

# Explosion och brand på en kemikaliefabrik.

830215 MARS 1800\_46

Vid destillation av 1-nitro-anthraquinon inträffade en spontan och oväntad sönderdelning orsakad av närvarande föroreningar. Den påföljande tryckökningen var så häftig att ett reaktionskärl exploderade. Explosionen följdes av en brand av en blandning av 1-nitro-anthraquinon, salpetersyra och en olja som användes i destillationsprocessen. En av förbränningsprodukterna var kvävedioxid. Produktionen stoppades och anläggningen utrymdes. Räddningstjänsten tillkallades Vägar i närheten av anläggningen avspärrades av polisen. Allmänheten varnades om giftgaserna.

## Inblandade ämnen och mängder

	CAS Nr.	Mängd
1-nitro-anthraquinon	82-34-8	1000 kg
salpetersyra	7697-37-2	
kvävedioxid (förbränningsprodukt)	10102-44-0	okänt

## Skador:

Människor:	En person omkom och fem skadades av branden.
Materiella:	Fabriken totalförstördes av branden. Kostnaden uppskattas till 24,4 MECU.
Miljö/ekologi:	Inga effekter rapporterade.
Infrastruktur:	Vägar i närheten av fabriken stängdes av och allmänheten varnades för giftgaserna.

## Erfarenheter redovisade (Ja/Nej):

Se...

## Report Profile

### Identification of Report:

country: FA ident key: 1800\_046\_01

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

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

start: 1983-02-15 start:

finish: finish:

### Establishment:

name:

address:

industry: 2001 general chemicals manufacture

Organic Chemical (Process Plant for 1-Nitro-anthraquinone 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:** 1800\_046\_01

**Accident Types:**

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

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

**fire:** Yes

**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:** Yes

**description:**

- 1-Nitro-anthraquinone (C.A.S. CODE: 82-34-8): amount involved in the explosion and the following fire =

1,000 Kg together with Nitric Acid (C.A.S. CODE: 7697-37-2).... see Appendix Short Report / description of substances involved

**Immediate Sources of Accident:**

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

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

**description:**

The accident occurred during the distillation of 1-nitro-anthraquinone in an organic chemical industry. The

accident occurred during normal operation and involved the melting vessel used for the raw

1-nitro-anthraquinone distillation.

**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:** Yes

**human injuries:** Yes **community disruption:** Yes

**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:** Yes

**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:

After the accident, the plant had been thoroughly investigated and it was established to extend tests on the thermochemical reactions carried out.

## A Occurrence Full Report

**country:** FA **ident key:** 1800\_046\_01

### 1 Type of Accident

**remarks:** During the distillation of 1-nitro-anthraquinone there was an unexpected spontaneous decomposition because of the presence of impurities. The overpressure generated by the decomposition caused the physical explosion of a melting vessel (cod... see Appendix Full Report A / type of accident

### 2 Dangerous Substances

**remarks:** The total establishment and the potential directly involved inventories of 1-Nitroanthraquinone refer to the amount involved in the explosion and the following fire. No data are available about the amount of hot-oil and nitric acid involved... see Appendix Full Report A / dangerous substances

### 3 Source of Accident

**illustration:** - not applicable -

**remarks:** The accident occurred during the distillation (code 3104) of 1-nitro-anthraquinone in an organic chemical industry (code 2001). The accident occurred during normal operation and involved the melting vessel (code 4007) used for the raw 1-nit... 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** 5106 operation: runaway reaction

- not applicable -

- not applicable -

- not applicable -

- not applicable -

**human / organizational** 5307 organization: process analysis (inadequate, incorrect)

- not applicable -

- not applicable -

- not applicable -

- not applicable -

**remarks:** The unexpected spontaneous decomposition (code 5106) of raw 1-nitro-anthraquinone was caused by unknown catalytic effects of impurities (inorganic salts). The decomposition was unexpected because of an insufficient process analysis (code 53... see Appendix Full Report A / causes of major occurrence

### 6 Discussion about the Occurrence

- not applicable -

**Type of Accident** country: FA ident key: 1800\_046\_01

**event:**

**major occurrence** 1202 fire: pool fire (burning pool of liquid, contained or uncontained)

**initiating event** 1304 explosion: runaway reaction explosion (usually exothermic)

**associated event** 1401 other: combustion products into air

### Dangerous substances

country: FA ident key: 1800\_046\_01

**a) total establishment inventory**

CAS number: 10102-44-0 identity: Nitrogen 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: No**

actual quantity: -1 potential quantity: -1

**c) substance belongs to relevant inventory indirectly involved: Yes**

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

**a) total establishment inventory**

CAS number: 7697-37-2 identity: Nitric Acid

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: identity: Hot-oil

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:** 82-34-8 **identity:** 1-nitro-anthraquinone

**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

**Source of Accident - Situation** **country:** FA **ident key:** 1800\_046\_01

## **situation**

### **industry**

**initiating event** 2001 general chemicals manufacture

**associated event** 2001 general chemicals manufacture

### **activity/unit**

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

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

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

### **component**

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

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

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

## **B Consequences Full Report**

**country:** FA **ident key:** 1800\_046\_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 roads in the area were closed by the police and population external to t... see Appendix

Full Report B / area concerned - remarks

## 2 People

**establishment popul. emergency personnel off-site population**

**total at risk**

**immediate fatalities** 1

**subsequent fatalities**

**hospitalizing injuries** 5

**other serious injuries**

**health monitoring**

**remarks** Inside the establishment 1 person was killed and 5 injured by the fire.... 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.... 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 DM ECU DM**

**material losses** 5E+07

**response, clean up, restoration**

**remarks** The plant was completely destroyed by the fire. The cost of the damages has been... 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** Roads in the area were closed by the police. Population external to the establis... see Appendix

## **7 Discussion of Consequences**

# **C Response Full Report**

country: FA ident key: 1800\_046\_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 plant ... 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\_046\_01 report**

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

**ACCIDENT CASE HISTORY DESCRIPTION:**

During the distillation of 1-nitro-anthraquinone there was an unexpected spontaneous decomposition because of the presence of impurities. The overpressure generated by the decomposition caused the physical explosion of a melting vessel. The explosion was followed by the fire of 1-nitro-anthraquinone and nitric acid contained in the vessel and of hot-oil used in the distillation process. During the fire nitrogen dioxide was released into the environment. The plant was shut-down and evacuated. Roads in the area were closed by the police.

### **Appendix Short Report / description of substances involved:**

- 1-Nitro-anthraquinone (C.A.S. CODE: 82-34-8): amount involved in the explosion and the following fire = 1,000 Kg together with Nitric Acid (C.A.S. CODE: 7697-37-2).

- Hot-Oil (used in the melting vessel during the distillation): amount involved in the fire = not known.

- Nitrogen Dioxide (C.A.S. CODE: 10102-44-0): amount developed during the fire = not known.

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

#### CAUSES:

The unexpected spontaneous decomposition of raw 1-nitro-anthraquinone was caused by unknown catalytic effects of impurities (inorganic salts). The decomposition was unexpected because of an insufficient process analysis.

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

#### EFFECTS ON PEOPLE:

Inside the establishment 1 person was killed and 5 injured by the fire.

#### MATERIAL LOSS:

The plant was completely destroyed by the fire. The cost of the damages has been estimated in about 50 millions of German Marcs (about 24.4 MECU).

#### COMMUNITY DISRUPTION:

Roads in the area were closed by the police. Population external to the establishment was alerted about the toxic cloud developed by the fire.

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

#### INTERNAL TO THE ESTABLISHMENT:

The plant was shut-down and evacuated. The fire brigade intervened on-site.

#### EXTERNAL TO THE ESTABLISHMENT:

Roads in the area were closed by the police. Population external to the establishment was alerted about the toxic cloud developed by the fire.

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

During the distillation of 1-nitro-anthraquinone there was an unexpected spontaneous decomposition because of the presence of impurities. The overpressure generated by the decomposition caused the physical explosion of a melting vessel (code 1304). The explosion was followed by the fire of 1-nitro-anthraquinone and nitric acid contained in the vessel and of hot-oil used in the distillation process (code 1202). During the fire nitrogen dioxide was released into the environment (code 1401).

### **Appendix Full Report A / dangerous substances:**

The total establishment and the potential directly involved inventories of 1-Nitroanthraquinone refer to the amount involved in the explosion and the following fire. No data are available about the amount of hot-oil and nitric acid involved in the fire and of nitrogen dioxide developed during the fire and released into the environment.

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

The accident occurred during the distillation (code 3104) of 1-nitro-anthraquinone in an organic chemical industry (code 2001). The accident occurred during normal operation and involved the melting vessel (code 4007) used for the raw 1-nitro-anthraquinone distillation.

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

The unexpected spontaneous decomposition (code 5106) of raw 1-nitro-anthraquinone was caused by unknown catalytic effects of impurities (inorganic salts). The decomposition was unexpected because of an insufficient process analysis (code 5307).

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

Even if roads in the area were closed by the police and population external to the establishment was alerted about the toxic cloud developed by the fire, in the Original Report there is no evidence of significant effects outside the establishment.

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

Inside the establishment 1 person was killed and 5 injured by the fire.

### **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 plant was completely destroyed by the fire. The cost of the damages has been estimated in about 50 millions of German Marcs (about 24.4 MECU).

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

Roads in the area were closed by the police. Population external to the establishment was alerted about the toxic cloud developed by the fire.

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

After the accident, the plant had been thoroughly investigated and it was established to extend tests on the thermochemical reactions carried out.