address:

industry: 2004 pesticides, pharmaceuticals, other fine chemicals

Organic Chemical (Ammonia Production Unit in a Fertilizer Plant)

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_029_01

Accident Types:

release: No **explosion:** Yes

water contamination: No **other:** No

fire: No

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:

- Hydrogen (C.A.S. CODE: 1333-74-0, E.E.C. CODE: 001-001-00-9); amount involved = not known.... see Appendix

Short Report / description of substances involved

Immediate Sources of Accident:

storage: No **transfer:** No

process: Yes **other:** No

description:

The accident occurred during the maintenance of a valve on a piping of the ammonia synthesis loop in the ammonia production unit within a fertilizer plant. The operating pressure in the ammonia synthesis loop was 250 bar.

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: Yes

human injuries: No **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: No **restoration:** No

sheltering: No **other:** No

evacuation: No

description:

INTERNAL TO THE ESTABLISHMENT:

After the explosion, the ammonia production unit was shut-down.

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:** 1800_029_01

1 Type of Accident

remarks: During the on-stream repair of a valve on the piping of the ammonia

synthesis loop, some stud bolts broke causing the escape of a jet of a

gaseous mixture of hydrogen and nitrogen at 250 bars (code 1101). The

escaping mixture formed an unco... see Appendix Full Report A / type of

accident

2 Dangerous Substances

remarks: No data are available about the amount of hydrogen and nitrogen involved in

the accident.

3 Source of Accident

illustration: - not applicable -

remarks: The accident occurred during the maintenance of a valve (code 4010) on a

piping of the ammonia synthesis loop in the ammonia production unit (code

3102) within a fertilizer plant (code 2004). The operating pressure in the ammonia synthesis ... 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 5102 operation: component/machinery failure/malfunction

- not applicable -

- not applicable -

- not applicable -

- not applicable -

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

5307 organization: process analysis (inadequate, incorrect)

5401 person: operator error

- not applicable -

- not applicable -

remarks: The release was caused by the rupture of some stud bolts (code 5102) during the on-stream repair. Investigation revealed that two causes have probably contributed: the flange stud-bolts of the valve have been replaced by others made of a ma... see Appendix Full Report A / causes of major occurrence

6 Discussion about the Occurrence

- not applicable -

Type of Accident country: FA ident key: 1800_029_01

event:

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

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

associated event - not applicable -

Dangerous substances

country: FA ident key: 1800_029_01

a) total establishment inventory

CAS number: 7727-37-9 **identity:** Nitrogen

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: STARTING MATERIAL

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: 1333-74-0 **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): -1

use of substance as: STARTING MATERIAL

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:** 1800_029_01

situation

industry

initiating event 2004 pesticides, pharmaceuticals, other fine chemicals

associated event - not applicable -

activity/unit

major occurrence 3102 process: chemical continuous reaction

initiating event 3102 process: chemical continuous reaction

associated event - not applicable -

component

major occurrence 4010 valves/controls/monitoring devices/drain cocks

initiating event 4010 valves/controls/monitoring devices/drain cocks

associated event - not applicable -

B Consequences Full Report

country: FA ident key: 1800_029_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 a... see Appendix

Full Report B / area concerned - remarks

2 People

establishment popul. emergency personnel off-site population

total at risk

immediate fatalities 2

subsequent fatalities

hospitalizing injuries

other serious injuries

health monitoring

remarks 2 workers were killed by the explosion.

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 ECU

material losses

response, clean up, restoration

remarks The explosion damaged the valves and the pipings of the plant. No data are avail... 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:** 1800_029_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 / 1800_029_01 report

Appendix Short Report / description of accident types:

ACCIDENT CASE HISTORY DESCRIPTION:

A minor leak had been detected in a flange on the piping of the ammonia synthesis loop. The company called a specialized external contractor to perform an on-stream repair of the valve, selected both for the limited extents of the leakage and the economic costs and efforts associated to a shut-down of a very complex system. The on-stream repair consisted in (see the drawing attached to the Original Report):

- fabrication of a special bracket in two parts adapted to the dimensions of the flange of the valve;
- injection of filling material in the bracket around the flange (the material had to be injected at a pressure higher than the operating pressure inside the pipe).

During the repair some stud bolts broke causing the escape of a jet of a gaseous mixture of hydrogen and nitrogen at 250 bars. The escaping mixture exploded, killing 2 workers.

Appendix Short Report / description of substances involved:

- Hydrogen (C.A.S. CODE: 1333-74-0, E.E.C. CODE: 001-001-00-9): amount involved = not known.
- Nitrogen (C.A.S. CODE: 7727-37-9): amount involved = not known.

Appendix Short Report / description of suspected causes:

CAUSES:

Investigation revealed that two causes have probably contributed to the accident:

- 1- the flange stud-bolts of the valve have been replaced by others made of a material not equivalent to the one originally specified;
- 2- the maintenance company performing the repair have not taken into account the overpressure on the stud-bolts due to the injection of the filling material in the bracket.

Appendix Short Report / description of immediate effects:

EFFECTS ON PEOPLE:

2 workers were killed by the explosion.

MATERIAL LOSS:

The explosion damaged the valves and the pipings of the plant. No data are available about the cost of the damages. A prolonged shut-down of the plant was necessary.

Appendix Short Report / description of immediate lessons learned:

MEASURES TO PREVENT ANY RECURRENCE OF SIMILAR ACCIDENTS:

After the accident, the following measures were established:

- compilation of written maintenance procedures with emphasis on safety issues;
- establishment of the sequence of operations to be followed during repair of such valves.

Appendix Full Report A / type of accident:

During the on-stream repair of a valve on the piping of the ammonia synthesis loop, some stud bolts broke causing the escape of a jet of a gaseous mixture of hydrogen and nitrogen at 250 bars (code 1101). The escaping mixture formed an unconfined gas cloud which exploded (code 1307), killing 2 workers.

Appendix Full Report A / source of accident - remarks:

The accident occurred during the maintenance of a valve (code 4010) on a piping of the ammonia synthesis loop in the ammonia production unit (code 3102) within a fertilizer plant (code 2004). The operating pressure in the ammonia synthesis loop was 250 bar.

Appendix Full Report A / causes of major occurrence:

The release was caused by the rupture of some stud bolts (code 5102) during the on-stream repair. Investigation revealed that two causes have probably contributed: the flange stud-bolts of the valve have been replaced by others made of a material not equivalent to the one originally specified; the maintenance company performing the repair have not taken into account the overpressure on the stud-bolts due to the injection of the filling material in the bracket (codes 53003, 5307 and 5401).

Appendix Full Report B / area concerned - remarks:

In the Original Report there is no evidence of significant effects outside the ammonia production unit.

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 explosion damaged the valves and the pipings of the plant. No data are available about the cost of the damages. A prolonged shut-down of the plant was necessary.

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:

- compilation of written maintenance procedures with emphasis on safety issues;
- establishment of the sequence of operations to be followed during repair of such valves.