

Gasutsläpp och brand på en ammoniakfabrik.

871223 MARS 1987_06

Olyckan inträffade på en fabrik i den petrokemiska industrin för produktion av urea och ammoniak. En 24-tums rörledning brast till följd av materialtrötthet i en svetsfog. Gasen i rörledningen bestod av väte (43,5 vol-%), kväve (14,1 vol-%), metan (0,2 vol-%), koldioxid (12,3 vol-%) och vatten (29,3 vol-%). Ungefär 60 kg vätgas antändes och orsakade en explosion som hördes 2,5 km bort. Gasledningen slets upp och förvreds kraftigt på båda sidor om brottstället. Ett 12 meter långt rörstycke strax uppströms vreds runt så kraftigt att mynningen roterades mer än ett varv. Samtidigt slog rörstycket sönder ett angränsande kärl vilket ledde till ett metanutsläpp. Vätgasen som strömmade ur röret uppströms antändes och brann med en 70 m lång jetflamma. Metangasen antändes även den och brann med en jetflamma. En operatör som hörde explosionen och såg att instrumentpanelen indikerade en större läcka stängde omedelbart av gasflödet. Inom 5 minuter var branden släckt. Företagets interna katastrofplan sattes i aktion. Räddningstjänsten anropades av en oroad person utanför fabriken.

Inblandade ämnen och mängder

	CAS Nr.	Mängd
väte	1333-74-0	280 kg
metan	74-82-8	600 kg
ammoniak	7664-41-7	10 kg
kväve	7727-37-9	okänt
koldioxid	124-38-9	okänt
vatten	7732-18-5	okänt

Skador:

Människor:	Inga.
Materiella:	Begränsade skador på anläggningen. Några fönster krossades i närheten av olycksplatsen, somliga utanför fabriksområdet.
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: 1987_006_01

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

Date of Major Occurrence: Time of Major Occurrence

start: 1987-12-23 start: 12:00:00

finish: finish:

Establishment:

name:

address:

industry: 2002 petrochemical, refining, processing

Petrochemical (Ammonia/Urea production)

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: 1987_006_01

Accident Types:

release: Yes explosion: Yes

water contamination: No other: No

fire: Yes

description:

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

Substance(s) Directly Involved:

toxic: Yes explosive: Yes

ecotoxic: No other: No

flammable: Yes

description:

- Hydrogen (C.A.S. CODE: 1333-74-0, E.E.C. CODE: 001-001-00-9): amount involved = 280 Kg (60 Kg initially

exploded, the remaining 220 Kg burned as a jet-fire).... see Appendix Short Report / description of substances

involved

Immediate Sources of Accident:

storage: No transfer: No

process: Yes other: No

description:

The accident occurred in a petrochemical industry for the Ammonia/Urea production. The failure occurred in a

24" stainless steel piping carrying synthesis gas from the CO shift converter to the carbon dioxide absorber

of the ammonia syntheses... see Appendix Short Report / description of immediate sources

Suspected Causes:

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

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

other: No

ecological harm: No

national heritage loss: No

description:

MATERIAL LOSS:... 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:

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

Immediate Lessons Learned:

prevention: Yes **other:** No

mitigation: No

description:

The plant had to be modified so that the water injection system will be replaced by a reboiler system. This will eliminate the probable cause of the pipeline rupture (i.e. the presence of water droplets within a much hotter gas stream in th... see Appendix Short Report / description of immediate lessons learned

A Occurrence Full Report

country: FA **ident key:** 1987_006_01

1 Type of Accident

remarks: The rupture of a 24" pipe resulted in the release (code 1101) and ignition of a hydrogen vapour cloud (code 1307). The hydrogen released subsequently burned as a jet-fire about 70 m long (code 1203). The rupture caused further damages to ad... see Appendix Full Report A / type of accident

2 Dangerous Substances

remarks: The total establishment inventory of hydrogen refers to the amount involved

in the explosion of the unconfined vapour cloud (about 60 Kg) and in the following jet-fire (about 220 Kg). The total establishment inventory of methane refers to ... see Appendix Full Report A / dangerous substances

3 Source of Accident

illustration: - not applicable -

remarks: The accident occurred in a petrochemical industry (code 2002) for the Ammonia/Urea production. The failure occurred in a 24" stainless steel piping (codes 3301 and 4011) carrying synthesis gas from the CO shift converter to the carbon diox... 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 5102 operation: component/machinery failure/malfunction

5104 operation: corrosion/fatigue

- not applicable -

- not applicable -

- not applicable -

human / organizational 5302 organization: management attitude problem

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

5313 organization: maintenance/repair (none, inadequate, inappropriate)

- not applicable -

- not applicable -

remarks: The accident occurred due to the rupture of a 24" pipe (code 5102) caused by a cyclic fatigue corrosion (code 5104). The cyclic fatigue corrosion was induced by thermal cycling. The underlying causes that led to the corrosion of the pipe we... see Appendix Full Report A / causes of major occurrence

6 Discussion about the Occurrence

- not applicable -

Type of Accident country: FA ident key: 1987_006_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 - not applicable -

Dangerous substances

country: FA **ident key:** 1987_006_01

a) total establishment inventory

CAS number: 7732-18-5 **identity:** Water

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: Yes

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

a) total establishment inventory

CAS number: 7727-37-9 **identity:** Nitrogen

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

a) total establishment inventory

CAS number: 74-82-8 **identity:** Methane

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): 0,6

use of substance as: NORMAL FINISHED PRODUCT

b) substance belongs to relevant inventory directly involved: No

actual quantity: -1 potential quantity: -1

c) substance belongs to relevant inventory indirectly involved: Yes

actual quantity: 0,6 indir_pot_quant: 0,6

a) total establishment inventory

CAS number: 1333-74-0 identity: Hydrogen

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): 0,28

use of substance as: STARTING MATERIAL

b) substance belongs to relevant inventory directly involved: Yes

actual quantity: 0,06 potential quantity: 0,06

c) substance belongs to relevant inventory indirectly involved: Yes

actual quantity: 0,22 indir_pot_quant: 0,22

a) total establishment inventory

CAS number: 124-38-9 identity: Carbon 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: 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

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): 0,01

use of substance as: NORMAL FINISHED PRODUCT

b) substance belongs to relevant inventory directly involved: No

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

c) substance belongs to relevant inventory indirectly involved: Yes

actual quantity: 0,01 **indir_pot_quant:** 0,01

Source of Accident - Situation country: FA ident key: 1987_006_01

situation

industry

initiating event 2002 petrochemical, refining, processing

associated event 2002 petrochemical, refining, processing

activity/unit

major occurrence 3301 transfer: pipeline/pipework transfer

initiating event 3301 transfer: pipeline/pipework transfer

associated event 3301 transfer: pipeline/pipework transfer

component

major occurrence 4011 general pipework/flanges

initiating event 4011 general pipework/flanges

associated event 4011 general pipework/flanges

B Consequences Full Report

country: FA ident key: 1987_006_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 explosion damaged the pipes on an adjacent pipe-rack and a heat exchanger. I... see Appendix

Full Report B / area concerned - remarks

2 People

establishment popul. emergency personnel off-site population

total at risk 41

immediate fatalities

subsequent fatalities

hospitalizing injuries

other serious injuries

health monitoring

remarks As no one was in the vicinity of the pipeline when the explosion occurred, no on... 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 Irish Pounds ECU Irish Pounds

material losses 100000

response, clean up, restoration

remarks The explosion damaged the pipes on an adjacent pipe-rack and a heat exchanger. I... 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 In the Original Report there is no evidence of significant overpressures outside... see Appendix

7 Discussion of Consequences

C Response Full Report

country: FA **ident key:** 1987_006_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 plant had to be modified s... see Appendix Full Report C / lesson learned - prevent

measures to mitigate consequences:

- not applicable -

useful references:

- not applicable -

5 Discussion about Response

- not applicable -

Appendices for the FA / 1987_006_01 report

Appendix Short Report / description of accident types:

SAFETY SYSTEMS OR OPERATORS INTERVENTION:

Operator in control room activated emergency procedures including fire alarm and emergency shut-down of the plant.

OTHER SYSTEMS INVOLVED AND OPERATING CONDITIONS:

Damages to pipes on adjacent pipe-rack resulting in the release of methane and of a small amount of ammonia vapours.

ACCIDENT CASE HISTORY DESCRIPTION:

A 24" pipe carrying synthesis gas (Hydrogen = 43.5%, Nitrogen = 14.08%, Methane = 0.2%, Carbon Dioxide = 12.3%, Water = 29.3% by volume) ruptured. About 60 Kg of hydrogen contained in the gas initially released formed an unconfined vapour cloud and exploded. The explosion was audible up to 2.5 Km from the factory and it caused considerable alarm to the residents. Lengths of pipe on either sides of the rupture were displaced as a result of the depressurization. An 8 m length pipe downstream rotated upon itself of about 380° while a 12 m length pipe upstream rotated of about 90°. This 12 m section damaged the pipes on an adjacent pipe-rack rupturing the vent header from the desulphurizer unit and causing the release of approximately 600 Kg of methane. The hydrogen released from the upstream section of the 24" pipe subsequently burned as a jet-fire about 70 m long. The released methane initially burned as a cloud (60 m long) and then as a jet-fire from the ruptured vent header. On hearing the explosion and by the indications from the plant instrumentation of a major leak, the plant operator shut-off the supply of natural gas to the plant and shut-down the individual units. After about 5 minutes the fire extinguished. A small amount of ammonia vapours which had been released from a fitting on a vapour return line (damaged by the 12 m section pipe) dispersed harmlessly.

Appendix Short Report / description of substances involved:

- Hydrogen (C.A.S. CODE: 1333-74-0, E.E.C. CODE: 001-001-00-9): amount involved = 280 Kg (60 Kg initially exploded, the remaining 220 Kg burned as a jet-fire).

- Methane (C.A.S. CODE: 74-82-8, E.E.C. CODE: 601-001-00-4): amount involved = 600 Kg.

- Ammonia (C.A.S. CODE: 7664-41-7, E.E.C. CODE: 007-001-00-5): amount involved = 10 Kg.
- Nitrogen (C.A.S. CODE: 7727-37-9): amount involved = not known.
- Carbon Dioxide (C.A.S. CODE: 124-38-9): amount involved = not known.
- Water (C.A.S. CODE: 7732-18-5): amount involved = not known.

Appendix Short Report / description of immediate sources:

The accident occurred in a petrochemical industry for the Ammonia/Urea production. The failure occurred in a 24" stainless steel piping carrying synthesis gas from the CO shift converter to the carbon dioxide absorber of the ammonia synthesis unit where water was injected into the synthesis gas to cool it from 230 °C to 179 °C at 28 bar.

Appendix Short Report / description of suspected causes:

INITIATING EVENT AND CONSEQUENCES:

The rupture of a 24" pipe resulted in the release and ignition of a hydrogen vapour cloud. The ruptured pipe caused further damages resulting in release and ignition of methane and in the release of a small amount of ammonia that dispersed harmlessly.

CAUSES:

Metallurgical examination of the 24" pipe showed that a fatigue failure occurred, induced by thermal cycling. Examination of the fracture faces of the ruptured seam weld showed a significant amount of fatigue cracking initiating at the bore of the pipe along a length of about 3 metres of the weld downstream the water injection point. At the upstream end, the rupture propagated circumferentially around the pipe as a shear failure. At the other end, the rupture arrested at a circumferential weld and then propagated as a circumferential tear in the pipe material. The spray pattern from the nozzle was such that water at 80 °C was intermittently hitting the inner surface of the pipe and quickly cooling the surface. The process gas stream at a temperature of 230 °C quickly heated up the pipe wall again only for it to be quickly cooled by water impingement at the start of the next cycle. This phenomenon which affected a number of areas in the pipe wall downstream of the water injection nozzle caused a number of small fatigue cracks which ultimately developed so that the material near the longitudinal weld failed. Subsequent examination of the spray nozzle showed that this may have been distorted for some time prior to the accident causing preferential impingement possibly enhancing the failure mechanism although it is not concluded that this distortion was the main cause of the failure. There was a two year history of previous leaks in welds further downstream on this section of pipe which it is now recognized were due to the same cause. At the time the company wrongly diagnosed the cause as external stress corrosion cracking.

Appendix Short Report / description of immediate effects:

MATERIAL LOSS:

The explosion damaged the pipes on an adjacent pipe-rack and a heat exchanger. It also caused the glasses breakage and superficial damages to the buildings. Outside the establishment the explosion caused the breakage of a small amount of windows and damaged the roof tiles on one house. The cost of these damages has been estimated in about 100,000 Irish Pounds (about 0.65 MECU).

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

The effects of the explosion are shown on a map attached to the Original Report. There were no off-site significant overpressures. At the nearest residence at a distance of 200 metres a small amount of glass breakage occurred (the overpressure was estimated to be about 2 kPa). 193 people lived within a 0.5 Km radius from the plant.

Appendix Short Report / description of emergency measures taken:

INTERNAL TO THE ESTABLISHMENT:

The fire alarm was activated and the Company's on-site emergency procedures were put into operation. The supply of natural gas to the plant was cut off and the plant shut-down sequentially. Subsequently, the whole ammonia plant was depressurized and routine decommissioning procedures were activated.

EXTERNAL TO THE ESTABLISHMENT:

The external emergency services were not called by the Company but they were activated by an alarmed resident in the area. The accident was over before the off-site services arrived on the scene.

Appendix Short Report / description of immediate lessons learned:

The plant had to be modified so that the water injection system will be replaced by a reboiler system. This will eliminate the probable cause of the pipeline rupture (i.e. the presence of water droplets within a much hotter gas stream in the pipe). Parts of the plant where a similar phenomenon was possible (high-pressure steam desuperheaters used during start-up only) were examined, but no defects were detected. When the Original Report was prepared, the Company was undertaking an assessment of its preventive maintenance procedures and expertise.

Appendix Full Report A / type of accident:

The rupture of a 24" pipe resulted in the release (code 1101) and ignition of a hydrogen vapour cloud (code 1307). The hydrogen released subsequently burned as a jet-fire about 70 m long (code 1203). The rupture caused further damages to adjacent piping causing the release of methane from a ruptured vent header, that initially burned as a flash-fire (code 1204) and then as a jet-fire (code 1203), and of a small amount of ammonia (code 1101) that dispersed harmlessly.

Appendix Full Report A / dangerous substances:

The total establishment inventory of hydrogen refers to the amount involved in the explosion of the unconfined vapour cloud (about 60 Kg) and in the following jet-fire (about 220 Kg). The total establishment inventory of methane refers to the amounts involved in the flash-fire and in the following jet-fire. No data are available about the amount of carbon dioxide, nitrogen and water involved in the accident.

Appendix Full Report A / source of accident - remarks:

The accident occurred in a petrochemical industry (code 2002) for the Ammonia/Urea production. The failure occurred in a 24" stainless steel piping (codes 3301 and 4011) carrying synthesis gas from the CO shift converter to the carbon dioxide absorber of the ammonia synthesis unit. The location on the establishment is shown on a map attached to the Original Report. 193 people lived within a 0.5 Km radius from the plant.

Appendix Full Report A / causes of major occurrence:

The accident occurred due to the rupture of a 24" pipe (code 5102) caused by a cyclic fatigue corrosion (code 5104). The cyclic fatigue corrosion was induced by thermal cycling. The underlying causes that led to the corrosion of the pipe were: a plant design inadequate (code 5308), insufficient maintenance procedures (code 5313) and an inadequate management attitude problem (5302) because it failed to clarify the causes of previous accidents.

Appendix Full Report B / area concerned - remarks:

The explosion damaged the pipes on an adjacent pipe-rack and a heat exchanger. It also caused the glasses breakage and superficial damages to the buildings. Outside the establishment, the explosion caused the breakage of a small amount of windows and damaged the roof tiles of one house. The extent of the effects of the explosion is shown on a map attached to the Original Report.

Appendix Full Report B / people:

As no one was in the vicinity of the pipeline when the explosion occurred, no one was injured.

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 damaged the pipes on an adjacent pipe-rack and a heat exchanger. It also caused the glasses breakage and superficial damages to the buildings. Outside the plant, the explosion caused the breakage of a small amount of windows and damaged the roof tiles on one house. The cost of these material losses has been evaluated in about 100,000 Irish Pounds (about 0.65 MECU).

Appendix Full Report B / disruption of community life:

In the Original Report there is no evidence of significant overpressures outside the establishment (at the nearest residence, at a distance of about 200 metres, there was a small amount of glasses breakage and it was estimated that the overpressure would have been 2 kPa) but, in any case, the explosion was audible up to 2.5 Km from the factory and it caused considerable alarm to the local residents.

Appendix Full Report C / lesson learned - prevent:

The plant had to be modified so that the water injection system will be replaced by a reboiler system. This will eliminate the probable cause of the pipeline rupture (i.e. the presence of water droplets within a much hotter gas stream in the pipe). Parts of the plant where a similar phenomenon was possible (high-pressure steam desuperheaters used during start-up only) were examined, but no were detected. When the Original Report was prepared, the company was undertaken an assessment of its preventive maintenance procedures and expertise.