

Klorutsläpp på kemikaliefabrik i samband med lossning.

860213 MARS 1986_08

Olyckan inträffade på en kemikaliefabrik i samband med lossning. Då flytande klor skulle lossas från en tankbil till en lagertank öppnades en klaffventil som släppte ut klor. Klormängden förångades ögonblickligen och tryckvågen skadade delar av anläggningen. Klorgas slapp ut i anläggningen och dess omedelbara närhet. Det är möjligt att det också skedde ett visst utsläpp av väteklorid. Larm utöstes på fabriken och företagets katastrofplan trädde i kraft. Räddningstjänsten informerades. Närliggande fabriker i området varnades. Läckan isolerades och vatten sprutades över läckkällan för att minimera effekterna av gasutsläppet. Olyckans orsaker tillskrevs bristfälliga rutiner och systemdesign.

Inblandade ämnen och mängder

	CAS Nr.	Mängd
klor	7782-50-5	94 kg
väteklorid	7647-01-0	okänt

Skador:

Människor:	Åtta personer skadades och fick föras till sjukhus. Två av dem fick även första hjälpen på grund av giftgaserna.
Materiella:	Anläggningen skadades.
Miljö/ekologi:	Inga effekter rapporterade.
Infrastruktur:	Inga.

Erfarenheter redovisade (Ja/Nej): Nej

Report Profile

Identification of Report:

country: FA ident key: 1986_008_01

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

Date of Major Occurrence: Time of Major Occurrence

start: 1986-02-13 start: 12:00:00

finish: finish:

Establishment:

name:

address:

industry: 2001 general chemicals manufacture

General Chemical (Unloading System for Liquid Chlorine)

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:** 1986_008_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): amount involved = 94 kg... see Appendix Short Report / description of substances involved

Immediate Sources of Accident:

storage: No **transfer:** Yes

process: Yes **other:** No

description:

The accident occurred in an unloading system for liquid chlorine from road tanker to storage tank in an organic chemical industry. The components involved were caustic absorption, bleach and hydrogen chloride columns in the vent system.

Suspected Causes:

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

human: Yes **other:** No

description:

INITIATING EVENT AND CONSEQUENCES:... 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: Yes **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:** 1986_008_01

1 Type of Accident

remarks: During the discharge from a road tanker to a storage tank, liquid chlorine

was sent into the vent main (code 1101). The flash vapourization of liquid

chlorine and the subsequent pressure surge caused damages to the absorption,

bleach and hy... see Appendix Full Report A / type of accident

2 Dangerous Substances

remarks: No data are available about the total establishment inventories of the

substances involved. The total establishment inventory of chlorine refers to

the amount released during the accident. Some hydrogen chloride may have

been released for a... see Appendix Full Report A / dangerous substances

3 Source of Accident

illustration: - not applicable -

remarks: The accident occurred during the unloading (code 3304) of liquid chlorine

from a road tanker into a storage tank of an general chemical industry (code

2001). The component involved in the initiating event was the transfer line
(code 4011) b... 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): East

stability (Pasquill):

ambient temperature (°C):

remarks: Wind from East carried the gas cloud towards the chlorine storage building and
Chlorination Raw Material Tank Farm before it dispersed into the atmosphere.

5 Causes of Major Occurrence

main causes

technical / physical - not applicable -

- not applicable -

- not applicable -

- not applicable -

- not applicable -

human / organizational 5305 organization: supervision (none, inadequate, inappropriate)

5307 organization: process analysis (inadequate, incorrect)

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

5401 person: operator error

- not applicable -

remarks: The immediate cause was an error by an experienced operator (code 5401) in leaving the
vent valve, on the line between the tank and the storage tank, open. This, together with
the lack of supervision during unloading (code 5305) and with a ... see Appendix Full
Report A / causes of major occurrence

6 Discussion about the Occurrence

- not applicable -

Type of Accident country: FA ident key: 1986_008_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 1301 explosion: pressure burst (rupture of pressure system)

Dangerous substances

country: FA ident key: 1986_008_01

a) total establishment inventory

CAS number: 7647-01-0 identity: Hydrogen Chloride

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

a) total establishment inventory

CAS number: 7782-50 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): 0,094

use of substance as: STARTING MATERIAL

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 0,094 potential quantity: 0,094

c) substance belongs to relevant inventory indirectly involved: Yes

actual quantity: 0,094 indir_pot_quant: 0,094

Source of Accident - Situation country: FA ident key: 1986_008_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 4999 other

initiating event - not applicable -

associated event - not applicable -

situation

industry

initiating event 2001 general chemicals manufacture

associated event 2001 general chemicals manufacture

activity/unit

major occurrence 3304 transfer: loading/unloading activities (transfer interfaces)

initiating event 3304 transfer: loading/unloading activities (transfer interfaces)

associated event 3304 transfer: loading/unloading activities (transfer interfaces)

component

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

initiating event 4011 general pipework/flanges

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

B Consequences Full Report

country: FA **ident key:** 1986_008_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 2

health monitoring

remarks Inside the establishment 6 people were hospitalized and 2 received first aid due... 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 a 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 pressure surge caused by the flash vapourization of liquid chlorine resulted... 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 The emergency controller contacted the neighbouring factories.... see Appendix Full Report B / di

7 Discussion of Consequences

C Response Full Report

country: FA **ident key:** 1986_008_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 / 1986_008_01 report

Appendix Short Report / description of accident types:

ACCIDENT CASE HISTORY DESCRIPTION:

During the discharge of liquid chlorine from a road tanker to a storage tank the vent valve on the transfer line was opened allowing liquid chlorine into the main vent. There was flash vapourisation of liquid chlorine and the pressure surge resulted in damages to caustic absorption, bleach and hydrogen chloride columns. The damages and also the failure of liquid loop seals resulted in a leak of gas (mainly chlorine) within the chlorination plant building and in a localized area immediately adjacent to the plant. Some hydrogen chloride may have been emitted for a short time as a result of the failure of the hydrogen chloride column and column loop seals before automatic isolation took place. The leak was isolated and water sprays were used to minimize the effects of residual fumes.

Appendix Short Report / description of substances involved:

- Chlorine (C.A.S. CODE: 7782-50-5): amount involved = 94 kg.

- Hydrogen Chloride (C.A.S. CODE: 7647-01-0, E.E.C. CODE: 017-002-00-2): amount involved = not known.

Appendix Short Report / description of suspected causes:

INITIATING EVENT AND CONSEQUENCES:

During unloading, vent valve on transfer line was opened when it should have been closed allowing liquid chlorine into the vent main. Flash vapourisation of liquid chlorine caused the observed damages and emission to atmosphere.

CAUSES:

The accident was caused by the error of an experienced operator (in leaving the vent valve opened during unloading) together with a wrong system design which made it possible to vent with open storage tanks.

Appendix Short Report / description of immediate effects:

EFFECTS ON PEOPLE:

Inside the establishment 6 people were hospitalized and 2 received first aid due to the toxic release.

MATERIAL LOSS:

The pressure surge caused by the flash vapourization of liquid chlorine resulted in damages to caustic absorption, bleach and hydrogen chloride columns in the vent system. No data are available about the cost of the damages.

Appendix Short Report / description of emergency measures taken:

INTERNAL TO THE ESTABLISHMENT:

'General Emergency' and 'Major Emergency' alarms sounded. Works emergency team mobilized. Water sprays were used to dilute toxic cloud. 2 people required first-aid with oxygen.

EXTERNAL TO THE ESTABLISHMENT:

London fire brigade were alerted. Emergency controller contacted neighbouring factories.

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 discharge procedure to be re-examined and a discharge action check list introduced which requires a signature by the supervisor;
- 2- a visual alarm to be fitted to the discharge pipework vent lines (a light flashes as soon as the vent lines are opened indicating that a venting operation is in progress). The sound operation of this system has been incorporated into a check procedure prior to discharge;
- 3- correctly sized orifice plates to be fitted into the vent lines to prevent the over-pressurization of the absorption columns should the vent valves be wrongly open or opened.

When the Original Report was prepared also the following actions were to be evaluated:

- 4- the provision of a liquid gas separator on the vent line (a suggestion from the recommendation contained in draft "Safety advice for bulk chlorine installations"). The separator is to be fitted with a temperature alarm which could then be connected to an automatic isolation valve;
- 5- the provision of a logic interlock system to automatically control the complete discharge (this system built in fail-safe devices in the event of failure).

The company decided to engage Courtaulds Engineering Ltd bringing forward their hazard operability study for their "safety case" and the whole of the plant had to be thoroughly investigated.

Appendix Full Report A / type of accident:

During the discharge from a road tanker to a storage tank, liquid chlorine was sent into the vent main (code 1101). The flash vapourization of liquid chlorine and the subsequent pressure surge caused damages to the absorption, bleach and hydrogen chloride columns (code 1301). Besides, the failure of liquid loop seals resulted in a leak of chlorine (and probably hydrogen chloride) into the chlorination building (code 1101).

Appendix Full Report A / dangerous substances:

No data are available about the total establishment inventories of the substances involved. The total establishment inventory of chlorine refers to the amount released during the accident. Some hydrogen chloride may have been released for a short period as a result of the failure of the hydrogen chloride column and of column loop seals before the automatic isolation of the plant took place.

Appendix Full Report A / source of accident - remarks:

The accident occurred during the unloading (code 3304) of liquid chlorine from a road tanker into a storage tank of an general chemical industry (code 2001). The component involved in the initiating event was the transfer line (code 4011) between road tanker and storage tank. The flash vaporization of liquid chlorine damaged the absorption, bleach and hydrogen chloride columns that, also with the failure of the liquid loop seals (codes 4007 and 4999) resulted in a chlorine leak.

Appendix Full Report A / causes of major occurrence:

The immediate cause was an error by an experienced operator (code 5401) in leaving the vent valve, on the line between the tank and the storage tank, open. This, together with the lack of supervision during unloading (code 5305) and with an inadequate system design (code 5308) which made possible to vent with the storage tank open, caused the accident. Also, the process analysis was inadequate (code 5307), because no measures have been foreseen to avoid overpressurization of columns.

Appendix Full Report B / area concerned - remarks:

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

Appendix Full Report B / people:

Inside the establishment 6 people were hospitalized and 2 received first aid due to the toxic release.

Appendix Full Report B / ecological harm:

In the Original Report there is no evidence of a significant ecological harm.

Appendix Full Report B / material loss:

The pressure surge caused by the flash vapourization of liquid chlorine resulted in damages to caustic absorption, bleach and hydrogen chloride columns in the vent system. No data are available about the cost of the damages.

Appendix Full Report B / disruption of community life:

The emergency controller contacted the neighbouring factories.

Appendix Full Report C / lesson learned - prevent:

After the accident, the following measures were established:

- 1- the discharge procedure to be re-examined and a discharge action check list introduced which requires a signature by the supervisor;
- 2- a visual alarm to be fitted to the discharge pipework vent lines (a light flashes as soon as the vent lines are opened indicating that a venting operation is in progress). The sound operation of this system has been incorporated into a check procedure prior to discharge;
- 3- correctly sized orifice plates to be fitted into the vent lines to prevent the over-pressurization of the absorption columns should the vent valves be wrongly open or opened.

When the Original Report was prepared also the following actions were to be evaluated:

4- the provision of a liquid gas separator on the vent line (a suggestion from the recommendation contained in draft "Safety advice for bulk chlorine installations"). The separator is to be fitted with a temperature alarm which could then be connected to an automatic isolation valve;

5- the provision of a logic interlock system to automatically control the complete discharge (this system built in fail-safe devices in the event of failure).

The company decided to engage Courtaulds Engineering Ltd bringing forward their hazard operability study for their "safety case" and the whole of the plant had to be thoroughly investigated.