

Explosion i samband med lossning vid en kemikaliedepå.

8801516 MARS 1988_14

Vid lossning från en tankbil med salpetersyra vid en kemikaliedepå begick operatören ett allvarligt misstag. Han kopplade slangarna till en tank med myrsyra istället för en tom tank. När den kraftigt oxiderande salpetersyran mötte den kraftigt reducerande myrsyran inträffade en mycket våldsamt reaktion som ledde till en explosion. Tanken brast i den svagaste svetsfogen. Delar av tanken hittades upp till 100 m bort. Operatören omkom vid explosionen. Tankbilen kastades in i en vägg. Somliga väggar rasade. Fönster krossades upp till 300 m bort. Kort efter explosionen anlände räddningstjänsten och började spola med finfördelat vatten för att begränsa gasspridningen. Kväveoxiderna som bildades vid reaktionen steg till skyn och bildade ett giftmoln som uppskattades till 12000 m³. Molnet bevakades med helikopter och följdes till dess att det skingrats.

Inblandade ämnen och mängder

	CAS Nr.	Mängd
salpetersyra	7697-37-2	okänt
myrsyra	64-18-6	okänt
kvävemonoxid	10102-43-9	okänt
kvävedioxid	10102-44-0	okänt
dikväveoxid	10024-97-2	okänt

Skador:

Människor:	En person omkom och fyra skadades vid explosionen. Tre brandmän förgiftades av röken och fördes till sjukhus.
Materiella:	Tankbilen och bygggander i närheten skadades svårt.
Miljö/ekologi:	ph för vattnet till reningsanläggningen sjönk till 3,5 innan räddningstjänsten hann börja späda ut avloppsvattnet. Inga effekter rapporterade.
Infrastruktur:	Vägtrafiken kring fabriken spärrades av i några timmar. Gasmolnet följdes med helikopter till dess att det skingrats.

Erfarenheter redovisade (Ja/Nej): Nej

Report Profile

Identification of Report:

country: FA ident key: 1988_014_01

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

Date of Major Occurrence: Time of Major Occurrence

start: 1988-05-16 start: 08:00:00

finish: finish:

Establishment:

name:

address:

industry: 2008 wholesale and retail storage and distribution (incl. LPG bottling & bulk

distrib., more: F1!)

Storage Activities (Storage of Various Chemicals)

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_014_01

Accident Types:

release: Yes explosion: Yes

water contamination: No other: No

fire: No

description:

At 07:55 a strong explosion inside a tank occurred during the unloading of nitric acid from a road tanker, followed by the release of a cloud with a yellow/red colour. The cloud had a strong smell and caused irritation of the eyes and skin.... see Appendix Short Report / description of accident types

Substance(s) Directly Involved:

toxic: Yes explosive: Yes

ecotoxic: No other: No

flammable: No

description:

- Mixture of Nitric Acid (C.A.S. CODE: 7697-37-2) and Formic Acid (C.A.S. CODE: 64-18-6); amount involved = not known.... see Appendix Short Report / description of substances involved

Immediate Sources of Accident:

storage: Yes transfer: Yes

process: No other: No

description:

The accident occurred during the unloading of nitric acid from a road tanker in a installation where a lot of chemicals (such as caustic soda, nitric acid, sulphuric acid, liquid ammonia, hydrogen chloride, sodium hypochlorite, ecc.) were s... see Appendix Short Report / description of immediate sources

Suspected Causes:

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

human: Yes **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:** Yes

external services: Yes **restoration:** No

sheltering: No **other:** Yes

evacuation: No

description:

INTERNAL TO THE ESTABLISHMENT:... see Appendix Short Report / description of emergency measures taken

Immediate Lessons Learned:

prevention: No **other:** No

mitigation: No

description:

Under examination.

A Occurrence Full Report

country: FA **ident key:** 1988_014_01

1 Type of Accident

remarks: During the unloading of nitric acid from a road tanker, by mistake, the operator connected it to the wrong tank, i.e. he emptied the nitric acid into a tank containing formic acid. The mixing of the two acids produced a rapid exothermic rea... see Appendix Full Report A / type of accident

2 Dangerous Substances

remarks: No data are available about the amounts of nitric acid and formic acid

involved in the explosion. Also, no data are available about the amount of nitrogen oxides released into the environment as a consequence of the reaction between nitric ... see Appendix Full Report A / dangerous substances

3 Source of Accident

illustration: - not applicable -

remarks: The accident occurred during the unloading (code 3304) of nitric acid from a road tanker in a installation where a lot of chemicals (such as caustic soda, nitric acid, sulphuric acid, liquid ammonia, hydrogen chloride, sodium hypochlorite, ... 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: When the accident occurred the wind was directed towards the sea.

5 Causes of Major Occurrence

main causes

technical / physical 5107 operation: unexpected reaction/phase-transition

- not applicable -

- not applicable -

- not applicable -

- not applicable -

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

5304 organization: training/instruction (none, inadequate, inappropriate)

5401 person: operator error

- not applicable -

- not applicable -

remarks: It seems that, during the unloading of nitric acid from a road tanker, by mistake (code 5401), the operator connected the tanker with the wrong tank, i.e. he emptied the nitric acid into a tank containing formic acid. The mixing of the two ... see Appendix Full Report A / causes of major occurrence

6 Discussion about the Occurrence

- not applicable -

Type of Accident country: FA ident key: 1988_014_01

event:

major occurrence 1304 explosion: runaway reaction explosion (usually exothermic)

initiating event - not applicable -

associated event - not applicable -

event:

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

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

associated event - not applicable -

Dangerous substances

country: FA ident key: 1988_014_01

a) total establishment inventory

CAS number: 10024-97-2 identity: Nitrogen 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: 10102-43-9 identity: Nitrogen Monoxide

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: 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: 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: 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: 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: 64-18-2 **identity:** Formic 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: 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

Source of Accident - Situation **country:** FA **ident key:** 1988_014_01

situation

industry

initiating event - not applicable -

associated event - not applicable -

activity/unit

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

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

associated event - not applicable -

component

major occurrence - not applicable -

initiating event - not applicable -

associated event - not applicable -

situation

industry

initiating event 2008 wholesale and retail storage and distribution (incl. LPG bottling & bulk distrib., more: F1!)

associated event - not applicable -

activity/unit

major occurrence 3202 storage: distribution-associated (not on-site of manufacture)

initiating event 3302 transfer: mechanical transfer (conveyors, 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_014_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 The road traffic around the establishment was prohibited for some hours. The evo... 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 4 3

other serious injuries

health monitoring

remarks Inside the establishment 1 person was killed and 4 people injured by the explosi... 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 The water to the water treatment plant of Bari Sud, connected with the Chimica d... 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 seriously damaged some tanks. Some buildings inside the establishm... 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 some hours

- 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 Road traffic around the establishment was prohibited for some hours. The evolut... see Appendix

7 Discussion of Consequences

C Response Full Report

country: FA ident key: 1988_014_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

Under examination.

measures to mitigate consequences:

Under examination.

useful references:

- not applicable -

5 Discussion about Response

- not applicable -

Appendices for the FA / 1988_014_01 report

Appendix Short Report / description of accident types:

At 07:55 a strong explosion inside a tank occurred during the unloading of nitric acid from a road tanker, followed by the release of a cloud with a yellow/red colour. The cloud had a strong smell and caused irritation of the eyes and skin. The main pollutants were nitrogen oxides. It seems that, by mistake, the operator connected the road tanker to the wrong tank, i.e. he emptied the nitric acid into a tank containing formic acid. The mixing of the two acids produced a rapid exothermic reaction that led to the explosion. The man attending the operation was killed by the explosion. Few minutes later the fire brigade intervened (using personal breathing apparatuses and protective clothing), diluted the liquid acid on the ground with water and created a containment to prevent the acid spreading over on the ground. Nebulized water was also used to dilute the nitrogen oxides vapours. In the meantime the evolution of the cloud (directed towards the sea) was continuously observed from a helicopter. Personnel on the helicopter relieved that the cloud was rapidly dispersing in about 100 metres from the source of release. At about 12:00 the concentration of the cloud, diluted by the action of wind, was no more dangerous.

The exploded tank was cut along the inferior weld; some parts have been found at about 50 metres away while the top flange in which the relief valves were installed was found at about 100 metres away. Two other empty tanks, nearby to the exploded one, were found at 25 metres from the point where the accident occurred. The road tanker struck a wall. Some buildings inside the establishment suffered extensive damages. Some walls and roofs inside the establishment were put down. Broken windows were found up to 300 metres away. Road traffic around the establishment was prohibited for some hours. The water to the water treatment plant of Bari Sud, connected with the Chimica d'Agostino factory, reached a low pH (about 3.5) and returned to pH=7 after the intervention of fire brigade in diluting the liquid acid on the ground with water.

Appendix Short Report / description of substances involved:

- Mixture of Nitric Acid (C.A.S. CODE: 7697-37-2) and Formic Acid (C.A.S. CODE: 64-18-6): amount involved = not known.

- Nitrogen Oxides (C.A.S. CODE: 10102-43-9 [NO], 10102-44-0 [NO₂], 10024-97-2 [N₂O]): amount involved = not known.

On the basis of some stoichiometric calculations it has been estimated that, following the explosion, a cloud of about 12,000 Nm³ was released. The cloud was composed by oxygen, nitrogen, water and nitrogen oxides.

Appendix Short Report / description of immediate sources:

The accident occurred during the unloading of nitric acid from a road tanker in a installation where a lot of chemicals (such as caustic soda, nitric acid, sulphuric acid, liquid ammonia, hydrogen chloride, sodium hypochlorite, ecc.) were stored. No data are available about the amount of the substances in the storage installation. The road tanker (of Soc. Terni Industrie Chimiche di Nera Montoro-Marni) was subdivided in three sections: one containing a 31.8% ammonia solution, the other two nitric acid. The 30 m³ tank (2.5 metres high and with a diameter of about 6 metres) for the storage of nitric acid was nearby two other tanks: the first containing formic acid and the second phosphoric acid. The three stainless steel tanks were similar.

Appendix Short Report / description of suspected causes:

CAUSES:

It seems that, during the unloading of nitric acid from a road tanker, by mistake, the operator connected the tanker with the wrong tank, i.e. he emptied the nitric acid into a tank containing formic acid. The mixing of the two acids produced a rapid exothermic reaction that led to the explosion of the tank followed by the release of a cloud with a yellow/red colour. Under these hypotheses the tank explosion could be explained because the reaction between the formic acid (a reducing substance) and the nitric acid (a strong oxidizing substance) is very rapid and highly exothermic and leads to the formation of water, carbon dioxide and nitrogen oxides. The operator's error in the unloading operation was caused by an inadequate training/instruction together with an insufficient operating procedures (code 5303).

Appendix Short Report / description of immediate effects:

EFFECTS ON PEOPLE:

Inside the establishment 1 person was killed and 4 people injured by the explosion. Three firemen were hospitalized because of a probable intoxication during emergency operations.

MATERIAL LOSS:

The explosion seriously damaged some tanks. Some buildings inside the establishment suffered extensive damages. Outside the installation the windows were broken up to 300 metres away. No data are available about the cost of the material damages.

COMMUNITY DISRUPTION:

The road traffic around the establishment was prohibited for some hours.

Appendix Short Report / description of emergency measures taken:

INTERNAL TO THE ESTABLISHMENT:

Few minutes after the explosion occurred, the fire brigade intervened (using personal breathing apparatuses and protective clothings), diluted the liquid acid on the ground with water and created a containment to prevent the acid spreading over on the ground. Nebulized water was also used to dilute the nitrogen oxides vapours.

EXTERNAL TO THE ESTABLISHMENT:

The road traffic around the establishment was prohibited for some hours. The evolution of the cloud (directed towards the sea) was continuously observed from a helicopter. Personnel on the helicopter relieved that the cloud was rapidly dispersing in about 100 metres from the source of release. At about 12:00 the concentration of the cloud, diluted by the action of wind, was no more dangerous.

Appendix Full Report A / type of accident:

During the unloading of nitric acid from a road tanker, by mistake, the operator connected it to the wrong tank, i.e. he emptied the nitric acid into a tank containing formic acid. The mixing of the two acids produced a rapid exothermic reaction that led to a strong explosion (code 1304) inside the tank, followed by the release of a cloud with a yellow/red colour (code 1101). The cloud had a strong smell and caused irritation of the eyes and skin. The main pollutants were nitrogen oxides.

Appendix Full Report A / dangerous substances:

No data are available about the amounts of nitric acid and formic acid involved in the explosion. Also, no data are available about the amount of nitrogen oxides released into the environment as a consequence of the reaction between nitric acid and formic acid. On the basis of some stoichiometric calculations it had been estimated that, following the explosion, a cloud of about 12,000 Nm³ was released. The cloud was composed by oxygen, nitrogen, water and nitrogen oxides.

Appendix Full Report A / source of accident - remarks:

The accident occurred during the unloading (code 3304) of nitric acid from a road tanker in a installation where a lot of chemicals (such as caustic soda, nitric acid, sulphuric acid, liquid ammonia, hydrogen chloride, sodium hypochlorite, ecc.) were stored (codes 2008, 3202). No data are available about the amount of the substances in the storage installation. The component involved was a 30 m³ tank (2.5 metres high and with a diameter of 6 metres) for the storage of nitric acid (code 4003).

Appendix Full Report A / causes of major occurrence:

It seems that, during the unloading of nitric acid from a road tanker, by mistake (code 5401), the operator connected the tanker with the wrong tank, i.e. he emptied the nitric acid into a tank containing formic acid. The mixing of the two acids produced a rapid exothermic reaction (code 5107) that led to the explosion of the tank. The operator error in the unloading operation was caused by an inadequate training/instruction (code 5304) together with insufficient operating procedures (code 5303)

Appendix Full Report B / area concerned - remarks:

The road traffic around the establishment was prohibited for some hours. The evolution of the cloud (directed towards the sea) was continuously observed from a helicopter. At about 12:00 the cloud concentration, diluted by the action of wind, was no more dangerous. The water to the treatment plant of Bari Sud, connected with the Chimica d'Agostino factory, reached a low pH (about 3.5) and returned to pH=7 after the intervention of fire brigade in diluting the liquid acid on the ground with water.

Appendix Full Report B / people:

Inside the establishment 1 person was killed and 4 people injured by the explosion. Three firemen were hospitalized because of a probable intoxication during emergency operations.

Appendix Full Report B / ecological harm:

The water to the water treatment plant of Bari Sud, connected with the Chimica d'Agostino factory, reached a low pH (about 3.5) and returned to pH=7 after the intervention of fire brigade in diluting the liquid acid on the ground with water. The evolution of the cloud (directed towards the sea) was continuously observed from a helicopter. At about 12:00 the concentration of the cloud was no more dangerous. In any case, in the Original Report there is no evidence of significant ecological harms.

Appendix Full Report B / material loss:

The explosion seriously damaged some tanks. Some buildings inside the establishment suffered extensive damages. Outside the installation, the windows were broken up to 300 metres away. No data are available about the cost of the material damages.

Appendix Full Report B / disruption of community life:

Road traffic around the establishment was prohibited for some hours. The evolution of the cloud (directed towards the sea) was continuously observed from a helicopter. At about 12:00 the concentration of the cloud was no more dangerous.