

Explosion på en kemianläggning för produktion av katalysatorer.

890707 MARS 1989_16

Olyckan inträffade vid underhållsarbete på en lagertank för ammoniak. Efter att det mekaniska arbetet var avslutat och tanken skulle fyllas registrerades ett övertryck i tanken och en läcka upptäcktes. Fyllningen avbröts och problemen rapporterades till underhållsavdelningen. Läckan reparerades. Försöket att fylla tanken rapporterades INTE vidare. Efter skiftbyte noterade förmannen att tanken var tom och beordrade reparationsarbetet på tanken. Vid putsning på en rörledning upptäcktes ett visslande ljud. Fyra arbetare satte sig i säkerhet bakom en betongvägg. Kort därefter exploderade tanken. Tankens tak flög över ett angränsande hus och landade 60 m bort. Ingen skadades.

Inblandade ämnen och mängder

	CAS Nr.	Mängd
25% ammoniak i vattenlösning	7664-41-7	150 liter

Skador:

Människor:	Inga.
Materiella:	Anläggningen skadades.
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_016_01

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

Date of Major Occurrence: Time of Major Occurrence

start: 1989-07-07 start:

finish: finish:

Establishment:

name:

address:

industry: 2001 general chemicals manufacture

Inorganic Chemical (Catalyst and Molecular Sieve Production for Oil Industry)

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_016_01**Accident Types:****release:** Yes **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:** Yes **explosive:** Yes**ecotoxic:** No **other:** No**flammable:** Yes**description:**

- 25% Aqueous Ammonia Solution (C.A.S CODE: 7664-41-7): amount involved = approximately 50 litres in the 100 m³ tank (estimate). Theoretical calculations showed that an amount of about 150 litres has to be considered more likely. Insignifi... see Appendix Short Report / description of substances involved

Immediate Sources of Accident:**storage:** Yes **transfer:** No**process:** Yes **other:** No**description:**

The accident occurred in a storage tank for aqueous ammonia solution (after the replacement of its bottom part) in an inorganic chemical industry for the production of catalyst and molecular sieve used in the oil industry. Chemical reactor... 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:

PERSONS EXPOSED:... 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:... see Appendix Short Report / description of emergency measures taken

Immediate Lessons Learned:

prevention: Yes **other:** No

mitigation: Yes

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_016_01

1 Type of Accident

remarks: During the maintenance of a storage tank for aqueous ammonia solutions

(replacement of the bottom part), an explosion of an ammonia vapours/air

explosive mixture occurred (code 1307). The explosion is believed to have

been caused by the ig... see Appendix Full Report A / type of accident

2 Dangerous Substances

remarks: The amount of 25% aqueous ammonia solution involved in the accident had

been evaluated in approximately 50 litres but theoretical calculations

showed that an amount of about 150 litres has to be considered more likely.

The total establish... see Appendix Full Report A / dangerous substances

3 Source of Accident

illustration: - not applicable -

remarks: The accident occurred in a 100 m³ storage tank (codes 4003 and 3201) for

aqueous ammonia solution (after the replacement of its bottom part) in an

inorganic chemical industry (code 2001) for the production of catalyst and

molecular sieve u... 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 - not applicable -

- 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)

5401 person: operator error

- not applicable -

- not applicable -

remarks: The trial to fill the tank was not reported to the shift supervisor because of:- human error (code 5401); - internal communication inadequate (code 5303); - work-permits procedures inadequate(code 5303); - insufficient training/instruction... see Appendix Full Report A / causes of major occurrence

6 Discussion about the Occurrence

- not applicable -

Type of Accident country: FA ident key: 1989_016_01

event:

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

initiating event 1307 explosion: VCE (vapour cloud explosion; supersonic wave front)

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

Dangerous substances

country: FA ident key: 1989_016_01

a) total establishment inventory

CAS number: 7664-41-7 **identity:** Ammonia

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: No

actual quantity: -1 **potential quantity:** -1

c) substance belongs to relevant inventory indirectly involved: Yes

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

Source of Accident - Situation country: FA ident key: 1989_016_01

situation

industry

initiating event 2001 general chemicals manufacture

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 4003 container; non-pressurised (hopper, tank, drum, bag, etc.)

initiating event 4003 container; non-pressurised (hopper, tank, drum, bag, etc.)

associated event - not applicable -

B Consequences Full Report

country: FA ident key: 1989_016_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 90

immediate fatalities

subsequent fatalities

hospitalizing injuries

other serious injuries

health monitoring

remarks No one of the 90 people that has been estimated to be present in the plant when ... 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 preventing human access or activities)** Suspected
- **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 (onl... 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 HFL ECU HFL

material losses 200000

response, clean up, restoration

remarks The explosion caused damages to piping, wiring, platforms in the area, scrubber,... 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_016_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:

After the accident, the re-des... see Appendix Full Report C / lesson learned - mitigate

useful references:

- not applicable -

5 Discussion about Response

- not applicable -

Appendices for the FA / 1989_016_01 report

Appendix Short Report / description of accident types:

ACCIDENT CASE HISTORY DESCRIPTION:

A storage tank for aqueous ammonia solutions was up for maintenance (replacement of the bottom part). The tank got a new bottom on Wednesday (05/07/89) and was replaced Wednesday evening. After mechanical completion of the replacement work, the Thursday evening a trial had been undertaken to fill the tank up, but overpressure was registered in the tank and also the flange connecting the feeding line to the tank leaked. Consequently the filling operation was stopped. The problems were reported to the maintenance department, the flange connection was repaired and the pressure relief line checked. The trial to fill the tank was not reported to the shift supervisor. A shift change took place and the supervisor recorded in the production log-book that the tank was empty. The next day (Friday 07/07/89) a safe work permit was issued by the supervisor of the next shift to the mechanics to disconnect the piping associated with this tank for further repair. The repair work proceeded and during the grinding of a disconnected pipe, a mechanic noticed a whistling sound and hid, together with the 3 others mechanics, behind a concrete tankfarm wall. Soon afterwards, the tank exploded. The top of the tank was blown over an adjacent manufacturing building, landing at the grass-strip between the adjacent building and the office-buildings and struck into another office building (approximately 60 metres away) which was empty. No injuries occurred. The production was provisionally continued by using a road-tanker for the aqueous ammonia solution storage.

Appendix Short Report / description of substances involved:

- 25% Aqueous Ammonia Solution (C.A.S CODE: 7664-41-7): amount involved = approximately 50 litres in the 100 m³ tank (estimate). Theoretical calculations showed that an amount of about 150 litres has to be considered more likely. Insignificant amounts of ammonia vapours may have been released into the environment after the explosion.

Appendix Short Report / description of immediate sources:

The accident occurred in a storage tank for aqueous ammonia solution (after the replacement of its bottom part) in an inorganic chemical industry for the production of catalyst and molecular sieve used in the oil industry. Chemical reactors and storage tanks in the factory had a volumetric capacity up to approximately 100 m³. The factory was approximately located at a distance of 1,000 metres from the nearest dwelling houses.

Appendix Short Report / description of suspected causes:

CAUSES:

The trial to fill the tank was not reported to the shift supervisor because of:

- human error;
- internal communication inadequate;
- work-permits procedures inadequate;
- insufficient training/instruction of the personnel.

The ammonia vapours/air explosive mixture formed in the storage tank after the trial was probably ignited by the grinding of the disconnected pipe.

The pressure relief lines also failed to operate as expected but from the Original Report is not fully clear if it was caused by a wrong component design or not.

Appendix Short Report / description of immediate effects:

PERSONS EXPOSED:

No one of the 90 people that has been estimated to be present in the plant when the accident occurred were injured by the explosion (no one was in the office building when the accident occurred).

MATERIAL LOSS:

The explosion caused damages to piping, wiring, platforms in the area, scrubber, tank insulation, office building. The cost of these damages has been evaluated in about 200,000 Guilders (about 0.086 MECU).

Appendix Short Report / description of emergency measures taken:

INTERNAL TO THE ESTABLISHMENT:

The mechanics hid behind a concrete tankfarm wall.

EXTERNAL TO THE ESTABLISHMENT:

No off-site emergency measures were necessary, except the warning to the authorities.

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- improvement of procedures;
- 2- improvement of communication;
- 3- improvement of training of personnel.

MEASURES TO MITIGATE THE EFFECTS OF THE ACCIDENT:

After the accident, the re-design of vapour relief lines was established.

Appendix Full Report A / type of accident:

During the maintenance of a storage tank for aqueous ammonia solutions (replacement of the bottom part), an explosion of an ammonia vapours/air explosive mixture occurred (code 1307). The explosion is believed to have been caused by the ignition of the ammonia vapours caused by the repair works (grinding of a disconnected pipe). Insignificant amounts of ammonia vapours may have been released into the environment after the explosion (code 1101).

Appendix Full Report A / dangerous substances:

The amount of 25% aqueous ammonia solution involved in the accident had been evaluated in approximately 50 litres but theoretical calculations showed that an amount of about 150 litres has to be considered more likely. The total establishment and the potential directly involved inventories of ammonia solution refer to the amount involved in the accident. Insignificant amounts of ammonia vapours may have been released into the environment after the explosion.

Appendix Full Report A / source of accident - remarks:

The accident occurred in a 100 m³ storage tank (codes 4003 and 3201) for aqueous ammonia solution (after the replacement of its bottom part) in an inorganic chemical industry (code 2001) for the production of catalyst and molecular sieve used in the oil industry. Chemical reactors and storage tanks in the factory had a volumetric capacity up to approximately 100 m³. The factory was approximately located at a distance of 1,000 metres from the nearest dwelling houses.

Appendix Full Report A / causes of major occurrence:

The trial to fill the tank was not reported to the shift supervisor because of: - human error (code 5401); - internal communication inadequate (code 5303); - work-permits procedures inadequate (code 5303); - insufficient training/instruction of the personnel (code 5304). The ammonia vapours/air explosive mixture formed in the storage tank after the trial was probably ignited by the grinding of the disconnected pipe. The pressure relief lines also failed to operate as expected.

Appendix Full Report B / area concerned - remarks:

In the Original Report there is no evidence of significant effects outside the establishment (only insignificant amounts of ammonia vapours may have been released into the environment after the explosion).

Appendix Full Report B / people:

No one of the 90 people that has been estimated to be present in the plant when the accident occurred were injured by the explosion (no one was in the office building when the accident occurred).

Appendix Full Report B / ecological harm:

In the Original Report there is no evidence of significant ecological harms (only insignificant amounts of ammonia vapours may have been released into the environment after the explosion).

Appendix Full Report B / material loss:

The explosion caused damages to piping, wiring, platforms in the area, scrubber, tank insulation, office building. The cost of these damages has been evaluated in about 200,000 Guilders (about 0.086 MECU).

Appendix Full Report B / disruption of community life:

In the Original Report there is no evidence of significant effects outside the establishment (only insignificant amounts of ammonia vapours may have been released into the environment after the explosion).

Appendix Full Report C / lesson learned - prevent:

After the accident, the following measures were established:

- 1- improvement of procedures;
- 2- improvement of communication;
- 3- improvement of training of personnel.

Appendix Full Report C / lesson learned - mitigate:

After the accident, the re-design of vapour relief lines was established.