Brand i ett lagerområde på en pappersindustri

911011 MARS 1800_19

Klockan 14:15 upptäcktes en en tjock vit dimma på lagerområdet på en pappersindustri. Dimman bestod huvudsakligen av svaveldioxid, men även av fasta partiklar. En tid före upptäckten hade man noterat en lukt från den lagerbyggnad som dimmolnet kom från. Den sannolika orsaken befanns vara lagringsmisstag. Säckar med FAS(formamidine sulfinic acid) låg intill säckar med basisk tvål på ett sådant sätt att reaktion kunde uppstå. FAS bröts ned till svaveldioxid i en värmeutvecklande reaktion. Brand utbröt inte då nedbrytningstemperaturen var måttlig. För säkerhets skull kyldes säckarna ned med vatten av den tillkallade räddningstjänsten och civilförsvaret. Svaveldioxidmolnet skingrades i atmosfären undefär klockan 16:15. De fasta nedbrytningsresterna i molnet följde med släckningsvattnet och rann ut i hamnvattnet. De lokalamyndigheterna observerade hamnvattnet i några dagar men observerade inga effekter på vattenlivet.

Inblandade ämnen och mängder

	CAS Nr.	Mängd
Formamidine Sulfinic Acid [FAS]		22,7 ton
svaveldioxid	7446-09-05	11 ton
nedbrytningsprodukter		
urea	57-13-6	okänt
svavel	7704-34-0	okänt

Skador:

Människor:	12 människor på fabriksområdet och 19 utanför skadades av FAS och fick spendera tid på sjukhus.
Materiella:	Produkt till ett uppskattat värde av 0,12 MECU gick förlorad.
Miljö/ekologi:	De fasta nedbrytnings resterna i molnet följde med släckningsvattnet och rann ut i hamnvattnet. De lokalamyndigheterna observerade hamnvattnet under några dagar men observerade inga effekter på vattenlivet.
Infrastruktur:	Inga.

Erfarenheter redovisade (Ja/Nej): Ja

Endast förebyggande åtgärder.

Report Profile

Identification of Report:

country: FA **ident key:** 1800_019_01

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

Date of Major Occurrence: Time of Major Occurrence

start: 11/10/1991 **start:** 14:00:00

finish: finish:

Establishment:

name:

address:

industry: 2018 paper manufacture, printing, publishing

Wood, Pulp & Paper (Storehouse for FAS, Alkaline Soap and Other)

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_019_01

Accident Types:

release: Yes **explosion:** No

water contamination: Yes **other:** No

fire: No

description:

SAFETY SYSTEMS OR OPERATORS INTERVENTION:... see Appendix Short Report / description of accident types

Substance(s) Directly Involved:

toxic: Yes **explosive:** No

ecotoxic: Yes **other:** No

flammable: No

description:

- Formamidine Sulfinic Acid [FAS]: amount involved = 22,700 Kg. ... 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 a storage room of a paper industry. In that room formamidine sulfinic acid (FAS) was stored (in big-bags on wooden pallets) at ambient temperature, together with alkaline soap and other

chemicals. The location of th... see Appendix Short Report / description of immediate sources

Suspected Causes:

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

human: Yes **other:** No

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:** Yes

other: No

ecological harm: No

national heritage loss: No

description:

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

Emergency Measures taken:

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

external services: Yes **restoration:** No

sheltering: No **other:** Yes

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:** 1800_019_01

1 Type of Accident

remarks: About 22.7 tonnes of formamidine sulfinic acid (FAS) decomposed almost istantaneously producing a thick white fog of sulphur dioxide and a solid residue (code 1999). The sulphur dioxide cloud (code 1101) dispersed in the atmosphere. The res... see Appendix Full Report A / type of accident

2 Dangerous Substances

remarks: The inventories of formamidine sulfinic acid (FAS) involved in the accident refer to the whole amount in the storage room. The total establishment and

the potential directly involved inventories of sulphur dioxide refer to the maximum amoun... see Appendix Full Report A / dangerous substances

3 Source of Accident

illustration: - not applicable -

remarks: The accident occurred in a storage room (code 3201) of a paper industry (code 2018). In that room formamidine sulfinic acid (FAS) was stored (in big-bags on wooden pallets) at ambient temperature, together with alkaline soap and other chemi... 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): 5

direction (from): N-E

stability (Pasquill):

ambient temperature (∞C):

remarks: Wind direction North-East. Wind speed = about 5 m/s.

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: The likely cause for the FAS decomposition (code 5107) was storage mistakes (codes 5303, 5304 and 5401), which caused chemical reactions between the stored chemicals. The exothermic reactions took probaly place between the bags of FAS and t... see Appendix Full Report A / causes of major occurrence

6 Discussion about the Occurrence

- not applicable -

Type of Accident **country:** FA **ident key:** 1800_019_01

event:

major occurrence 1105 release: solid release to water

initiating event - not applicable -

associated event - not applicable -

event:

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

initiating event 1999 other: other

associated event - not applicable -

Dangerous substances

country: FA **ident key:** 1800_019_01

a) total establishment inventory

CAS number: 57-13-6 **identity:** Urea

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: 7446-09-05 **identity:** Sulphur 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): 13,5

use of substance as: ABNORMAL PRODUCT

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 11 **potential quantity:** 13,5

c) substance belongs to relevant inventory indirectly involved: No

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

a) total establishment inventory

CAS number: 7704-34-0 **identity:** Sulphur

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: Other Decomposition Products

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: Formamidine Sulfinic 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): 22,7

use of substance as: NORMAL FINISHED PRODUCT

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 22,7 **potential quantity:** 22,7

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_019_01

situation

industry

inititating event 2018 paper manufacture, printing, publishing

associated event - not applicable -

activity/unit

major occurrence 3201 storage: process-associated (stockholding, etc. on-site of manufacture)

inititating event 3201 storage: process-associated (stockholding, etc. on-site of manufacture)

associated event - not applicable -

component

major occurrence 4003 container; non-pressurised (hopper, tank, drum, bag, etc.)

inititating event 4003 container; non-pressurised (hopper, tank, drum, bag, etc.)

associated event - not applicable -

B Consequences Full Report

country: FA **ident key:** 1800_019_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 The sulphur dioxide cloud escaped the storage room and was released from Maglemo... see Appendix

Full Report B / area concerned - remarks

2 People

establishment popul. emergency personnel off-site population

total at risk 30

immediate fatalities

subsequent fatalities

hospitalizing injuries 12 19

other serious injuries

health monitoring

remarks 12 people inside and 19 outside the enstablishment were injured and hospitalized... 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 residue of the decomposition of FAS (sulphur, urea, melted FAS and other dec... 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 DKR ECU DKR

material losses 1000000

response, clean up, restoration

remarks No material losses occurred except the decomposed product (about 22.7 tonnes of ... see Appendix

Full Report B / material loss

6 Disruption of Community Life

establishment/plant evacuated disabled/unoccupiable destroyed

- nearby residences/hotels No No No

- nearby factories/offices/small shops No No No

- schools, hospitals, institutions No No No

- other places of public assembly No No No

interruption of utilities etc. no / yes duration

- gas No

- electricity No

- water No

- sewage treatment works No

- telecommunications No

- main roads No

- railways No

- waterways No

- air transport No

significant public concern none local level national level

- off site populations No Yes No

- media interest No No No

- political interest No No No

remarks The sulphur dioxide cloud escaped from the storage room and was released from Ma... see Appendix

7 Discussion of Consequences

Ecological Components involved

country: FA **ident key:** 1800_019_01

type: 6999 other

threatened: Suspected **affected:** not applicable

type: 6403 offshore: sea/seabed

threatened: Suspected **affected:** not applicable

type: 6402 offshore: estuary

threatened: Suspected **affected:** not applicable

C Response Full Report

country: FA **ident key:** 1800_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 condit... see Appendix Full Report C / lesson learned - prevent

measures to mitigate consequences:

After the accident, it was est... see Appendix Full Report C / lesson learned - mitigate

useful references:

- not applicable -

5 Discussion about Response

- not applicable -

Appendices for the FA / 1800_019_01 report

Appendix Short Report / description of accident types:

SAFETY SYSTEMS OR OPERATORS INTERVENTION:

The gate to the storehouse was closed at 14:00. Nothing unusual was observed. The last time the storage room of FAS was visited before the accident was in the morning of Friday, 11th of October.

ENVIRONMENTAL AND ATMOSPHERIC CONDITIONS:

Wind direction North-East. Wind speed = about 5 m/s.

ACCIDENT CASE HISTORY DESCRIPTION:

On Friday, 11th of October 1991 at 14:15, about 22.7 tonnes of formamidine sulfinic acid (FAS) decomposed almost instantaneously producing a thick white fog of sulphur dioxide and a solid residue. The sulphur dioxide cloud disappeared at approximately 16:15. An open fire did not developped. The maximum temperature reached during the decomposition has not been very high because the wooden pallets on which the FAS big- bags were stored were not burnt or discoloured.

Appendix Short Report / description of substances involved:

- Formamidine Sulfinic Acid [FAS]: amount involved = 22,700 Kg.

- Sulphur dioxide (C.A.S. CODE: 7446-09-05, E.E.C. CODE: 016-011-00-9): amount involved = 11,000 Kg (theoretical maximum = 13,500 Kg).

No data are available about the amount of the other FAS decomposition products (urea [C.A.S. CODE: 57-13-6], sulphur [7704-34-0] and other substances) involved in the accident.

Appendix Short Report / description of immediate sources:

The accident occurred in a storage room of a paper industry. In that room formamidine sulfinic acid (FAS) was stored (in big-bags on wooden pallets) at ambient temperature, together with alkaline soap and other chemicals. The location of the establishment is shown on a map attached to the Original Report.

Appendix Short Report / description of suspected causes:

INITIATING EVENT AND CONSEQUENCES:

The initiating event is not fully known. A smell in the warehouse was felt for some time prior to the accident. FAS decomposed to Sulphur dioxide escaping the building. The solide residue flowed out of the building.

CAUSES:

The likely cause was storage mistakes, which caused chemical reactions between the stored chemicals. These reactions were exothermic and initiated the fast decomposition of FAS. The exothermic reactions took probably place between the bags of FAS and the bags of alkaline soap. Alkaline dust from sodium carbonate, which was sprinkled on the floor to give a driving support for trucks, may also have been involved in the reaction, and condensed water may have been accelerated the reactions. The storage of FAS in two layers may have accelerated the rate of decomposition, as it reduced the heat transfer from the bags.

Appendix Short Report / description of immediate effects:

EFFECTS ON PEOPLE:

12 people inside and 19 outside the establishment were injured by the release of sulphur dioxide. All of them were hospitalized.

MATERIAL LOSS:

No material losses occurred except the decomposed product (about 22.7 tonnes of FAS) and other chemicals that were damaged. The cost of the lost products has been evaluated in about 1 million DKR (about 0.12 MECU).

ECOLOGICAL HARM:

Sulphur dioxide was released from Maglemoelle Papirfabrik into the neighbourhood, a part of the town Naestved. The residue (melted FAS, sulphur, urea and other decomposition products) flowed into the harbour. The local environmental authority observed the harbour on the day of the accident and two days later. As the water in the harbour was rapidly diluted via the channel, no disturbances in acquatic life was observed.

MAP OF THE ACCIDENT AREA AND MAX. DENSITY OF POPULATION:

On a map attached to the Original Report is shown the area which was alarmed by the police.

Appendix Short Report / description of emergency measures taken:

INTERNAL TO THE ESTABLISHMENT:

The fire brigade (14 people) assisted by the civil defense (16 people) stopped the decomposition of FAS by overflowing the product with plenty of water. The residue of the FAS decomposition flowed into the harbour.

EXTERNAL TO THE ESTABLISHMENT:

The area involved by the sulphur dioxide cloud was alarmed by the police. The local environmental authority observed the harbour on the day of the accident and two days later. As the water in the harbour was rapidly diluted via the channel, no disturbances in acquatic life were observed.

Appendix Short Report / description of immediate lessons learned:

MEASURES TO PREVENT ANY RECURRENCE OF SIMILAR ACCIDENTS:

After the accident, the conditions for FAS storage have been changed and the following measures were established:

1- improvement of the quality of the big-bags used for FAS (watertight and stronger, in such a way to reduce the possibility of damages during transport);

2- separate clean storage room for FAS;

3- storage of FAS in one layer only and separation of bags to ensure good heat transfer.

MEASURES TO MITIGATE THE EFFECTS OF THE ACCIDENT:

After the accident, it was established to install a redundant monitoring system (operating in continuous) for sulphur dioxide concentrations connected to an alarm system in Maglemoelle Papirfabrik and Naestved Fire Brigade and to a sprinkler system.

Appendix Full Report A / type of accident:

About 22.7 tonnes of formamidine sulfinic acid (FAS) decomposed almost istantaneously producing a thick white fog of sulphur dioxide and a solid residue (code 1999). The sulphur dioxide cloud (code 1101) dispersed in the atmosphere. The residue (melted FAS, sulphur, urea and other decomposition products) flowed into the harbour (code 1105). As the water in the harbour was rapidly diluted via the channel, no disturbances of acquatic life were observed.

Appendix Full Report A / dangerous substances:

The inventories of formamidine sulfinic acid (FAS) involved in the accident refer to the whole amount in the storage room. The total establishment and the potential directly involved inventories of sulphur dioxide refer to the maximum amount obtaining by the decomposition of 22.7 tonnes of FAS. No data are available about the amounts involved of the other decomposition products of FAS (urea, sulphur, melted FAS, ecc.)

Appendix Full Report A / source of accident - remarks:

The accident occurred in a storage room (code 3201) of a paper industry (code 2018). In that room formamidine sulfinic acid (FAS) was stored (in big-bags on wooden pallets) at ambient temperature, together with alkaline soap and other chemicals (code 4003). The location of the establishment is shown on a map attached to the Original Report.

Appendix Full Report A / causes of major occurrence:

The likely cause for the FAS decomposition (code 5107) was storage mistakes (codes 5303, 5304 and 5401), which caused chemical reactions between the stored chemicals. The exothermic reactions took probaly place between the bags of FAS and the bags of alkaline soap. Alkaline dust from sodium carbonate, which was sprinkled on the floor to give a driving support for trucks may also have been involved. The storage of FAS in two layers may have accelerated the rate of decomposition.

Appendix Full Report B / area concerned - remarks:

The sulphur dioxide cloud escaped the storage room and was released from Maglemoelle Papirfabrik into the neighbourhood, a part of the town Naestved (12 people inside and 19 people outside the establishment were hospitalized). The residue of the decomposition (melted FAS, sulphur, urea and other products) flowed into the harbour. The area which was alarmed by the police is shown on a map attached to the Original Report.

Appendix Full Report B / people:

12 people inside and 19 outside the enstablishment were injured and hospitalized by the release of sulphur dioxide. The fire brigade (14 people) assisted by the civil defense (16 people) stopped the decomposition of FAS by overflowing the product with plenty of water.

Appendix Full Report B / ecological harm:

The residue of the decomposition of FAS (sulphur, urea, melted FAS and other decomposition products) was overflowed with plenty of water by the fire fire brigade assisted by the civil defense and flowed into the harbour. The local environmental authority observed the harbour on the day of the accident and two days later. As the water in the harbour was rapidly diluted via the channel, no disturbances in acquatic life were observed.

Appendix Full Report B / material loss:

No material losses occurred except the decomposed product (about 22.7 tonnes of FAS) and other chemicals that were damaged. The cost of the lost products has been evaluated in about 1 million DKR (about 0.12 MECU).

Appendix Full Report B / disruption of community life:

The sulphur dioxide cloud escaped from the storage room and was released from Maglemoelle Papirfabrik into the neighbourhood, a part of the town Naestved (19 people people outside the establishment were hospitalized). The residue of the FAS decomposition flowed into the harbour. The area which was alarmed by the police is shown on a map attached to the Original Report.

Appendix Full Report C / lesson learned - prevent:

After the accident, the conditions for FAS storage have been changed and the following measures were established:

1- improvement of the quality of the big-bags used for FAS (watertight and stronger, in such a way to reduce the possibility of damages during transport);

2- separate clean storage room for FAS;

3- storage of FAS in one layer only and separation of bags to ensure good heat transfer.

Appendix Full Report C / lesson learned - mitigate:

After the accident, it was established to install a redundant monitoring system (operating in continuous) for sulphur dioxide concentrations connected to an alarm system in Maglemoelle Papirfabrik and Naestved Fire Brigade and to a sprinkler system.