

Gasexplosion och påföljande brand på ett värmeverk i tätbebyggt område.

940330 MARS 1800_39

Då olyckan inträffade klockan 01:30 befann sig fem anställda på anläggningen, ett värmeverk i tätbebyggt område. Under uppstart av en gasdriven ångpanna släpptes en ansenlig mängd gas ut från en underjordisk gasledning. Utsläppet kan ha orsakats av en felaktig hantering av tätningen som kontrollerar huvudgasledningen. Innan man hunnit strypa tillflödet till läckpunkten exploderar gasen. Med hjälp av seismografer uppskattades explosionen till motsvarande 50 kg TNT. Inom några få minuter efter explosionen är räddningstjänsten på plats. 50 fordon och 200 brandmän från 12 brandstationer deltog i släcknings- och räddningsarbetet. De närliggande butikerna bevakades inom kort för att förhindra plundring av affärer vars skyltfönster krossats vid explosionen.

Inblandade ämnen och mängder

	CAS Nr.	Mängd
kolpulver		8000 ton
naturgas		40 m3
saltsyra		20 m3
NaOH		20 m3
Svavelsyra		10 m3
PCB/PCT		22,45 ton

Skador:

Människor:	En operatör dödades i det underjordiska utrymmet. Utanför värmeverket avled en 6 årig flicka efter 4 dagar. 56 personer skadades mer eller mindre allvarligt och fick föras till sjukhus för vård. Ytterligare 25 kan behandlas på platsen.
Materiella:	Värmeverket förstördes till stora delar; tre ångpannor totalförstördes. Ett närliggande trevånings bostadshus och ett femvånings affärshus skadades svårt. Fönster krossades på avstånd upp till 2-3 km bort.
Miljö/ekologi:	Inga effekter rapporterade.
Infrastruktur:	Se materiella skador. Ett stort antal människor blev tillfälligt arbetslösa under återuppbyggnaden. Värmedistributionen avbröts och störningar kvarstod i flera veckor för en närliggande arbetsplats för försvarsministeriet med 3500 anställda. IT-teknologin stördes allvarligt då kylsystemen stängdes av.

Erfarenheter redovisade (Ja/Nej):

Report Profile

Identification of Report:

country: FA ident key: 1800_039_01

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

Date of Major Occurrence: Time of Major Occurrence

start: 1994-03-30 start: 01:30:00

finish: 1994-03-30 finish: 06:00:00

Establishment:

name:

address:

industry: 2005 power supply and distribution (electric, gas, etc.)

District Heating 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:** 1800_039_01

Accident Types:

release: No **explosion:** Yes

water contamination: No **other:** No

fire: Yes

description:

At the moment of the accident (1h30), 5 employees are present in the plant. A gas boiler and a carbon boiler are on service. The mixed boiler is available for starting up with gas, and the previous team did various vain attempts to start. T... see Appendix Short Report / description of accident types

Substance(s) Directly Involved:

toxic: No **explosive:** Yes

ecotoxic: No **other:** No

flammable: Yes

description:

-Carbon powder 8000 t... see Appendix Short Report / description of substances involved

Immediate Sources of Accident:

storage: No **transfer:** No

process: No **other:** Yes

description:

- not applicable -

Suspected Causes:

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

human: Yes **other:** No

description:

Without anticipating the conclusions of the on course judicial inquiry, the available information show that the explosion is probably linked to a gas escape occurred of the feed line of the boilers in the under ground of the plant, at the l... see Appendix Short Report / description of suspected causes

Immediate Effects:

material loss: Yes

human deaths: Yes

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

other: No

ecological harm: Yes

national heritage loss: No

description:

An operator is killed in the underground, 2 other are seriously injured. The two remaining operators, although shocked, can leave uninjured the building. The destruction of a pavilion sited the border of the site, 50 m away from the bui... see Appendix Short Report / description of immediate effects

Emergency Measures taken:

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

external services: Yes **restoration:** No

sheltering: No **other:** No

evacuation: No

description:

- not applicable -

Immediate Lessons Learned:

prevention: No **other:** No

mitigation: No

description:

- not applicable -

A Occurrence Full Report

country: FA **ident key:** 1800_039_01

1 Type of Accident

remarks: Fire (following the explosion) of limited importance.

2 Dangerous Substances

remarks: (1) Quantity corresponding to the volume of the feed pipe (110 m long, mean diameter 300 mm, pressure 4,5 bars) (2) Polychlorodiphenyls and terphenyls

3 Source of Accident

illustration: - not applicable -

remarks: The fire which followed the explosion involves different parts of the building and of the equipments.

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: Without particular object. The meteorological conditions as normally were not so hard to significantly influence the effects of the main explosion.

5 Causes of Major Occurrence

main causes

technical / physical - not applicable -

- not applicable -

- not applicable -

- not applicable -

- not applicable -

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

5305 organization: supervision (none, inadequate, inappropriate)

5307 organization: process analysis (inadequate, incorrect)

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

5312 organization: isolation of equipment/system (none, inadequate, inappropriate)

remarks: See document AC 950190 here attached. 5303 concerns the normal working procedures and the intervention procedures in case of dangerous situation (Insufficient safety report).

6 Discussion about the Occurrence

- not applicable -

Type of Accident country: FA ident key: 1800_039_01

event:

major occurrence 1307 explosion: VCE (vapour cloud explosion; supersonic wave front)

initiating event 1101 release: gas/vapour/mist/etc release to air

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

Dangerous substances

country: FA ident key: 1800_039_01

a) total establishment inventory

CAS number: identity: Sulphuric Acid (10 M3)

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): 10

use of substance as: STARTING MATERIAL

b) substance belongs to relevant inventory directly involved: No

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: Soda (20m3)

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): 20

use of substance as: STARTING MATERIAL

b) substance belongs to relevant inventory directly involved: No

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: Powder Carbon

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): 8000

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: Pcb/pct(2) (refrigerating 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): 22,45

use of substance as: STARTING MATERIAL

b) substance belongs to relevant inventory directly involved: No

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: Natural Gas (1) 40 Nm3

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: Hydrochloric Acid (20 M3)

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): 20

use of substance as: STARTING MATERIAL

b) substance belongs to relevant inventory directly involved: No

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_039_01

situation

industry

initiating event 2005 power supply and distribution (electric, gas, etc.)

associated event 2005 power supply and distribution (electric, gas, etc.)

activity/unit

major occurrence 3106 process: power generation (burning fuel, etc.)

initiating event 3106 process: power generation (burning fuel, etc.)

associated event 3106 process: power generation (burning fuel, etc.)

component

major occurrence 4010 valves/controls/monitoring devices/drain cocks

initiating event 4010 valves/controls/monitoring devices/drain cocks

associated event 4999 other

B Consequences Full Report

country: FA ident key: 1800_039_01

1 Area concerned

affected

extent of effects installation: Yes

establishment: Yes

off-site; local: Yes

off-site; regional: not applicable

off-site; transboundary: not applicable

illustration of effects - not applicable -

remarks - not applicable -

2 People

establishment popul. emergency personnel off-site population

total at risk 5

immediate fatalities 1

subsequent fatalities 1

hospitalizing injuries 2 2

other serious injuries 60

health monitoring

remarks The people at risk (off-site) were various hundreds. The exact number of the hea... 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 - not applicable -

4 National Heritage Loss

effects on:

- historical sites not applicable - historic monuments not applicable
- historic buildings not applicable - art treasures not applicable

remarks - not applicable -

5 Material Loss

establishment losses off site losses

costs (direct costs to operator) (social costs)

in ECU FF ECU FF

material losses 4E+08 1E+08

response, clean up, restoration

remarks See details in the document AC 950190

6 Disruption of Community Life

establishment/plant evacuated disabled/unoccupiable destroyed

- nearby residences/hotels No No Yes
- nearby factories/offices/small shops No Yes 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 Yes No

remarks The perturbations in the offices heating (2.2 millions of m2) and of the riparia... see Appendix

7 Discussion of Consequences

- not applicable -

Ecological Components involved

country: FA **ident key:** 1800_039_01

type: 6102 inland: urban development

threatened: Yes **affected:** not applicable

type: 6101 inland: metropolitan development

threatened: Yes **affected:** not applicable

C Response Full Report

country: FA **ident key:** 1800_039_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

The report of the working grou... see Appendix Full Report C / lesson learned - prevent

measures to mitigate consequences:

This document will be availabl... see Appendix Full Report C / lesson learned - mitigate

useful references:

idem (paragraph a and b)

5 Discussion about Response

- not applicable -

Appendices for the FA / 1800_039_01 report

Appendix Short Report / description of accident types:

At the moment of the accident (1h30), 5 employees are present in the plant. A gas boiler and a carbon boiler are on service. The mixed boiler is available for starting up with gas, and the previous team did various vain attempts to start. The message has been transmitted to the night team that try the same to put the boiler in service. An instruction is given by the quarter chief to go and examine the position of the obturator ONIS which allows to block up the main gas circuit.

A few before the explosion, an untimely release of gas arrives in the underground, joined probably to the erroneous action of the ONIS obturator by one of the operators. The noise warns the quarter chief, who send another operator in order to locally intervene. The in service gas boiler is shut down with urgency, and the personnel go out to cut the general supply at the level of the cut off place, 110 m away from the building. At this time the explosion occurs. Warned by the noise, the firemen arrive on place very rapidly, some minutes or more after the explosion. The red plan (help to the victims in large number) is immediately unlatched. 50 vehicles and 200 firemen, arrived from 12 fire-stations, are engaged in the fight and in the rescue. The different ignited fires on site are extinguished without particular difficulty. Various hundreds of C.R.S. men (compagnie republicaine de surete') participate to the fight against the pillage.

The extremely rapid guarding (less than 1/2 hour after the explosion) of the commerces which have lost their shop-windows permits to avoid the essential from the thefts.

The measurements made by university sismographs shows that the dissipated energy on the ground is equivalent to a load of 50 kg of TNT.

Appendix Short Report / description of substances involved:

-Carbon powder 8000 t

-Natural gas 40 Nm3 (quantity corresponding to the volume of the feeding pipe, 110 m long, mean diameter 300 mm, pressure 4,5 bars)

-Chlorhydric acid 20 m3

-Kali 20 m3

-Sulphuric acid 10 m3

-PCB/PCT(cooling oil) 22.45 t (polychlorodipheniles and terphenyles)

Appendix Short Report / description of suspected causes:

Without anticipating the conclusions of the on course judicial inquiry, the available information show that the explosion is probably linked to a gas escape occurred of the feed line of the boilers in the under ground of the plant, at the level of an operculum obturator ONIS installed on the line which supplies the only mixed boiler. This obturator found unlocked and partially open, should have been wrongly operated.

The carbon boiler on duty at the moment of the event could not be urgently shut down.

It constitutes one of the hot points more susceptible to have generated the explosion.

Considered the importance of the network pressure and of leak section represented by this partial opening, it is possible that the power of the gas jet has been sufficient to create a suspension of carbon powder, that could have had two consequences:

- the opacity of the local atmosphere could have prevented the operator to successfully intervene on the manual valve close to the leakage point;
- the accident could have been created by an explosive mixture of gas and carbon powder gas, the behaviour of this last could have contributed to the violence of the effects.

Appendix Short Report / description of immediate effects:

An operator is killed in the underground, 2 other are seriously injured. The two remaining operators, although shocked, can leave uninjured the building. The destruction of a pavilion sited the border of the site, 50 m away from the building, causes the death of a little girl, 6 years old, after 4 days. In the vicinity of the site, 56 persons receive injures of different gravity and are hospitalized for care and observations; other 25 are shocked and receive cares on the place. Finally 250 persons are evacuated from their houses, sheltered in a sportive complex and then temporarily reloaged. The district heating plant is ravaged by the explosion: 3 boilers are destroyed, the other and the joined equipments are more or less gravely damaged, the bureaus and the control room are collapsed. The majority of the slates covering the building is hurled on the ground and the remains of the bardage and thermic isolant are propelled externally to the site. The electro-filters are seriously damaged, but the chimney doesn't show external damages. The material damages in the vicinity of the plant are very important: a 3 stories habitation building and two trade buildings (one of 5 stories) are very damaged. Damagement of various ten of vehicles. About 600 people were put on technical unemployment. In the nearby buildings the glass of the windows have been broken up to a distance of 2-3 km.- The average of the recordered oscillations during 6 mn gives a lateral displacement of 1 mm at the level of the 23rd story of the seismologic tower. The building of the "Grande Arche" is affected with damages on the external structure and on the decoration elements. For safety reasons 3500 civil servants of the "Ministere de l'Equipment" are put in technical unemployment for half a day. No heating in some buildings in which live about 150.000 customers and employees of the Ministry of the Defence . The interruption of the cold climatization disturbed important informatic systems.

Appendix Full Report B / people:

The people at risk (off-site) were various hundreds. The exact number of the heavy injured persons externally to the site is still in evaluation on the basis of the indemnity requests presented to the insurance companies.

Appendix Full Report B / disruption of community life:

The perturbations in the offices heating (2.2 millions of m2) and of the riparians (30,000 comfortless persons) last various weeks. The climatization of the important informatic systems is affected too. A deep consideration on the safety of the urban and industrial heating is carried on by the Ministry of the Environment and of the Ministry of the Industry (Pertaining and Administrative level).

Appendix Full Report C / lesson learned - prevent:

The report of the working group on the return of experience about the accidents in the industrial and tertiary heatings, controlled by BARPI (Ministry of the Environment) proposes a whole of recommendations for improving the safety of such kind of installations.

Appendix Full Report C / lesson learned - mitigate:

This document will be available as soon as possible (2nd quarter of 1995)