

# Explosion och gasutsläpp på en fabrik för produktion av fotogen.

911106 MARS 1991\_09

Olyckan inträffade på en fabrik inom den organisk kemiska industrin under rutinmässig drift. En kylkrets var i drift och kondensorn arbetade för full kapacitet. Då en andra kondensor skulle startas upp hördes en explosion och ett vitt ammoniakmoln kunde både ses och luktas. Orsakerna till olyckan är inte fullt utredda. Kylkretsen nödstoppades och alla ventiler kring den skadade kondensorn stängdes. Personalen i kontrollrummet larmade räddningstjänsten som använde sig av vattengardiner för att kyla de utsatta delarna av anläggningen och begränsa spridningen av ammoniakångorna.

## Inblandade ämnen och mängder

|          | CAS Nr.   | Mängd   |
|----------|-----------|---------|
| ammoniak | 7664-41-7 | 1200 kg |

## Skador:

Människor: 6 personer skadades av ammoniakutsläppet.

Materiella: Apparaturen skadades av explosionen.

Miljö/ekologi: Inga effekter rapporterade.

Infrastruktur: Inga

## Erfarenheter redovisade (Ja/Nej): Ja

Kortfattat anges förebyggande åtgärder.

## Report Profile

### Identification of Report:

country: FA ident key: 1991\_009\_01

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

### Date of Major Occurrence: Time of Major Occurrence

start: 1991-11-06 start:

finish: finish:

### Establishment:

name:

address:

industry: 2001 general chemicals manufacture

Organic Chemical (Paraffine Production)

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:** 1991\_009\_01

**Accident Types:**

**release:** Yes **explosion:** Yes

**water contamination:** No **other:** No

**fire:** No

**description:**

SAFETY SYSTEMS OR OPERATORS INTERVENTION:... see Appendix Short Report / description of accident types

**Substance(s) Directly Involved:**

**toxic:** Yes **explosive:** Yes

**ecotoxic:** No **other:** No

**flammable:** Yes

**description:**

- Ammonia (C.A.S. CODE: 7664-41-7, E.E.C. CODE: 007-001-00-5): amount involved = 1,200 Kg.

**Immediate Sources of Accident:**

**storage:** No **transfer:** No

**process:** Yes **other:** No

**description:**

The accident occurred during normal operation in an organic chemical industry for paraffine's production. The system involved was the cooling circuit. When the accident occurred the cooling circuit was in service and the condenser was opera... see Appendix Short Report / description of immediate sources

**Suspected Causes:**

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

**human:** No **other:** Yes

**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:** 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:** 1991\_009\_01

### **1 Type of Accident**

**remarks:** The cooling circuit was in service and the condenser was operating at full power. After starting the operation of a second condenser with open suction and delivery valves, an explosion was heard by the personnel in control room. Further a w... see Appendix Full Report A / type of accident

### **2 Dangerous Substances**

**remarks:** The total establishment and the potential directly involved inventories of ammonia refer to the amount released during the accident. From the Original Report it is not fully clear if ammonia is a starting material or not.

### **3 Source of Accident**

**illustration:** - not applicable -

**remarks:** The accident occurred during normal operation in an organic chemical industry for paraffine's production (code 2001). The system involved was the cooling circuit (code 3104). When the accident occurred the cooling circuit was in service and... see Appendix Full Report A / source of accident - remarks

### **4 Meteorological Conditions**

**precipitation none: fog: rain: hail: snow:**

No No Yes No No

**wind speed (m/s):**

**direction (from):** W N W

**stability (Pasquill):**

**ambient temperature (°C):**

**remarks:** Rainy. Wind intensity about 4 azs. Wind from West/NorthWest.

## 5 Causes of Major Occurrence

**main causes**

**technical / physical** 5501 other: not identified

- not applicable -

- not applicable -

- not applicable -

- not applicable -

**human / organizational** - not applicable -

- not applicable -

- not applicable -

- not applicable -

- not applicable -

**remarks:** The causes of failure have not fully identified (code 5501). When the Original Report was prepared, two theories were checked: a water hammer (of condensed water); mechanical failure of one of the components (the material of the condenser w... see Appendix Full Report A / causes of major occurrence

## 6 Discussion about the Occurrence

- not applicable -

**Type of Accident** country: FA ident key: 1991\_009\_01

**event:**

**major occurrence** 1101 release: gas/vapour/mist/etc release to air

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

**associated event** - not applicable -

## Dangerous substances

country: FA ident key: 1991\_009\_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):** 1,2

**use of substance as:** STARTING MATERIAL

**b) substance belongs to relevant inventory directly involved:** Yes

**actual quantity:** 1,2 **potential quantity:** 1,2

**c) substance belongs to relevant inventory indirectly involved:** No

**actual quantity:** -1 **indir\_pot\_quant:** -1

**Source of Accident - Situation** **country:** FA **ident key:** 1991\_009\_01

## **situation**

**industry**

**initiating event** 2001 general chemicals manufacture

**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** 4009 heat exchanger (boiler, refrigerator, heating coils, etc.)

**initiating event** 4009 heat exchanger (boiler, refrigerator, heating coils, etc.)

**associated event** - not applicable -

## **B Consequences Full Report**

**country:** FA **ident key:** 1991\_009\_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**

**immediate fatalities**

**subsequent fatalities**

**hospitalizing injuries** 6

**other serious injuries**

## **health monitoring**

**remarks** Inside the establishment 6 people were injured by the ammonia release.... 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 beca... 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 caused damages to the condenser but no data are available about th... 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:** 1991\_009\_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 follow... see Appendix Full Report C / lesson learned - mitigate

useful references:

- not applicable -

### **5 Discussion about Response**

- not applicable -

## **Appendices for the FA / 1991\_009\_01 report**

### **Appendix Short Report / description of accident types:**

SAFETY SYSTEMS OR OPERATORS INTERVENTION:

The emergency shut-down of cooling circuit was activated. When the accident occurred alarms were not in operation.

ENVIRONMENTAL AND ATMOSPHERIC CONDITIONS:

Rainy. Wind intensity about 4 azs. Wind from West/NorthWest.

ACCIDENT CASE HISTORY DESCRIPTION:

The cooling circuit was in service and the condenser was operating at full power. After starting the operation of a second condenser with open suction and delivery valves, an explosion was heard by the personnel in control room. Further a white vapour cloud smelling of ammonia was observed. The emergency shut-down of cooling circuit was activated.

### **Appendix Short Report / description of immediate sources:**

The accident occurred during normal operation in an organic chemical industry for paraffine's production. The system involved was the cooling circuit. When the accident occurred the cooling circuit was in service and the condenser was operating at full power.

### **Appendix Short Report / description of suspected causes:**

CAUSES:

The causes of failure have not fully identified. When the Original Report was prepared, two theories were checked:

1- a water hammer (of condensed water);

2- mechanical failure of one of the components (the material of the condenser was tested).

### **Appendix Short Report / description of immediate effects:**

#### EFFECTS ON PEOPLE:

Inside the establishment 6 people were injured by the ammonia release.

#### MATERIAL LOSS:

The explosion caused damages to the condenser but no data are available about the cost of the material losses.

### **Appendix Short Report / description of emergency measures taken:**

#### INTERNAL TO THE ESTABLISHMENT:

The fire brigade was alarmed and intervened putting on a water curtain around the cooling machine room in order to avoid ammonia dispersion. The emergency shut-down of cooling circuit was activated. All valves around the damaged condenser were closed.

### **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- inspection of the other condensers of the cooling circuit;
- 2- temperature in machine room during low external temperatures to be kept at a value sufficient to avoid condensate formation in the stand-by components;
- 3- inspection of the pressure side of non-return valve;
- 4- shutting of the vertical condenser against the condensate return.

#### MEASURES TO MITIGATE THE EFFECTS OF THE ACCIDENT:

After the accident, the following measures were established:

- 1- installation of sensor elements to detect ammonia;
- 2- installation of sprinklers above windows and doors in order to avoid ammonia dispersion.

### **Appendix Full Report A / type of accident:**

The cooling circuit was in service and the condenser was operating at full power. After starting the operation of a second condenser with open suction and delivery valves, an explosion was heard by the personnel in control room. Further a white vapour cloud smelling of ammonia was observed (code 1101). From the Original Report it is not fully clear which kind of explosion occurred.

### **Appendix Full Report A / source of accident - remarks:**

The accident occurred during normal operation in an organic chemical industry for paraffine's production (code 2001). The system involved was the cooling circuit (code 3104). When the accident occurred the cooling circuit was in service and the condenser was operating at full power (code 4009).

### **Appendix Full Report A / causes of major occurrence:**

The causes of failure have not fully identified (code 5501). When the Original Report was prepared, two theories were checked: a water hammer (of condensed water); mechanical failure of one of the components (the material of the condenser was tested).

### **Appendix Full Report B / area concerned - remarks:**

In the Original Report there is no evidence of significant effects outside the establishment because the fire brigade put on a water curtain around the cooling machine room in order to avoid ammonia dispersion.

### **Appendix Full Report B / people:**

Inside the establishment 6 people were injured by the ammonia release.

### **Appendix Full Report B / ecological harm:**

In the Original Report there is no evidence of significant ecological harms because the fire brigade put on a water curtain around the cooling machine room in order to avoid ammonia dispersion.

### **Appendix Full Report B / material loss:**

The explosion caused damages to the condenser but no data are available about the cost of the material losses.

### **Appendix Full Report B / disruption of community life:**

In the Original Report there is no evidence of significant effects outside the establishment because the fire brigade put on a water curtain around the cooling machine room in order to avoid ammonia dispersion.

### **Appendix Full Report C / lesson learned - prevent:**

After the accident, the following measures were established:

- 1- inspection of the other condensers of the cooling circuit;
- 2- temperature in machine room during low external temperatures to be kept at a value sufficient to avoid condensate formation in the stand-by components;
- 3- inspection of the pressure side of non-return valve;

4- shutting of the vertical condenser against the condensate return.

**Appendix Full Report C / lesson learned - mitigate:**

After the accident, the following measures were established:

- 1- installation of sensor elements to detect ammonia;
- 2- installation of sprinklers above windows and doors in order to avoid ammonia dispersion.