

# Klorgasutsläpp på en kloralkalifabrik

840301 MARS 1800\_50

Vid igångkörning av en turbo-kompressor på en kloralkalifabrik öppnades en säkerhetsventil som sedan inte stängdes. Ungefär 1500 kg klorgas släppte ut under 15 minuter innan ventilen kunde lokaliseras och stängas.

## Inblandade ämnen och mängder

	CAS Nr.	Mängd
klor	7582-50-5	

## Skador:

Människor: 13 människor på fabriksområdet och 6 stycken utanför skadades av giftutsläppet.

Materiella: Inga.

Miljö/ekologi: Klorgasen orsakade synbara skador på den omgivande växtligheten.

Infrastruktur: Allmänheten uppmanades att hålla dörrar och fönster stängda.

## Erfarenheter redovisade (Ja/Nej): Ja

Förebyggande åtgärder redovisas kortfattat.

## Report Profile

### Identification of Report:

country: FA ident key: 1800\_050\_01

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

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

start: 1984-03-01 start:

finish: finish:

### Establishment:

name:

address:

industry: 2001 general chemicals manufacture

Halogen, Alkali, Phosphorous & Sulphur Industry (Chlorine-Alkali Electrolysis 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\_050\_01

**Accident Types:**

release: Yes explosion: No

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: No

ecotoxic: No other: No

flammable: No

**description:**

- Chlorine (C.A.S. CODE: 7782-50-5, E.E.C. CODE: 017-001-00-7): amount involved = about 1,500 kg.

**Immediate Sources of Accident:**

storage: No transfer: No

process: Yes other: No

**description:**

The accident occurred during the start-up of a turbo-compressor in a chlorine-alkali electrolysis plant. The components involved was a relief valve installed on the pipeline of the chlorine destroyer system and the discharge pipeline that e... 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: No

human deaths: No

human injuries: Yes community disruption: No

other: No

**ecological harm:** Yes

**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:** 1800\_050\_01

### **1 Type of Accident**

**remarks:** Owing to repeated start-up of a turbo compressor, a pressure wave caused the

opening of a relief valve installed on the pipeline of the chlorine

destroyer system, as well as a leakage from the discharge pipeline that

entered into the chlori... see Appendix Full Report A / type of accident

### **2 Dangerous Substances**

**remarks:** The total establishment and the potential directly involved inventories of

chlorine refer to the amount released during the accident (emission into the

atmosphere of about 1,500 kg over 18 minutes through a 30 m high stack).

### **3 Source of Accident**

**illustration:** - not applicable -

**remarks:** The accident occurred during the start-up of a turbo-compressor in a

chlorine-alkali electrolysis plant (codes 3103 and 2001). The components

involved was a relief valve (code 4010) installed on the pipeline of the

chlorine destroyer system... 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** 5307 organization: process analysis (inadequate, incorrect)

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

inappropriate)

- not applicable -

- not applicable -

- not applicable -

**remarks:** The chlorine release occurred because: 1- the relief valve opened when it was not

necessary (code 5102); 2- the position of the relief valve (opened) was not indicated in

the control room (codes 5307 and 5308); 3- the capacity of the chlori... see Appendix Full

Report A / causes of major occurrence

## 6 Discussion about the Occurrence

- not applicable -

**Type of Accident** country: FA ident key: 1800\_050\_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: 1800\_050\_01

### a) total establishment inventory

**CAS number:** 7782-50-5 **identity:** Chlorine

**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):** 1,5

use of substance as: NORMAL FINISHED PRODUCT

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

actual quantity: 1,5 potential quantity: 1,5

**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\_050\_01

### **situation**

#### **industry**

initiating event - not applicable -

associated event - not applicable -

#### **activity/unit**

major occurrence - not applicable -

initiating event - not applicable -

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 2001 general chemicals manufacture

associated event - not applicable -

#### **activity/unit**

major occurrence 3103 process: electrochemical operation

initiating event 3103 process: electrochemical operation

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\_050\_01

### **1 Area concerned**

#### **affected**

extent of effects installation: Yes

establishment: Yes

off-site; local: Yes

**off-site; regional:** No

**off-site; transboundary:** No

**illustration of effects** - not applicable -

**remarks** Inside the establishment, 13 people were injured by the toxic release. Outside t... 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** 13 6

**other serious injuries**

**health monitoring**

**remarks** Inside the establishment 13 people were injured by the toxic release. Outside th... 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) not applicable

- 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** The chlorine release caused damages to the surrounding vegetation (in the Origin... 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 material losses occurred except the released chlorine.... 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** Observers were sent to the surrounding area that might have been affected by the... see Appendix

## 7 Discussion of Consequences

### Ecological Components involved

**country:** FA **ident key:** 1800\_050\_01

**type:** 6108 inland: woodland; predominantly or totally natural

**threatened:** not applicable **affected:** not applicable

**type:** 6107 inland: woodland; predominantly or totally plantation

**threatened:** not applicable **affected:** not applicable

## C Response Full Report

**country:** FA **ident key:** 1800\_050\_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\_050\_01 report

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

#### ACCIDENT CASE HISTORY DESCRIPTION:

Owing to repeated start-up of a turbo compressor, a pressure wave caused the opening of a relief valve installed on the pipeline of the chlorine destroyer system, as well as a leakage from the discharge pipeline that entered into the chlorine pumping station, causing the activation of the chlorine sensors located there. A search for the leakage source in the pumping station was undertaken until the chlorine destroyer plant was exhausted. Chlorine was dispersed into the atmosphere through the chimney stack (emission into the atmosphere of about 1,500 kg over 18 minutes through a 30 m high stack). Finally, the relief valve was recognized as the cause of the release and it was immediately closed. The concentration of chlorine was measured at the perimeter fence. Observers were sent into the surrounding area that might have been affected by the chlorine cloud in order to ensure that, in case of danger, all windows would be closed.

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

The accident occurred during the start-up of a turbo-compressor in a chlorine-alkali electrolysis plant. The components involved was a relief valve installed on the pipeline of the chlorine destroyer system and the discharge pipeline that entered into the chlorine pumping station.

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

#### CAUSES:

The chlorine release occurred because:

- 1- the relief valve opened when it was not necessary;
- 2- the position of the relief valve (opened) was not indicated in the control room;
- 3- the capacity of the chlorine destroyer plant was unknown when the accident occurred;
- 4- it was not possible to regenerate the chlorine destroyer in a short time when it was exhausted.

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

#### EFFECTS ON PEOPLE:

Inside the establishment 13 people were injured by the toxic release. Outside the establishment 6 people were injured by the toxic release.

#### ECOLOGICAL HARM:

The chlorine release caused damages to the surrounding vegetation.

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

#### INTERNAL TO THE ESTABLISHMENT:

The sensors in the chlorine pumping station activated an alarm. Information to plant management, police and fire department. The plant was shut-down. Measurements of the chlorine concentration were carried out at the firm fence. When the relief valve was recognized as the cause of the chlorine release, it was immediately closed.

#### EXTERNAL TO THE ESTABLISHMENT:

Observers were sent to the surrounding area that might have been affected by the chloride cloud in order to ensure that, in case of danger, all windows would be 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- the position of the relief valve and the chlorine flow to the chlorine destroyer plant to be indicated in the control room;
- 2- review of the design cases for sizing the chlorine destroyer plant.

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

Owing to repeated start-up of a turbo compressor, a pressure wave caused the opening of a relief valve installed on the pipeline of the chlorine destroyer system, as well as a leakage from the discharge pipeline that entered into the chlorine pumping station. A search for the leakage source in the pumping station was undertaken until the chlorine destroyer plant was exhausted. Chlorine was dispersed into the atmosphere through the chimney stack (code 1101).

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

The accident occurred during the start-up of a turbo-compressor in a chlorine-alkali electrolysis plant (codes 3103 and 2001). The components involved was a relief valve (code 4010) installed on the pipeline of the chlorine destroyer system and the discharge pipeline (code 4011) that entered into the chlorine pumping station.

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

The chlorine release occurred because: 1- the relief valve opened when it was not necessary (code 5102); 2- the position of the relief valve (opened) was not indicated in the control room (codes 5307 and 5308); 3- the capacity of the chlorine destroyer plant was unknown when the accident occurred (codes 5307 and 5308); 4- it was not possible to regenerate the chlorine destroyer in a short time when it was exhausted (codes 5307 and 5308).

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

Inside the establishment, 13 people were injured by the toxic release. Outside the establishment, 6 people were injured by the toxic release that also caused damages to the surrounding vegetation.

**Appendix Full Report B / people:**

Inside the establishment 13 people were injured by the toxic release. Outside the establishment 6 people were injured by the toxic release. From the Original Report is not fully clear that it was hospitalizing injuries.

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

The chlorine release caused damages to the surrounding vegetation (in the Original Report is not clear whether vegetation was planted or not).

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

No material losses occurred except the released chlorine.

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

Observers were sent to the surrounding area that might have been affected by the chloride cloud in order to ensure that, in case of danger, all windows would be closed.

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

After the accident, the following measures were established:

- 1- the position of the relief valve and the chlorine flow to the chlorine destroyer plant to be indicated in the control room;
- 2- review of the design cases for sizing the chlorine destroyer plant.