

Kemikalieutsläpp från en fabrik för ytbeläggning

881209 MARS 1988_05

Olyckan inträffade på en fabrik för ytbeläggning. En läcka i kylvattenssystemet gjorde att vatten kom in i en tank med råmaterial, främst flytande titanklorid. Läckan uppstod till följd av korrosion i en rörkrök. Den våldsamma reaktionen som resulterade i att reaktortanken slets upp i en svetsfog. Titantetraklorid och reaktionsprodukterna släpptes ut i atmosfären. Trafiken spärades av och befolkningen varnades.

Inblandade ämnen och mängder

	CAS Nr.	Mängd
titandioxid		okänt
titantetraklorid	7550-45-0	okänt
väteklorid	7647-01-0	okänt
titandikloridoxid		okänt

Skador:

Människor: Inga.

Materiella: Inga.

Miljö/ekologi: Inga effekter rapporterade.

Infrastruktur: De hotade delarna av staden stängdes och allmänheten varnades via högtalare.

Erfarenheter redovisade (Ja/Nej): Ja

Kortfattat anges förebyggande åtgärder.

Report Profile

Identification of Report:

country: FA ident key: 1988_005_01

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

Date of Major Occurrence: Time of Major Occurrence

start: 1988-12-09 start:

finish: finish:

Establishment:

name:

address:

industry: 2001 general chemicals manufacture

Surface Coating & Dyes (Titanium Dioxide Production 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:** 1988_005_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:** No

ecotoxic: No **other:** No

flammable: No

description:

Titanium dioxide, titanium dichloride oxide and hydrogen chloride formed by the reaction between water and liquid titanium tetrachloride.... see Appendix Short Report / description of substances involved

Immediate Sources of Accident:

storage: No **transfer:** No

process: Yes **other:** No

description:

The accident occurred in the unit for titanium tetrachloride distillation of the titanium dioxide production plant in a surface coating and dyes industry. The components involved were the titanium tetrachloride condensator and the pure-prod... 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: Yes

human deaths: No

human injuries: No **community disruption:** Yes

other: No

ecological harm: No

national heritage loss: No

description:

MATERIAL LOSS:... 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:** 1988_005_01

1 Type of Accident

remarks: A leakage in the cooling water circuit of the titanium tetrachloride condensator caused cooling water to flow from the empty pure-product tank to the half full raw material tank. The violent reaction between water and liquid titanium tetrac... see Appendix Full Report A / type of accident

2 Dangerous Substances

remarks: No data are available about the amounts of titanium tetrachloride, titanium dioxide, titanium dichloride oxide and hydrogen chloride released into the environment during the accident. Titanium dioxide, titanium dichloride oxide and hydrogen... see Appendix Full Report A / dangerous substances

3 Source of Accident

illustration: - not applicable -

remarks: The accident occurred in the unit for the titanium tetrachloride distillation (codes 3104 and 3201) of titanium dioxide production plant in a

surface coating and dyes industry (code 2001). The components involved were

the titanium tetrachlo... 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

5104 operation: corrosion/fatigue

- not applicable -

- not applicable -

- not applicable -

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

unclear)

5307 organization: process analysis (inadequate, incorrect)

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

inappropriate)

- not applicable -

- not applicable -

remarks: The accident was caused by the rupture (code 5102), due to corrosion (code 5104), of

U-tube of the titanium tetrachloride condensator in the cooling water circuit. Corrosion

was caused by the cleaning of the U-tube in the cooling water circ... see Appendix Full

Report A / causes of major occurrence

6 Discussion about the Occurrence

- not applicable -

Type of Accident country: FA ident key: 1988_005_01

event:

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

initiating event 1301 explosion: pressure burst (rupture of pressure system)

associated event - not applicable -

Dangerous substances

country: FA ident key: 1988_005_01

a) total establishment inventory

CAS number: 7550-45-0 **identity:** Titanium Tetrachloride

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: identity: Titanium Dioxide

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: ABNORMAL 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: identity: Titanium Dichloride Oxide

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: ABNORMAL 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: 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: ABNORMAL 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

Source of Accident - Situation country: FA ident key: 1988_005_01

situation

industry

initiating event - not applicable -

associated event - not applicable -

activity/unit

major occurrence - not applicable -

initiating event 3201 storage: process-associated (stockholding, etc. on-site of manufacture)

associated event - not applicable -

component

major occurrence - not applicable -

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

associated event - not applicable -

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 3104 process: physical operations (mixing, melting crystallizing, etc.)

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: 1988_005_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 Even if the threatened part of the City centre was closed, the traffic deviated... 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

other serious injuries

health monitoring

remarks No people were injured during the accident.

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 raw material tank was damaged but no data are available about its cost.... 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 Yes No

- **political interest** No No No

remarks The threatened part of the City centre was closed and the traffic deviated. The... see Appendix

7 Discussion of Consequences

C Response Full Report

country: FA **ident key:** 1988_005_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

A safety analysis of all parts... 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 / 1988_005_01 report

Appendix Short Report / description of accident types:

ACCIDENT CASE HISTORY DESCRIPTION:

A leakage in the cooling water circuit of the titanium tetrachloride condensator caused cooling water to flow from the empty pure-product tank to the half full raw material tank. The violent reaction between water and liquid titanium tetrachloride caused the tank to rip open in the welding seem. Titanium tetrachloride and the reaction products (titanium dioxide [TiO₂], titanium dichloride oxide [TiOCl₂] and hydrogen chloride [HCl]) were released. Further emission of the substances occurred as air replaced the vapours in the tank. Traffic was deviated and the population alerted.

Appendix Short Report / description of substances involved:

Titanium dioxide, titanium dichloride oxide and hydrogen chloride formed by the reaction between water and liquid titanium tetrachloride.

- Titanium Tetrachloride (C.A.S. CODE: 7550-45-0): amount involved = not known.
- Titanium Dioxide: amount involved = not known.
- Hydrogen Chloride (C.A.S. CODE: 7647-01-0, E.E.C. CODE: 017-002-00-2): amount involved = not known.
- Titanium Dichloride Oxide: amount involved = not known.

Appendix Short Report / description of immediate sources:

The accident occurred in the unit for titanium tetrachloride distillation of the titanium dioxide production plant in a surface coating and dyes industry. The components involved were the titanium tetrachloride condensator and the pure-product and the raw material tanks.

Appendix Short Report / description of suspected causes:

CAUSES:

The accident was caused by corrosion of U-tube of the titanium tetrachloride condensator in the cooling water circuit. It was caused by the cleaning of the U-tube in the cooling water circuit with chemicals. The underlying causes that led to the U-tube corrosion were: inadequate maintenance procedures, insufficient process analysis (the risk related with an accidental titanium tetrachloride/water contact was not previously identified) and inadequate plant design.

Appendix Short Report / description of immediate effects:

MATERIAL LOSS:

The raw material tank was damaged but no data are available about its cost.

COMMUNITY DISRUPTION:

The threatened part of the City centre was closed and the traffic deviated. The population was alerted by means of loudspeakers and radio.

Appendix Short Report / description of emergency measures taken:

INTERNAL TO THE ESTABLISHMENT:

The titanium tetrachloride distillation unit was stopped. The water supply to the raw material tank was stopped. The fire brigade intervened and put on a water curtain to mitigate the effects of the gas dispersion. Gas concentrations measurements were carried out within the titanium dioxide plant.

EXTERNAL TO THE ESTABLISHMENT:

The threatened part of the City centre was closed and the traffic deviated. The population was alerted by means of loudspeakers and radio. Air quality measurements were carried out.

Appendix Short Report / description of immediate lessons learned:

MEASURES TO PREVENT ANY RECURRENCE OF SIMILAR ACCIDENTS:

A safety analysis of all parts of the unit in which water and titanium tetrachloride may come in contact was made and the following safety measures were recommended:

- 1- installation of a flow and temperature control through automatic switches to give alarm and shut-down the process in case of disturbances of normal distillation;
- 2- by-product hydrogen chloride to be led to absorption with subsequent combustion;
- 3- instead of cleaning of tubes, scraping by insufficient heat transition.

Appendix Full Report A / type of accident:

A leakage in the cooling water circuit of the titanium tetrachloride condensator caused cooling water to flow from the empty pure-product tank to the half full raw material tank. The violent reaction between water and liquid titanium tetrachloride caused the tank to rip open in the welding seem (code 1301). Titanium tetrachloride and the reaction products (titanium dioxide [TiO₂], titanium dichloride oxide [TiOCl₂] and hydrogen chloride [HCl]) were released (code 1101).

Appendix Full Report A / dangerous substances:

No data are available about the amounts of titanium tetrachloride, titanium dioxide, titanium dichloride oxide and hydrogen chloride released into the environment during

the accident. Titanium dioxide, titanium dichloride oxide and hydrogen chloride formed by the reaction between water and liquid titanium tetrachloride.

Appendix Full Report A / source of accident - remarks:

The accident occurred in the unit for the titanium tetrachloride distillation (codes 3104 and 3201) of titanium dioxide production plant in a surface coating and dyes industry (code 2001). The components involved were the titanium tetrachloride condensator (code 4009) and the pure-product and the raw material tanks (code 4003).

Appendix Full Report A / causes of major occurrence:

The accident was caused by the rupture (code 5102), due to corrosion (code 5104), of U-tube of the titanium tetrachloride condensator in the cooling water circuit. Corrosion was caused by the cleaning of the U-tube in the cooling water circuit with chemicals. The underlying causes that led to the U-tube corrosion were: inadequate maintenance procedures (code 5303), insufficient process analysis (code 5307) and inadequate plant design (code 5308).

Appendix Full Report B / area concerned - remarks:

Even if the threatened part of the City centre was closed, the traffic deviated and the population was alerted by means of loudspeakers and radio, in the Original Report there is no evidence of significant effects outside the titanium dioxide production plant.

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 raw material tank was damaged but no data are available about its cost.

Appendix Full Report B / disruption of community life:

The threatened part of the City centre was closed and the traffic deviated. The population was alerted by means of loudspeakers and radio.

Appendix Full Report C / lesson learned - prevent:

A safety analysis of all parts of the unit in which water and titanium tetrachloride may come in contact was made and the following safety measures were recommended:

- 1- installation of a flow and temperature control through automatic switches to give alarm and shut-down the process in case of disturbances of normal distillation;
- 2- by-product hydrogen chloride to be led to absorption with subsequent combustion;
- 3- instead of cleaning of tubes, scraping by insufficient heat transition.