Dammexplosion på en anläggning för produktion av zinkpulver.

DATUM **MARS 1991_19**
911020

Olyckan inträffade på en zinkpulveranläggning.Två kylare förbereddes för rengöring efter att ha varit i bruk under ett par veckors tid. Rengöringsarbetet utfördes på så vis att man med hammare slog på utsidan av kylaren för att frigöra zinkdamm. En explosion inträffade inne i kylaren. Lågor slog ut ur kylaren och antände manne kläder. Han tog sig ned och fick hjälp till nödduschen.Troligen hade en kärna av hett zinkpulver fallit ut i den luftade kylaren på grund av hammarslagen och resulterat i en dammexplosion.

Inblandade ämnen och mängder

	CAS Nr.	Mängd
zinkpulver	7440-66-6	okänt

Skador:

Människor:	1 anställd brännskadades och fördes till sjukhus i ambulans..
Materiella:	Mindre kador på anläggningen.
Miljö/ekologi:	Inga effekter rapporterade.
Infrastruktur:	Inga.

Erfarenheter redovisade (Ja/Nej): Ja

Kortfattat anges förebyggande åtgärder.

Report Profile

Identification of Report:

country: FA **ident key:** 1991_019_01

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

Date of Major Occurrence: Time of Major Occurrence

start: 1991-10-20 **start:** 06:00:00

finish: finish:

Establishment:

name:

address:

industry: 2011 metal refining and processing (includes foundries, electrochemical refining,

plating, etc.)

Metal (Zinc Powder Production Plant)

Seveso II status: not applicable: Yes **art. 6 (notification):** No

art. 7 (MAPP): No

art. 9 (safety report): No

Date of Report:

short: full:

Authority Reporting:

name:

address:

Authority Contact:

rep_cont_name:

rep_cont_phone:

rep_cont_fax:

Additional Comments:

a) - not applicable -

b) - not applicable -

c) - not applicable -

d) - not applicable -

e) - not applicable -

Short Report

country: FA **ident key:** 1991_019_01

Accident Types:

release: No **explosion:** Yes

water contamination: No **other:** No

fire: No

description:

SYSTEM ORIGINATING AND OPERATING CONDITIONS:... see Appendix Short Report / description of accident types

Substance(s) Directly Involved:

toxic: No **explosive:** Yes

ecotoxic: No **other:** No

flammable: No

description:

- Zinc Powder (C.A.S. CODE: 7440-66-6): amount involved = not known.

Immediate Sources of Accident:

storage: No **transfer:** No

process: Yes **other:** Yes

description:

The accident occurred during maintenance (cleaning operation) of a condenser distillation column of a zinc

powder production plant. Following the procedures, the two condensers of the zinc powder plant, after many

weeks of production, were ... see Appendix Short Report / description of immediate sources

Suspected Causes:

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

human: No **other:** Yes

description:

INITIATING EVENT AND CONSEQUENCES:... see Appendix Short Report / description of suspected causes

Immediate Effects:

material loss: Yes

human deaths: No

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

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: No **restoration:** No

sheltering: No **other:** No

evacuation: No

description:

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

Immediate Lessons Learned:

prevention: Yes **other:** No

mitigation: Yes

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:** 1991_019_01

1 Type of Accident

remarks: During maintenance, the worker responsible for the cleaning operation had already begun to hit with a hammer a heat exchanger standing close to the condenser when a dust explosion occurred inside the condenser (code 1305). Two covers were l... see Appendix Full Report A / type of accident

2 Dangerous Substances

remarks: No data are available about the amount of zinc powder involved in the accident.

3 Source of Accident

illustration: - not applicable -

remarks: The accident occurred during maintenance (cleaning operation) of a condenser distillation column (codes 3104 and 4009) of a zinc powder production plant (code 2011). Following the procedures, the two condensers of the zinc powder plant, aft... 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 5107 operation: unexpected reaction/phase-transition

- not applicable -

- not applicable -

- not applicable -

- not applicable -

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

5307 organization: process analysis (inadequate, incorrect)

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

- not applicable -

- not applicable -

remarks: The probable cause of explosion was a hot nucleus of zinc powder precipitating into the aired condenser due to the hammer blows and igniting there as a powder cloud (code 5107).

The underlying causes were insufficient operating procedures i... see Appendix Full Report A / causes of major occurrence

6 Discussion about the Occurrence

- not applicable -

Type of Accident **country:** FA **ident key:** 1991_019_01

event:

major occurrence 1305 explosion: dust explosion

initiating event 1305 explosion: dust explosion

associated event - not applicable -

Dangerous substances

country: FA **ident key:** 1991_019_01

a) total establishment inventory

CAS number: 7440-66-6 **identity:** Zinc Powder

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:** 1991_019_01

situation

industry

inititating event 2011 metal refining and processing (includes foundries, electrochemical refining, plating, etc.)

associated event - not applicable -

activity/unit

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

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

associated event - not applicable -

component

major occurrence 4009 heat exchanger (boiler, refrigerator, heating coils, etc.)

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

associated event - not applicable -

B Consequences Full Report

country: FA **ident key:** 1991_019_01

1 Area concerned

affected

extent of effects installation: Yes

establishment: No

off-site; local: No

off-site; regional: No

off-site; transboundary: No

illustration of effects - not applicable -

remarks In the Original Report there is no evidence of significant effects outside the i... see Appendix Full Report B / area concerned - remarks

2 People

establishment popul. emergency personnel off-site population

total at risk 2

immediate fatalities

subsequent fatalities

hospitalizing injuries 1

other serious injuries

health monitoring

remarks 1 people (the worker responsible for the cleaning operation of the condenser) wa... 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 ECU

material losses

response, clean up, restoration

remarks The explosion caused the following damages: a cable of an elevated cable-way cra... 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 Yes No No

- media interest No No No

- political interest No No No

remarks In the Original Report there is no evidence of significant effects outside the i... see Appendix

7 Discussion of Consequences

C Response Full Report

country: FA **ident key:** 1991_019_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 follow... see Appendix Full Report C / lesson learned - prevent

measures to mitigate consequences:

After the accident, the follow... see Appendix Full Report C / lesson learned - mitigate

useful references:

- not applicable -

5 Discussion about Response

- not applicable -

Appendices for the FA / 1991_019_01 report

Appendix Short Report / description of accident types:

SYSTEM ORIGINATING AND OPERATING CONDITIONS:

Following the procedures, the two condensers of the zinc powder plant, after many weeks of production, were put out of service for cleaning operation on October 18, 1991. The cleaning works should have begun on October 19, 1991.

SAFETY SYSTEMS OR OPERATORS INTERVENTION:

A colleague brought the injured man to a safety shower in order to extinguish the fire. By an ambulance the injured was then accompanied to the hospital.

ACCIDENT CASE HISTORY DESCRIPTION:

On October 19, 1991 the shift foreman had established that the temperature was still just above ambient and decided to put-off the cleaning operation till the day after. On October 20, 1991 the shift mechanic opened the cleaning valve of the condenser and of the nitrogen circuit. He did not notice anomalies and informed the shift foreman. The shift foreman ordered a worker to execute the job. The man responsible for the cleaning operation had already begun to hit with a hammer a heat exchanger standing close to the condenser when a dust explosion occurred inside the condenser. Two covers were lifted and from an opening the outcoming flames ignited the dress of the worker. He ran downstairs asking for help and a colleague accompanied him to a nearby safety-shower.

Appendix Short Report / description of immediate sources:

The accident occurred during maintenance (cleaning operation) of a condenser distillation column of a zinc powder production plant. Following the procedures, the two condensers of the zinc powder plant, after many weeks of production, were put out of service for cleaning operation on October 18, 1991. The cleaning works should have begun on October 19, 1991.

Appendix Short Report / description of suspected causes:

INITIATING EVENT AND CONSEQUENCES:

The worker responsible for the cleaning operation had already begun to hit with a hammer a heat exchanger standing close to the condenser when a dust explosion occurred inside the condenser. Two covers were lifted and from an opening the outcoming flames ignited the dress of the worker.

CAUSES:

The probable cause of explosion was a hot nucleus of zinc powder precipitating into the aired condenser due to the hammer blows and igniting there as a powder cloud. The underlying causes were insufficient operating procedures in cleaning operations together with insufficient process analysis and system design.

Appendix Short Report / description of immediate effects:

EFFECTS ON PEOPLE:

1 people (the worker responsible for the cleaning operation of the condenser) was injured by fire. A colleague brought the injured man to a safety shower in order to extinguish the fire. By an ambulance the injured was then accompanied to the hospital.

MATERIAL LOSS:

The explosion caused the following damages: a cable of an elevated cable-way crane burned; in some places cables were damaged by sparks. No data are available about the cost of the (negligible) material losses.

Appendix Short Report / description of emergency measures taken:

INTERNAL TO THE ESTABLISHMENT:

The worker responsible for the cleaning operation ran downstairs with his dress on fire asking for help and a colleague accompanied him to a nearby safety shower in order to extinguish the fire. By an ambulance the injured was then accompanied to the hospital.

Appendix Short Report / description of immediate lessons learned:

MEASURES TO PREVENT ANY RECURRENCE OF SIMILAR ACCIDENTS:

After the accident, the following procedures were established:

1- closed encapsulation (without net) of the pressure release valves in the condenser;

2- closed encapsulation of the heat exhanger in the condenser;

3- automatic hammer in the heat exchanger (during the transition phase: beating bar);

4- introduction of nitrogen in the condenser during the cooling phase;

5- equipping of the heat exchanger with a stirring gear during the cooling phase.

MEASURES TO PREVENT ANY RECURRENCE OF SIMILAR ACCIDENTS:

After the accident, the following procedures were established:

1- pressure release valves to be opened only when wearing heat protective clothing and after management permission;

2- don’t standing close to the condenser without mask and only after management permission;

3- establishment of shut-down procedures for the condensers.

Appendix Full Report A / type of accident:

During maintenance, the worker responsible for the cleaning operation had already begun to hit with a hammer a heat exchanger standing close to the condenser when a dust explosion occurred inside the condenser (code 1305). Two covers were lifted and from an opening the outcoming flames ignited the dress of the worker.

Appendix Full Report A / source of accident - remarks:

The accident occurred during maintenance (cleaning operation) of a condenser distillation column (codes 3104 and 4009) of a zinc powder production plant (code 2011). Following the procedures, the two condensers of the zinc powder plant, after many weeks of production, were put out of service for cleaning operation on October 18, 1991. The cleaning works should have begun on October 19, 1991.

Appendix Full Report A / causes of major occurrence:

The probable cause of explosion was a hot nucleus of zinc powder precipitating into the aired condenser due to the hammer blows and igniting there as a powder cloud (code 5107). The underlying causes were insufficient operating procedures in cleaning operations (code 5303) together with insufficient process analysis and system design (codes 5307 and 5308).

Appendix Full Report B / area concerned - remarks:

In the Original Report there is no evidence of significant effects outside the installation.

Appendix Full Report B / people:

1 people (the worker responsible for the cleaning operation of the condenser) was injured by fire. A colleague brought the injured man to a safety shower in order to extinguish the fire. By an ambulance the injured was then accompanied to the hospital.

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 explosion caused the following damages: a cable of an elevated cable-way crane burned; in some places cables were damaged by sparks. No data are available about the cost of the (negligible) material losses.

Appendix Full Report B / disruption of community life:

In the Original Report there is no evidence of significant effects outside the installation.

Appendix Full Report C / lesson learned - prevent:

After the accident, the following procedures were established:

1- closed encapsulation (without net) of the pressure release valves in the condenser;

2- closed encapsulation of the heat exhanger in the condenser;

3- automatic hammer in the heat exchanger (during the transition phase: beating bar);

4- introduction of nitrogen in the condenser during the cooling phase;

5- equipping of the heat exchanger with a stirring gear during the cooling phase.

Appendix Full Report C / lesson learned - mitigate:

After the accident, the following procedures were established:

1- pressure release valves to be opened only when wearing heat protective clothing and after management permission;

2- don’t standing close to the condenser without mask and only after management permission;

3- establishment of shut-down procedures for the condensers.