Giftig rökutveckling och spridning av giftiga gaser från ett lager av gödningsämnen.

871029 MARS 1800_24

Rök upptäcktes i en lagerlokal för gödningsämnen klockan 09:15. En spontan och okontrollerad nedbrytningsreaktion som var värmeutvecklande ledde till rökutveckling, men inte till öppen eld. Försök av personalen att stoppa rökutvecklingen med bärbara eldsläckare misslyckades och räddningstjänsten tillkallades. Vid ankomsten kl. 09:43 beslöt räddningstjänsten att begära förstärkning med skumsläckningsutrustning. Släckningsarbetet fortgick med besvär till en början p.g.a. det tjocka gulröda moln av brandrök som hunnit bildas. Man koncentrerade sig på att förhindra det intilliggande lagret med ammoniumnitrat från att antändas genom bruk av vattengardiner. Klockan 10:30 var det uppenbart att giftröken utgjorde en allvarlig fara och klockan 11:15 förbereddes evakuering av människor inom 1 km radie genom bruk av högtalare, telefonsamtal och radio och TV. Samtidigt tillkallades förstärkning från närliggande områden och rökmolnet övervakades med hjälp av helikopter. Kontinuerliga mätningar av föroreningshalter gjordes. Giftmolnet nådde som mest en höjd av 250 m och täckte ett område på 15 km2. Källan till rökutecklingen spolades kontinuerligt med 700m3/h vatten till dess att rökutvecklingen stoppats. Klockan 13:00 uppmättes halter av salpetersyra på 5 ppm i delar av området. Klockan 14:15 aktiverades katastrofplanen ORSEC och man tog beslutet att evakuera lokalbefolkning. Klockan 16:00 hade rökutvecklingen avtagit avsevärt. Järnvägstrafiken återupptogs kl 19:00. Den evakuerade befolkningen kunde återvända klockan 22:00. Klockan 02:34 tog sig räddningstjänsten in i lagerlokalen där rökutvecklingen börjat. Klockan 05:00 hade rökutvecklingen stoppats helt. Katastrofplanen avbröts klockan 07:00.

Inblandade ämnen och mängder

	CAS Nr.	Mängd
gödningsämnen (15% N, 8% P, 22% K)		850 ton varav ca 100 ton uppskattas ha förbränts
förbränningsprodukter		
dikväveoxid	10024-97-2	okänt
kvävemonoxid	10102-43-9	okänt
kvävedioxid	10102-44-0	okänt
salpetersyra	7697-37-2	okänt
klor	7782-50-5	okänt
ammoniak	7664-41-7	okänt

Skador:

Människor:	På anläggningen skadades 25 människor av giftiga gaser, medan fyra fick brännskador.
Materiella:	Lageranläggningen skadades. Inga uppgifter om kostnader finns.
Miljö/ekologi:	Den giftiga brandröken skingrades i atmosfären. Det kontaminerade släckningsvattnet rann ut i Loire-floden. Inga effekter rapporterade.
Infrastruktur:	Då det blev uppenbart att brandröken var giftitg och hotade att spridas förbereddes evakuering av bebyggelse inom 1 km radie omfattande ca 73 000 människor; 25 000 av dessa hann evakueras innan den giftiga brandröken skingrats. Järnvägstrafik i området stoppades, allmänheten varnades över radio och TV och med högtalare.

Erfarenheter redovisade (Ja/Nej): Ja

A more detailed map of the area is given in Fig. 1 of the relevant presentation in the Seminar on "The Notification of Major Accidents" held at Rethymnon - Greece in October 6/7 in 1988. More detailed maps are attached to the confidential report on this accident by P.Gendre and Y.M.Vasseur.

Report Profile

Identification of Report:

country: FA **ident key:** 1800_024_01

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

Date of Major Occurrence: Time of Major Occurrence

start: 29/10/1987 **start:** 09:00:00

finish: finish:

Establishment:

name:

address:

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

distrib., more: F1!)

Storage Activities (Storage of solid chemical products in a granulated form)

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_024_01

Accident Types:

release: Yes **explosion:** No

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:

- Fertilizing Compounds (15% N, 8% P, 22% K): amount involved = 850,000 Kg (this amount refers to the inventory of fertilizing compounds in compartment N¯ 2 involved in the fire). It had been estimated that about 100,000 Kg of fertilizers c... see Appendix Short Report / description of substances involved

Immediate Sources of Accident:

storage: Yes **transfer:** No

process: No **other:** No

description:

The accident occurred in an installation built in 1973 and used to store chemicals and fertilizers. The storage installation was a rectangular metal-framed building with fibrocement shingle with dimensions of 100x35x9m and a usable height o... see Appendix Short Report / description of immediate sources

Suspected Causes:

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

human: No **other:** Yes

description:

CAUSES:... see Appendix Short Report / description of suspected causes

Immediate Effects:

material loss: Yes

human deaths: No

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

other: No

ecological harm: Yes

national heritage loss: No

description:

EFFECTS ON PEOPLE:... see Appendix Short Report / description of immediate effects

Emergency Measures taken:

on-site systems: Yes **decontamination:** No

external services: Yes **restoration:** No

sheltering: 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:... see Appendix Short Report / description of immediate lessons learned

A Occurrence Full Report

country: FA **ident key:** 1800_024_01

1 Type of Accident

remarks: Due to a self-substaining decomposition of fertilizers compounds, a fire (code 1201) developped in one of the compartments of an installation for the storage of fertilizers and chemicals. The fire produced a toxic smoke (containing nitric a... see Appendix Full Report A / type of accident

2 Dangerous Substances

remarks: The total establishment and the potential directly involved inventories of fertilizers (15% N, 8% P, 22% K) refer to the amount contained in compartment N¯ 2. The amounts of ammonium nitrate, urea 46% solution and the other fertilizers refe... see Appendix Full Report A / dangerous substances

3 Source of Accident

illustration: - not applicable -

remarks: The accident occurred in an installation built in 1973 and used to store chemicals and fertilizers (codes 2008 and 3202). The storage installation was a rectangular metal-framed building with fibrocement shingle with dimensions of 100x35x9m... 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 5501 other: not identified

- not applicable -

- not applicable -

- not applicable -

- not applicable -

human / organizational - not applicable -

- not applicable -

- not applicable -

- not applicable -

- not applicable -

remarks: The causes of the accident have not fully identified (code 5501) but probably the decomposition of fertilizers occurred due to: storage of fertilizers at too high temperature and with an excessive amount of organic material; presence of def... see Appendix Full Report A / causes of major occurrence

6 Discussion about the Occurrence

- not applicable -

Type of Accident **country:** FA **ident key:** 1800_024_01

event:

major occurrence - not applicable -

initiating event - not applicable -

associated event - not applicable -

event:

major occurrence 1201 fire: conflagration (a general engulfment fire)

initiating event 1201 fire: conflagration (a general engulfment fire)

associated event - not applicable -

Dangerous substances

country: FA **ident key:** 1800_024_01

a) total establishment inventory

CAS number: identity: Urea 46% Solution

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:** 200

c) substance belongs to relevant inventory indirectly involved: No

actual quantity: -1 **indir_pot_quant:** -1

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: 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: Fertilizers(15% N,8% P,22% K)

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): 850

use of substance as: NORMAL FINISHED PRODUCT

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 100 **potential quantity:** 850

c) substance belongs to relevant inventory indirectly involved: No

actual quantity: -1 **indir_pot_quant:** -1

a) total establishment inventory

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

name from Seveso I Directive: - not applicable -

name from Seveso II Directive: - not applicable -

category from Seveso II: - not applicable -

other hazards (1): - not applicable -

other hazards (2): - not applicable -

maximum quantity (tonnes): -1

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: 6484-52-2 **identity:** Ammonium Nitrate

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): 750

use of substance as: NORMAL FINISHED PRODUCT

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: -1 **potential quantity:** 750

c) substance belongs to relevant inventory indirectly involved: No

actual quantity: -1 **indir_pot_quant:** -1

a) total establishment inventory

CAS number: 7664-41-7 **identity:** Ammonia

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:** 1800_024_01

situation

industry

inititating 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)

inititating event 3202 storage: distribution-associated (not on-site of manufacture)

associated event - not applicable -

component

major occurrence 4006 free placement (unconfined pile, stack,etc; if bagged or in cylinders, more...F1!)

inititating event 4006 free placement (unconfined pile, stack,etc; if bagged or in cylinders,

more...F1!)

associated event - not applicable -

B Consequences Full Report

country: FA **ident key:** 1800_024_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 toxic cloud reached an height of about 250m and was 5km large and it was cov... see Appendix

Full Report B / area concerned - remarks

2 People

establishment popul. emergency personnel off-site population

total at risk 25000

immediate fatalities

subsequent fatalities

hospitalizing injuries 29

other serious injuries

health monitoring

remarks Inside the establishement, 29 people were injured by the accident (25 by the tox... see Appendix

Full Report B / people

3 Ecological Harm

pollution/contamination/damage of:

- residential area (covered by toxic cloud) not applicable

- common wild flora/fauna (death or elimination) not applicable

- rare or protected flora/fauna (death or elimination) not applicable

- water catchment areas and supplies for consumption or recreation not applicable

- land (with known potential for long term ecological harm or not applicable

preventing human access or activities)

- marine or fresh water habitat not applicable

- areas of high conservation value or given special protection not applicable

remarks During the main fire fighting attempt, products on fire were drenched under a wa... 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 storage installation was damaged by the fire but no data are available about... see Appendix

Full Report B / material loss

6 Disruption of Community Life

establishment/plant evacuated disabled/unoccupiable destroyed

- nearby residences/hotels Yes No No

- nearby factories/offices/small shops Yes No No

- schools, hospitals, institutions Yes No No

- other places of public assembly Yes 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 about 7.5 hours

- 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 rail traffic between Nantes Le Croisis and Redon had been interrupted. About... see Appendix

7 Discussion of Consequences

Ecological Components involved

country: FA **ident key:** 1800_024_01

type: 6204 freshwater: river

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

C Response Full Report

country: FA **ident key:** 1800_024_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 this accident, an extend... see Appendix Full Report C / lesson learned - prevent

measures to mitigate consequences:

- not applicable -

useful references:

A more detailed map of the are... see Appendix Full Report C / lesson learned - references

5 Discussion about Response

- not applicable -

Appendices for the FA / 1800_024_01 report

Appendix Short Report / description of accident types:

ACCIDENT CASE HISTORY DESCRIPTION:

At 08:00 four people started to work in the storage installation and, at 08:30, everything was normal. Some smoke was noticed by the storage personnel at about 09:15 am. The first reaction of the personnel was to use, unsuccessfully, portable fire extinguishers until the fire brigade intervened even if visible fire was never noticed. At 09:43 a 3 vehicle team arrived on-site and, after assessment of the situation, immediately requested a reinforcement with foam equipments. Fire fighting operations proceeded with difficulty owing to the jellow/red smoke cloud which had developped. The first attempt of the firemen was to isolate the ammonium nitrate in compartment N¯ 5 from the compartment involved in the fire by means of water curtains. At 10:30 the toxicity danger due to smoke cloud became evident and at 11:15 preparations for the evacuation of an area affecting about 73,000 people started (shelter information to the public by vehicles with loudspeakers, telephone calls to town halls and through TV and local radio stations). At the same time, the number of fire fighting equipments was increased involving all the nearby safety centres and continuous monitoring of cloud movements by means of a helicopter and metereological indications given by the Nantes station were carried out (the concentrations of main pollutants [nitric acid, nitrogen oxides and ammonia] inside and outside the storehouse and at nearby communities as a function of time are available in the Original Report and the in relevant presentation in the Seminar on "The Notification of Major Accidents" held at Rethymnon Greece on October 6/7 in 1988). The toxic cloud reached an height of about 250m and was 5km large and it was covering a surface of about 15 Km. At 11:30 the rail traffic between Nantes Le Croisis and Redon had been interrupted and preparation for evacuation in a radius of 1 km started. At 13:00 nitric acid concentrations of 5ppm were measured by the Nantes cell up to Coueron. The requisition of all public transport vehicles was made. At 13:50 a request to the army for assistance with vehicles was made. At 14:00 the Mobile Chemical Action Cell of Angers was asked for help and for a reserve of isolating respirators. At 14:15 the ORSEC plan was activated and at 14:30 the decision to evacuate was made. Public was notified by radio and by vehicles with loudspeakers. Schools, dance halls, sports hall were made available for receiving the evacuated people. During this period of time the products on fire were soaked with a total flow of 700m3/h. The fire was almost extinguished at 14:15 but emission of smoke was reduced considerably at 16:00 while reinforcement from other departments continued to arrive. At 17:20 the Prefect gave a Press Conference and at 18:00 a survey on the percentage evacuation achieved was undertaken. The rail traffic was resumed at 19:00 and population allowed to return home at 22:00. At 02:34 firemen penetrated inside the store and at 05:00 the fire was considered as extinguished. The ORSEC emergency plan terminated at 07:00.

Appendix Short Report / description of substances involved:

- Fertilizing Compounds (15% N, 8% P, 22% K): amount involved = 850,000 Kg (this amount refers to the inventory of fertilizing compounds in compartment N¯ 2 involved in the fire). It had been estimated that about 100,000 Kg of fertilizers compounds burned during the fire.

On a document attached to the Original Report the products of the combustion of NPK fertilizing compounds are shown but no data are available about the amount of theses combustion products released during the fire.

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

- Nitric Acid (C.A.S. CODE: 7697-37-2): amount involved = not known.

- Chlorine (C.A.S. CODE: 7782-50-5, C.E.E. CODE: 017-001-00-7): amount involved = not known.

- Ammonia (C.A.S. CODE: 7664-41-7, C.E.E. CODE: 007-001-00-5): amount involved = not known.

Appendix Short Report / description of immediate sources:

The accident occurred in an installation built in 1973 and used to store chemicals and fertilizers. The storage installation was a rectangular metal-framed building with fibrocement shingle with dimensions of 100x35x9m and a usable height of 7m (the total volume was about 21,000m3). The ground surface was subdivided into 8 compartments by mobile concrete partitions (STOMOS type). There were also a bagging facility with a conveyor belt serving all compartments, a room in concrete for agro-pharmaceutical products, a transformer (containing PCB) and a small office. The lay-out of the storage plant is shown on two maps attached to the Original Report.

On the day of the accident, four compartments (N¯ 3, 4, 6 and 7) were empty while the others contained:

- compartment N¯ 1: 600 tonnes of NPK 15-10-21 fertilizers (15% N, 10% P, 21% K);

- compartment N¯ 2: 850 tonnes of NPK 15-8-22 fertilizers (15% N, 8% P, 22% K);

- compartment N¯ 5: 650 tonnes of ammonium nitrate in free placement and 100 tonnes in sacks;

- compartment N¯ 8: 200 tonnes of an urea solution at 46%.

The compartment involved in the fire was N¯ 2 storing NPK 15-8-22 fertilizers produced by DSM MALIEABON of Utrecht and arrived in the storehouse by means of an english ship coming from Rotterdam on October 24.

The storage plant was about 100m (in the North direction) away from the La Loire river and 25m (in the South direction) away from the railway Nantes-Saint Nazaire. In the East direction, at about 25m there were other similar storehouses. In the West direction there were other storehouses (100 m and 400 m away) and other industries (400 m and 600 m). A more detailed map of the area is given in Fig. 1 of the relevant presentation in the Seminar on "The Notification of Major Accidents" held at Rethymnon -

Greece in October 6/7 in 1988. More detailed maps are attached to the confidential report on this accident by P.Gendre and Y.M.Vasseur.

Appendix Short Report / description of suspected causes:

CAUSES:

When the Original Report was prepared the causes of the accident have not fully identified but it is supposed that it occurred as a combination of the following elements:

a) storage of a fertilizer compound which decomposed (this phenomenon is called self-substaining decomposition) due to a too high temperature and an excessive concentration of organic material (wheat saw dust) due to previous transportation;

b) no monitoring by means of thermometric probes of the development of high temperature in the heap during storage was foreseen;

c) the presence in the fertilizers heap of defective (due to poor insulation) power cables. These defective cables (due to their age and the oversizing of the fuses and circuit breakers) caused the fertilizers decomposition; the short duration in which electrical current flew should be pointed out (switch-on at about 09:00 and detection of smoke and switch-off at about 09:15). On the other hand, the short-circuit assumption must be discarded because people worked until they were switched off and, besides, no blown fuse was found and the heat generated by a short-circuit is generally insufficient to initiate decomposition;

d) wooden pallets in contact with the fertilizers compounds which caught fire during decomposition and released heat which accelerated the decomposition;

e) the absence of any efficient fire-fighting means. If there had been a massive quantity of water rapidly available to put out the fire, the decomposition could have been slowed down before to develop out of control.

Appendix Short Report / description of immediate effects:

EFFECTS ON PEOPLE:

Internal to the establishement, 29 people were injured by the accident (25 by the toxic release and 4 by the fire).

MATERIAL LOSS:

The storage installation was damaged by the fire but no data are available about the cost of the material damages.

ECOLOGICAL HARM:

During the main fire fighting attempt, products on fire were drenched under a water flow rate of 700m3/h. The contaminated fire fighting water caused a slight pollution of the La Loire river.

COMMUNITY DISRUPTION:

When the toxicity danger due to smoke cloud became evident, preparations for the evacuation of an area affecting about 73,000 people started. The rail traffic between Nantes Le Croisis and Redon had been interrupted and preparation for evacuation in a radius of 1 km started. The requisition of all public transport vehicles was made. The ORSEC plan was activated and the decision to evacuate was made. Public was notified by radio and by vehicles with loudspeakers. Schools, dance halls, sports hall were made available for receiving the evacuated people.

Appendix Short Report / description of emergency measures taken:

INTERNAL TO THE ESTABLISHMENT:

A fire fighting team arrived on-site and, after assessment of the situation, immediately requested a reinforcement with foam equipments. The first attempt of the firemen was to isolate the ammonium nitrate in compartment N¯ 5 from the N¯ 2 involved in the fire by means of water curtains.

EXTERNAL TO THE ESTABLISHMENT:

When the toxicity danger due to smoke cloud became evident, preparations for the evacuation of an area affecting about 73,000 people started. At the same time, the number of fire fighting equipments was increased involving all the nearby safety centres and continuous monitoring of cloud movements by means of a helicopter and metereological indications given by the Nantes station were carried out. The rail traffic between Nantes Le Croisis and Redon had been interrupted and preparation for evacuation in a radius of 1 km started. Nitric acid concentrations of 5ppm were measured by the Nantes cell up to Coueron. The requisition of all public transport vehicles was made. A request to the army for assistance with vehicles was made. The Mobile Chemical Action Cell of Angers was asked for help and for a reserve of isolating respirators. The ORSEC plan was activated and the decision to evacuate was made. Public was notified by radio and by vehicles with loudspeakers. Schools, dance halls, sports hall were made available for receiving the evacuated people. During this period of time the products on fire were soaked with a total flow of 700m3/h. The fire was almost extinguished at 14:15 but emission of smoke was reduced considerably at 16:00.

Appendix Short Report / description of immediate lessons learned:

MEASURES TO PREVENT ANY RECURRENCE OF SIMILAR ACCIDENTS:

After this accident, an extended research programme on ignition and fire in bulk fertilizers and in chemical stored in pallets was initiated. This study showed that burning velocities experimentally determined with small samples could be rather misleading. Tests with bigger amounts of material had recommended.

Appendix Full Report A / type of accident:

Due to a self-substaining decomposition of fertilizers compounds, a fire (code 1201) developped in one of the compartments of an installation for the storage of fertilizers and chemicals. The fire produced a toxic smoke (containing nitric acid, nitrogen oxides, ammonia and chlorine) that dispersed into the environment (code 1401). Contaminated fire fighting water caused a slight pollution of a nearby river (code 1405).

Appendix Full Report A / dangerous substances:

The total establishment and the potential directly involved inventories of fertilizers (15% N, 8% P, 22% K) refer to the amount contained in compartment N¯ 2. The amounts of ammonium nitrate, urea 46% solution and the other fertilizers refer to the inventories stored in the other compartments that were not involved in the fire. On a document attached to the Original Report the combustion products of NPK fertilizer are shown but no data are available about the amounts released during the fire.

Appendix Full Report A / source of accident - remarks:

The accident occurred in an installation built in 1973 and used to store chemicals and fertilizers (codes 2008 and 3202). The storage installation was a rectangular metal-framed building with fibrocement shingle with dimensions of 100x35x9m and a usable height of 7m (the total volume was about 21,000m3). The ground surface was subdivided into 8 compartments by mobile concrete partitions (STOMOS type). The fire occurred in compartment N¯ 2 storing NPK 15-8-22 fertilizers (code 4006).

Appendix Full Report A / causes of major occurrence:

The causes of the accident have not fully identified (code 5501) but probably the decomposition of fertilizers occurred due to: storage of fertilizers at too high temperature and with an excessive amount of organic material; presence of defective power cables; no monitoring of the temperature of the goods stored in the heap; wooden pallets in contact with the fertilizers; absence of any efficient fire fighting means (codes 5303, 5307, 5308 and 5314).

Appendix Full Report B / area concerned - remarks:

The toxic cloud reached an height of about 250m and was 5km large and it was covering a surface of about 15 Km. Inside the storehouse the maximum measured concentration of toxic gas (nitric gas) was 50 ppm. Outside the storage installation, the maximum measured concentration of toxic gas was detected at 15:30 (5ppm of nitric acid up to Coeuron). The other toxic gases (ammonia, chlorine and nitrogen oxides) were measured in a lower concentration.

Appendix Full Report B / people:

Inside the establishement, 29 people were injured by the accident (25 by the toxic release and 4 by the fire). The ORSEC plan was put into operation and preparations for the evacuation of 73,000 people started but, about 5 hours after the smoke began to appear, it was necessary to evacuate only 25,000 people.

Appendix Full Report B / ecological harm:

During the main fire fighting attempt, products on fire were drenched under a water flow rate of 700m3/h. The contaminated fire fighting water caused a slight pollution of the La Loire river.

Appendix Full Report B / material loss:

The storage installation was damaged by the fire but no data are available about the cost of the material damages.

Appendix Full Report B / disruption of community life:

The rail traffic between Nantes Le Croisis and Redon had been interrupted. About 25,000 people were evacuated from their homes. Schools, dance halls, sports hall were made available for receiving the evacuated people. Public was informed by vehicles with loudspeakers, telephone calls to town halls and through TV and local radio stations.

Appendix Full Report C / lesson learned - prevent:

After this accident, an extended research programme on ignition and fire in bulk fertilizers and in chemical stored in pallets was initiated. This study showed that burning velocities experimentally determined with small samples could be rather misleading. Tests with bigger amounts of material had recommended.

Appendix Full Report C / lesson learned - references:

A more detailed map of the area is given in Fig. 1 of the relevant presentation in the Seminar on "The Notification of Major Accidents" held at Rethymnon - Greece in October 6/7 in 1988. More detailed maps are attached to the confidential report on this accident by P.Gendre and Y.M.Vasseur.