



----ENEMALTA DPS IPPC APPLICATION - FORM C----

APPENDIX E – Enemalta Safety Report - Part 2

0466 – Enemalta DPS IPPC Application

***Enemalta plc.
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<i>Date of Version Issue</i>	<i>11/10/16</i>
<i>Report Version number</i>	<i>Rev 01</i>

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APPENDICES REFERENCE

Reference	Document Title
Appendix A	Reference Drawings
Appendix B	Best-Available-Techniques Conclusions
Appendix C	Material Safety Data Sheets
Appendix D	Maintenance of Tank Bunds
Appendix E	Enemalta Safety Report
Appendix F	Enemalta Safety Management System
Appendix G	Enemalta Emergency Response Plan
Appendix H	Coordinated Safety Report
Appendix I	Coordinated Safety Management System
Appendix J	Coordinated Emergency Response Plan
Appendix K	Sewer Discharge Permit
Appendix L	VOC Abatement System Report
Appendix M	Enemalta DPS - Noise Monitoring Method Statement
Appendix N	DPS Noise Monitoring Reports 2014 & 2015
Appendix O	NEC Emissions Calculations Letter
Appendix P	Technically Competent Person - CV
Appendix Q	Decommissioning Plan

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ANNEXURES

ANNEX 1. MSDS

MATERIAL SAFETY DATA SHEET

READ AND UNDERSTAND MATERIAL SAFETY DATA SHEET BEFORE
HANDLING OR DISPOSING OF PRODUCT

29371 GASOIL, DIESEL AND HEATING

1. PRODUCT AND COMPANY NAME

PRODUCT CODE AND NAME

29371 GASOIL, DIESEL AND HEATING

DESCRIPTION

Gas Oils

COMPANY

Consols Oils
Plots 3 – 6 United Road
St Day
REDRUTH
Cornwall
TR16 5HY
Tel : 01209 820274
Fax : 01209 820919
Emergency Phone Number : 07720455322

2. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Name</u>	<u>% Wt</u>	<u>CAS No.</u>	<u>EC No.</u>
Fuels, diesel	95 - 99,99	68334-30-5	269-822-7
Xn R 40 Limited evidence of a carcinogenic effect.			
Xn R 65 Harmful: may cause lung damage if swallowed.			
R 66 Repeated exposure may cause skin dryness or cracking			
N R 51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.			

Product contains small amounts of additives.

3. HAZARDS IDENTIFICATION

Product classification

CARCINOGENIC CATEGORY 3
HARMFUL
DANGEROUS FOR THE ENVIRONMENT

Acute effects of exposure to man

Inhalation

Vapours or mist may cause irritation of the nose and throat, headache, nausea, vomiting, dizziness, drowsiness, euphoria, loss of coordination, and disorientation. In poorly ventilated areas or confined spaces, unconsciousness and asphyxiation may result.

Inhalation of vapours or mist may result in the absorption of potentially harmful amounts of material.

Skin contact

Brief contact may cause slight irritation. Prolonged contact, as with clothing wetted with material, may cause more severe irritation and discomfort, seen as local redness and swelling.

Believed not to be a skin sensitiser.

Eye contact

May cause irritation, experienced as mild discomfort and seen as slight excess redness of the eye.

Ingestion

If more than several mouthfuls are swallowed, abdominal discomfort, nausea and diarrhoea may occur.

Aspiration may occur during swallowing or vomiting, resulting in lung damage.

Chronic effects of exposure to man

Medical conditions aggravated by exposure

Because of its irritating properties, repeated skin contact may aggravate an existing dermatitis (skin condition).

Other remarks	Possible risk of irreversible effects.
Effects of exposure to the environment	Some short-term toxicity to aquatic and marine organisms.
4. FIRST AID MEASURES	
Route of exposure	
Inhalation	Remove to fresh air. If not breathing.
Skin contact	Wash skin with plenty of soap and water
Eye contact	Immediately flush eyes with plenty of
Ingestion	Do not induce vomiting. Get medical
Other recommendations	Aspiration of this product during induced intubation. Remove and dry-clean or launder clothing with handling contaminated clothing.

with handling contaminated clothing.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media	Use water fog, dry powder, foam or carbon dioxide. Use water to cool fire-exposed containers. If a leak or spill has not ignited, use water fog to disperse the vapours and to provide protection for personnel attempting to stop the leak.
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Extinguishing media which must not be used for safety reasons	Water jet
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Special exposure hazards arising from the substance or preparation itself,

combustion products, resulting gases	Hydrogen sulphide (H ₂ S) may be released when heated.
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In case of fire - Always call the fire brigade. Small fires, such as those capable of being fought with a hand-held extinguisher, can normally be fought by a person who has received instruction on the hazards of flammable liquid fires. Fires that are

beyond that stage should only be tackled by people who have received hands-on training.

Ensure escape path is available.

Special protective equipment for firefighters	<p>The nature of special protective equipment required will depend upon the size of the fire, the degree of confinement of the fire and the natural ventilation available. Fire-resistant clothing and self-contained breathing apparatus is recommended for</p> <p>fires in confined spaces and poorly-ventilated areas. Full fire-proof clothing is recommended for any large fires involving this product.</p>
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6. ACCIDENTAL RELEASE MEASURES

Procedures in case of accidental release or leakage	Ventilate area. Avoid breathing vapour. Use self-contained breathing apparatus or supplied air mask for large spills or
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	<p>Wipe up or absorb on suitable material and shovel up. Prevent entry into sewers and</p> <p>waterways. Avoid contact with skin, eyes or clothing.</p>
7. HANDLING AND STORAGE	
Handling	<p>Local exhaust ventilation recommended if generating vapour, dust, or mist. If exhaust ventilation is not available or inadequate, use approved respirator as appropriate.</p> <p>This product may contain volatile hydrocarbons which may accumulate in the container headspace, thereby creating a flammable or explosive atmosphere.</p> <p>Hydrogen sulphide (H₂S) may be released when heated.</p>
Storage	<p>Transport, handle and store in accordance with applicable local regulations and only in labelled containers designed for this product. Ground and bond shipping container, transfer line, and receiving container. Keep away from sparks, flame and other sources of ignition. Protect containers against static electricity, lightning and physical damage. Hot work (eg cutting or welding) must not be carried out on or near any container used for storage of this product unless it has been made safe by purging or other suitable means.</p> <p>Empty product containers may contain product residue. Do not reuse empty containers without commercial cleaning or reconditioning.</p>
Specific use (s)	On road transportation and Heating
8. EXPOSURE CONTROLS/PERSONAL PROTECTION	
Respiratory protection	<p>Airborne concentrations should be kept to lowest levels possible. If vapour, mist or</p> <p>cleaning large spills or upon entry into tanks, vessels, or other confined spaces.</p>

	<p>cleaning large spills or upon entry into tanks, vessels, or other confined spaces.</p> <p>Oxygen levels should be at least 19.5 % in confined spaces or other work areas.</p>
Hand and skin protection	<p>Protective clothing such as Flame retardant uniforms, coveralls or lab coats should be worn. Launder or dry-clean when soiled. North Red PVC gloves (Ref. 725), Nitrile Rubber or Viton gloves and lace up safety boots with steel toecaps resistant to</p> <p>chemicals and petroleum distillates required.</p>
Eye protection	<p>Safety glasses, chemical type goggles or full face shield recommended to prevent eye contact.</p>
Exposure limit for the product	<p>None established for product.</p> <p>Hydrogen sulphide : ACGIH TLV-TWA 10 ppm STEL 15 ppm. UK : EH40 : OEL : TWA : 10 ppm ; STEL : 15 ppm</p>

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Clear liquid
Odour	Petroleum odour
Flash point (ASTM D93), °C	56 min
Relative density	0.82 - 0.86 @ 15°C
Viscosity	2 - 5 mm ² /s @ 40°C
Boiling point/range, °C	160 - 385

10. STABILITY AND REACTIVITY

Conditions to avoid	Sources of ignition such as flames, sparks, hot surfaces.
Materials to avoid	Avoid contact with strong oxidising agents.
Hazardous decomposition products	<p>Oxides of carbon, nitrogen and sulphur, aldehydes and ketones.</p> <p>Hydrogen sulphide (H₂S) may be released on heating and may accumulate in confined spaces.</p>

11. TOXICOLOGICAL INFORMATION

Acute

Inhalation	<p>Likely to be irritating to the respiratory tract if high concentrations of mists or vapour are inhaled.</p> <p>May cause nausea, dizziness, headaches and drowsiness if high concentrations of vapour are inhaled.</p> <p>May be toxic when hydrogen sulphide is present in the vapour.</p>
Skin contact	<p>Repeated exposure may cause skin dryness or cracking</p> <p>Believed not to be a skin sensitiser.</p>
Eye contact	<p>Slightly irritating to the eyes.</p>
Ingestion	<p>Unlikely to cause harm if accidentally swallowed in small doses, though larger quantities may cause nausea and diarrhoea. Will injure the lungs if aspiration occurs, eg. during vomiting.</p>
Chronic	<p>This product, or a component of this product, has caused skin cancer when repeatedly applied to the skin of laboratory animals without any effort to remove the material between applications.</p>

12. ECOLOGICAL INFORMATION

Mobility	<p>Spillages may penetrate the soil causing ground water contamination.</p>
Persistence and degradability	<p>According to EC criteria : Not readily biodegradable</p>
Potential to bioaccumulate	<p>This product is expected to bioaccumulate.</p>
Aquatic toxicity	<p>Some short-term toxicity to aquatic and marine organisms.</p>

WGK=2

13. DISPOSAL CONSIDERATIONS

Disposal	Dispose in a safe manner in accordance with local/national regulations.
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Disposal	Dispose in a safe manner in accordance with local/national regulations.
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EWC-No : 13 07 01

14. TRANSPORT INFORMATION

Sea transport	
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UN No	1202
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Proper shipping name	GAS OIL
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IMO, IMDG Class/Packing group	3 / III
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Marine pollutant	No
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EmS No	3-07
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Road/rail transport	
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UN No	1202
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Proper shipping name	GAS OIL
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ADR/RID Class/Packing group 3 / III

Hazard identification No	30
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CEFIC Tremcard No	30GF1-III
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UK Emergency action code	3Z
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environment

Inland waterways	
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ADNR Class	3 / III
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Air transport	
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UN No	1202
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Proper shipping name	GAS OIL
IATA/ICAO Class/Packing	3 / III

IATA/ICAO Class/Packing group	3 / III
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15. REGULATORY INFORMATION

Classification/ Labelling information	Under the criteria of Directive EEC/67/548 (dangerous substances)
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Classification/ Labelling information	Under the criteria of Directive EEC/67/548 (dangerous substances)
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and EEC/1999/45 (dangerous preparations) :

Symbol (letter notation) +
Indication of danger

Xn HARMFUL

N DANGEROUS FOR THE ENVIRONMENT

Risk phrases

Xn R 40 Limited evidence of a carcinogenic effect.

Xn R 65 Harmful: may cause lung damage if swallowed.

R 66 Repeated exposure may cause skin dryness or cracking

N R 51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety phrases

S 2 Keep out of the reach of children.

S 24 Avoid contact with skin.

S 36/37 Wear suitable protective clothing and gloves.

S 43 In case of fire, use CO₂, dry chemical or foam. Never use water.

S 61 Avoid release to the environment. Refer to special instructions/Safety data sheets.

S 62 If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.

Hazardous ingredients

Fuels, diesel

Additional information

Refer to any national measures that may be relevant.

16. OTHER INFORMATION

	<p>Hazardous concentrations of hydrogen sulphide (H₂S) gas can accumulate in storage and rundown tanks, marine vessel compartments, sump pits or other confined spaces. When opening valves, hatches and dome covers, stand upwind, keep face as far from the</p> <p>opening as possible and avoid breathing any gases or vapours. When exposure concentrations are unknown and respiratory protection is not used, personal H₂S warning devices should be worn. These devices should not be relied on to warn of life</p> <p>threatening concentrations. H₂S fatigues the sense of smell rapidly. The rotten egg odour of H₂S disappears quickly, even though high concentrations are still present. The ACGIH TLV/TWA for H₂S is 10 ppm, the STEL 15 ppm. UK : EH40 : OEL : TWA : 10</p> <p>ppm ; STEL : 15 ppm</p> <p>The company recommends that all exposures to this product be minimized by strictly adhering to recommended occupational control procedures to avoid any potential adverse health effects.</p>
Full text of risk phrases	<p>Xn R 40 Limited evidence of a carcinogenic effect.</p> <p>Xn R 65 Harmful: may cause lung damage if swallowed.</p> <p>R 66 Repeated exposure may cause skin dryness or cracking</p> <p>N R 51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.</p>
Changes were made in sections :	3, 5,7, 8,10, 11, 12, 13, 14, 15, 16
MSDS: 29371	
DATE ISSUED 20/5/2003	Supersedes 24/10/2002
<p>All information contained in this Material Safety Data Sheet and, in particular, the health and safety and environmental information is accurate to the best of our knowledge and belief as at the date of issue specified. However, the Company makes no warranty or representation, express or implied, as to the accuracy or completeness of such information.</p> <p>The provision of this Material Safety Data Sheet is not intended, of itself, to</p>	

obviate the need for all users to satisfy themselves that the product described is suitable for their individual purposes and that the safety precautions and environmental advice are adequate for their individual purposes and situation. Further, it is the user's obligation to use this product safely and to comply with all applicable laws and regulations concerning the use of the product.

The company accepts no responsibility for any injury, loss or damage, consequent upon any failure to follow the safety and other recommendations contained in this Material Safety Data Sheet, nor from any hazards inherent in the nature of the material, nor from any abnormal use of the material.

MATERIAL SAFETY DATA SHEET

According to EU Directive 93/112/EEC
READ AND UNDERSTAND MATERIAL SAFETY DATA SHEET
BEFORE HANDLING OR DISPOSING OF PRODUCT

32794 HEAVY FUEL OIL,> 420 MM²/S (AT 50C),D=0.991 max

1. PRODUCT AND COMPANY NAME

PRODUCT CODE AND NAME

32794 HEAVY FUEL OIL,> 420 MM²/S (AT 50C),D=0.991 max

DESCRIPTION

Heavy Fuel Oil

COMPANY

FUEL & MARINE MARKETING LLC

3336 Richmond Ave

Houston, TX 77098

U.S.A.

Tel : +1(713)752-3942

Fax : +1(713)752-3981

Emergency Phone Number : +44/(0)18 65 407 333

Medical Emergency Number : +1/(504)680-1900

2. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Name</u>	<u>% Wt</u>	<u>CAS No.</u>	<u>EC No.</u>
Heavy fuel oil	100	68476-33-5	270-675-6
T R 45	May cause cancer.		
R 52/53	Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.		

3. HAZARDS IDENTIFICATION

Warning statement

CONTAINS COMPONENTS WHICH MAY CAUSE CANCER IN MAN
HYDROGEN SULPHIDE MAY BE RELEASED WHEN HEATED
FLAMMABLE HEADSPACE VAPOURS MAY BE PRESENT
HARMFUL TO THE AQUATIC ENVIRONMENT

Acute effects of exposure to man

Inhalation

Contains or may release hydrogen sulphide (H₂S) gas. H₂S concentrations above permissible concentrations can cause headache, dizziness, nausea, vomiting, and diarrhoea. At concentrations above 300 ppm, respiratory paralysis, causing unconsciousness and death, can occur.

Skin contact

Prolonged or widespread skin contact may result in the absorption of potentially harmful amounts of material.
Brief contact may cause slight irritation. Prolonged contact, as with clothing wetted with material, may cause more severe irritation and discomfort, seen as local redness and swelling.
Believed not to be a skin sensitiser.

Eye contact

May cause irritation, experienced as mild discomfort and seen as slight excess redness of the eye.

32794 HEAVY FUEL OIL,> 420 MM²/S (AT 50C),D=0.991 max

<u>Ingestion</u>	If more than several mouthfuls are swallowed, abdominal discomfort, nausea and diarrhoea may occur.
<u>Chronic effects of exposure to man</u>	
<u>Medical conditions aggravated by exposure</u>	Because of its irritating properties, repeated skin contact may aggravate an existing dermatitis (skin condition).
<u>Other remarks</u>	This product, or a component of this product, has caused skin cancer when repeatedly applied to the skin of laboratory animals without any effort to remove the material between applications.
<u>Effects of exposure to the environment</u>	Some short-term toxicity to aquatic and marine organisms.

4. FIRST AID MEASURES

Route of exposure

Inhalation Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may administer oxygen. Get immediate medical attention. External cardiac massage may be instituted if the heart has stopped.

Skin contact Wash skin with plenty of soap and water until all traces of material are removed. Remove and clean contaminated clothing and shoes. Get medical attention if skin irritation persists or skin contact has been prolonged.

Eye contact Immediately flush eyes with plenty of water for at least 15 minutes. Hold eyelids apart while flushing to rinse entire surface of eye and lids with water. Get medical attention.

Ingestion The ingestion of large amounts of product is unlikely. Should it occur, give two glasses of water (500 ml) if patient is conscious and can swallow. Do not induce vomiting. Get immediate medical attention. Never give anything by mouth to an unconscious or convulsing person.

Other recommendations Remove and dry-clean or launder clothing soaked or soiled with this material before reuse. Dry cleaning of contaminated clothing may be more effective than normal laundering. Inform individuals responsible for cleaning of potential hazards associated with handling contaminated clothing.
The odour of hydrogen sulphide (H₂S) gas is offensive and similar to rotten eggs. H₂S gas deadens the sense of smell, even at low concentrations. DO NOT depend on odour to detect presence of gas.

32794 HEAVY FUEL OIL,> 420 MM²/S (AT 50C),D=0.991 max

Warning. Rescue of overexposed persons should be attempted only after notifying others of the emergency and only if appropriate personal protective equipment and positive pressure self-contained breathing apparatus (SCBA) is available.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

Use water fog, dry powder, foam or carbon dioxide. Use water to cool fire-exposed containers. If a leak or spill has not ignited, use water fog to disperse the vapours and to provide protection for personnel attempting to stop the leak.

Extinguishing media which must not be used for safety reasons

Water jet

Special exposure hazards arising from the substance or preparation itself, combustion products, resulting gases

Hydrogen sulphide (H₂S) may be released when heated.
In case of fire - Always call the fire brigade. Small fires, such as those capable of being fought with a hand-held extinguisher, can normally be fought by a person who has received instruction on the hazards of flammable liquid fires. Fires that are beyond that stage should only be tackled by people who have received hands-on training.
Ensure escape path is available.

Special protective equipment for firefighters

The nature of special protective equipment required will depend upon the size of the fire, the degree of confinement of the fire and the natural ventilation available. Fire-resistant clothing and self-contained breathing apparatus is recommended for fires in confined spaces and poorly-ventilated areas. Full fire-proof clothing is recommended for any large fires involving this product.

6. ACCIDENTAL RELEASE MEASURES

Procedures in case of accidental release or leakage

Ventilate area. Avoid breathing vapour. Use self-contained breathing apparatus or supplied air mask for large spills or confined areas. Contain spill if possible. Wipe up or absorb on suitable material and shovel up. Prevent entry into sewers and waterways. Avoid contact with skin, eyes or clothing.

7. HANDLING AND STORAGE

Handling

Local exhaust ventilation recommended if generating vapour, dust, or mist. If exhaust ventilation is not available or inadequate, use approved respirator as appropriate.
This product may contain volatile hydrocarbons which may accumulate in the container headspace, thereby creating a flammable or explosive atmosphere.
Hydrogen sulphide (H₂S) may be released when heated.

32794 HEAVY FUEL OIL,> 420 MM²/S (AT 50C),D=0.991 max

Storage

Transport, handle and store in accordance with applicable local regulations and only in labelled containers designed for this product. Ground and bond shipping container, transfer line and receiving container.

Keep away from heat, sparks, flame and other sources of ignition. Protect containers against static electricity, lightning and physical damage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Respiratory protection

Airborne concentrations should be kept to lowest levels possible. If vapour, mist or dust is generated, use approved respirator as appropriate. Supplied air respiratory protection should be used for cleaning large spills or upon entry into tanks, vessels, or other confined spaces.

Oxygen levels should be at least 19.5 % in confined spaces or other work areas.

Hand and skin protection

Protective clothing such as uniforms, coveralls or lab coats should be worn. Launder or dry-clean when soiled. Gloves and boots resistant to chemicals and petroleum distillates required.

Eye protection

Chemical type goggles or face shield recommended to prevent eye contact.

Exposure limit for the product

None established for product.

Hydrogen sulphide (H₂S) may be released on heating and may accumulate in confined spaces.

Hydrogen sulphide : ACGIH TLV-TWA 10 ppm STEL 15 ppm.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Dark brown liquid

Odour

Petroleum odour

Flash point, °C

60 min (PMCC)

Relative density

0.991 max @ 15 °C

Viscosity

> 420 mm²/s @ 50 °C

Boiling point/range, °C

160 - 600

10. STABILITY AND REACTIVITY

Conditions to avoid

Sources of ignition such as naked flames, sparks, hot surfaces.

Materials to avoid

Avoid contact with strong oxidising agents.

Hazardous decomposition products

Carbon monoxide, carbon dioxide, aldehydes and ketones.

Hydrogen sulphide (H₂S) may be released on heating and may accumulate in confined spaces.

32794 HEAVY FUEL OIL,_> 420 MM²/S (AT 50C),D=0.991 max

11. TOXICOLOGICAL INFORMATION

Acute

Inhalation

Likely to be irritating to the respiratory tract if high concentrations of mists or vapour are inhaled.

May cause nausea, dizziness, headaches and drowsiness if high concentrations of vapour are inhaled.

May be toxic when hydrogen sulphide is present in the vapour.

Skin contact

Slightly irritating to the skin.

Believed not to be a skin sensitiser.

Eye contact

Slightly irritating to the eyes.

Ingestion

Unlikely to cause harm if accidentally swallowed in small doses, though larger quantities may cause nausea and diarrhoea.

Chronic

This product, or a component of this product, has caused skin cancer when repeatedly applied to the skin of laboratory animals without any effort to remove the material between applications.

12. ECOLOGICAL INFORMATION

Mobility

Spillages may penetrate the soil causing ground water contamination.

Persistence and degradability

Believed to biodegrade slowly.

Potential to bioaccumulate

This product is expected to bioaccumulate.

Aquatic toxicity

Some short-term toxicity to aquatic and marine organisms.

Limited data available indicates aquatic toxicity in the range 10-100 mg/l.

Remarks

This product, due to its density, can either float, sink or form emulsions if spilled on to water depending on the environmental conditions.

13. DISPOSAL CONSIDERATIONS

Disposal

Dispose in a safe manner in accordance with local/national regulations.

Remarks

None

14. TRANSPORT INFORMATION

Sea transport

UN No

1268

Proper shipping name

PETROLEUM DISTILLATES, N.O.S. (contains hydrocarbons)

32794 HEAVY FUEL OIL,> 420 MM²/S (AT 50C),D=0.991 max

IMO, IMDG Class/Packing group	3.3 / III
Marine pollutant	No
EmS No	3-07
MFAG Table No	311

Road/rail transport

UN No	1268
Proper shipping name	PETROLEUM DISTILLATES, N.O.S. (contains hydrocarbons)
ADR/RID Class/Packing group	3,31(c) / III
Hazard identification No	30
CEPIC Tremcard No	30G35
UK Emergency action code	3Z
Pollutant to the aquatic environment	No

Inland waterways

ADNR Class	3,31(c)
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Air transport

UN No	1268
Proper shipping name	PETROLEUM DISTILLATES, N.O.S. (contains hydrocarbons)
IATA/ICAO Class/Packing group	3 / III

15. REGULATORY INFORMATION

Labelling information

Heavy fuel oil EC No. 270-675-6

Indication of danger

T TOXIC

Risk phrases

T R 45 May cause cancer.
R 52/53 Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety phrases

S 53 Avoid exposure - obtain special instructions before use.
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 61 Avoid release to the environment. Refer to special instructions/Safety data sheets.

32794 HEAVY FUEL OIL,_v> 420 MM²/S (AT 50C),D=0.991 max

Additional information

Refer to any national measures that may be relevant.

16. OTHER INFORMATION

Hazardous concentrations of hydrogen sulphide (H₂S) gas can accumulate in storage and rundown tanks, marine vessel compartments, sump pits or other confined spaces. When opening valves, hatches and dome covers, stand upwind, keep face as far from the opening as possible and avoid breathing any gases or vapours. When exposure concentrations are unknown and respiratory protection is not used, personal H₂S warning devices should be worn. These devices should not be relied on to warn of lifethreatening concentrations. H₂S fatigues the sense of smell rapidly. The rotten egg odour of H₂S disappears quickly, even though high concentrations are still present. The company recommends that all exposures to this product be minimized by strictly adhering to recommended occupational control procedures to avoid any potential adverse health effects. The ash from combustion products will contain nickel, vanadium and other potentially toxic heavy metal oxides. Take appropriate precautions to avoid contact with and inhalation of ash and ash dust from combustion and exhaust spaces.

All information contained in this Material Safety Data Sheet and, in particular, the health and safety and environmental information is accurate to the best of our knowledge and belief as at the date of issue specified. However, the Company makes no warranty or representation, express or implied, as to the accuracy or completeness of such information.

The provision of this Material Safety Data Sheet is not intended, of itself, to obviate the need for all users to satisfy themselves that the product described is suitable for their individual purposes and that the safety precautions and environmental advice are adequate for their individual purposes and situation. Further, it is the user's obligation to use this product safely and to comply with all applicable laws and regulations concerning the use of the product.

The company accepts no responsibility for any injury, loss or damage, consequent upon any failure to follow the safety and other recommendations contained in this Material Safety Data Sheet, nor from any hazards inherent in the nature of the material, nor from any abnormal use of the material.

Version nr : 0.05

ANNEX 2. DRAWINGS

NUMBER	DESCRIPTION	DRAWING SCALE
01	Area of concern	1 / 10,000
02	Land use	N / S
03	General Plot Plan	1 / 3,000
04	Plot Plan – North Area Detail	1/1,000
05	Plot Plan – East Area Detail	1/1,000
06	Plot Plan – South Area Detail	1/1,000
	Enemalta Block 4 FOT BUILDING (UEM), SERVICE T.F. (UEK) LAYOUT GROUND FLOOR PLAN	NTS
	Enemalta Block 4 FOT BUILDING (UEM), SERVICE T.F. (UEK) & UREA T.F. (UVJ) LAYOUT SECTIONS LOOKING NORTH	NTS
DPS/XZ/170	DPS HFO FUEL LINES	NTS
DPS/XZ/169	DPS HFO FUEL LINES	NTS
DPS/FD/0001	Diesel Fuel Oil Pipelines at Delimara Power Station	NTS
DPS/FC/37	Delimara Power Station Heavy Fuel Oil Piping Diagram	NTS
DPS/XZ/84	Delimara Power Station Pits & Interceptors	NTS
0466 IPPC 0050	Delimara Power Station Tie-In Points - EGM	1 / 500
0466 IPPC 0040	Delimara Power Station Tie-In Points - SEP	1 / 500
0466 IPPC 0051	Delimara Power Station Proposed Route for Interconnection Cables to EGM Facilities	1 / 500



✉ SGS Tecnos, S.A.
C/ Lluís, 95-97, 6ª planta
08005 Barcelona
Telf: +34 93 320 36 33

www.sgs.com/

CLIENT:

 **enemalta**
ENEMALTA PLC

PROJECT: SAFETY REPORT

DRAWING NAME: AREA OF CONCERN

DRAWING: 1

LOCATION: DELIMARA- MALTA

SCALE: DINA3: 1/10000

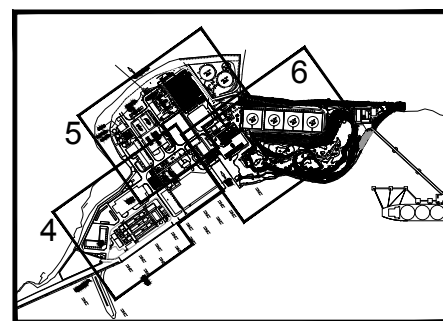
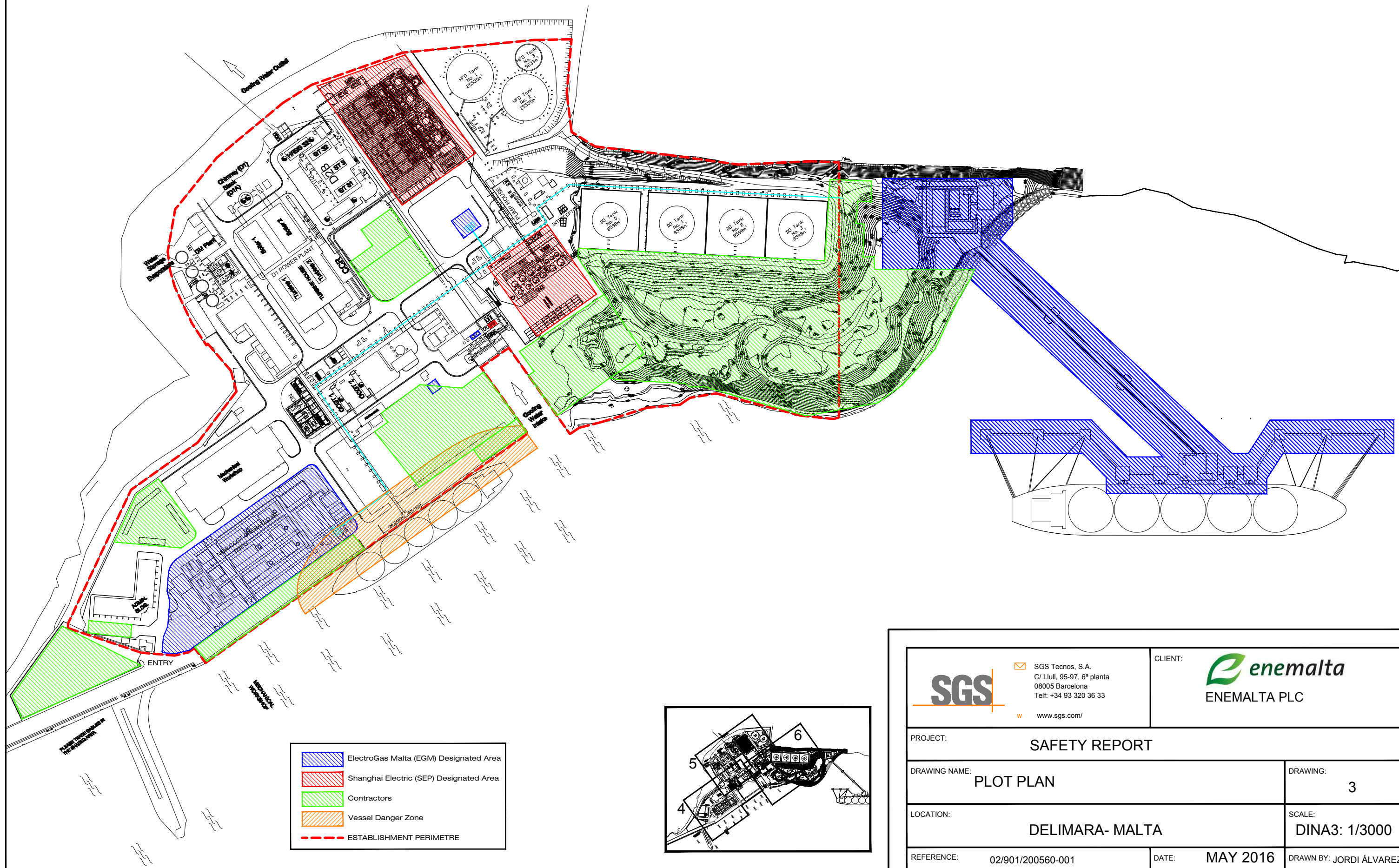
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DATE: MAY 2016

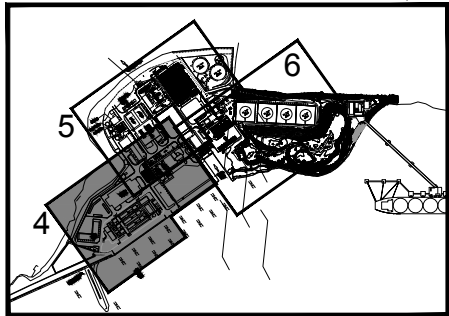
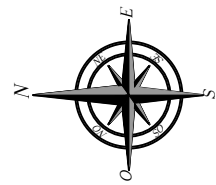
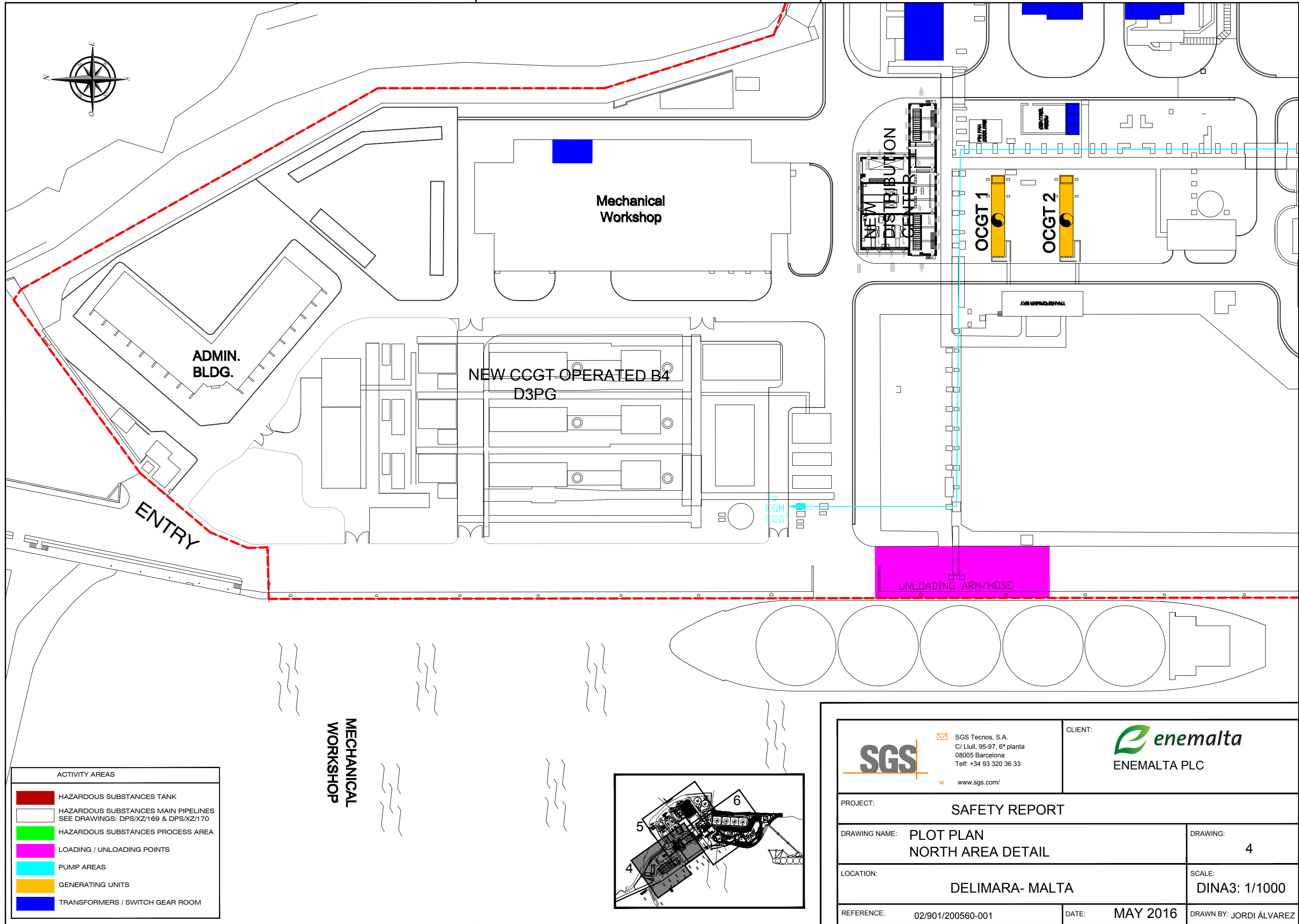
DRAWN BY: JORDI ÁLVAREZ



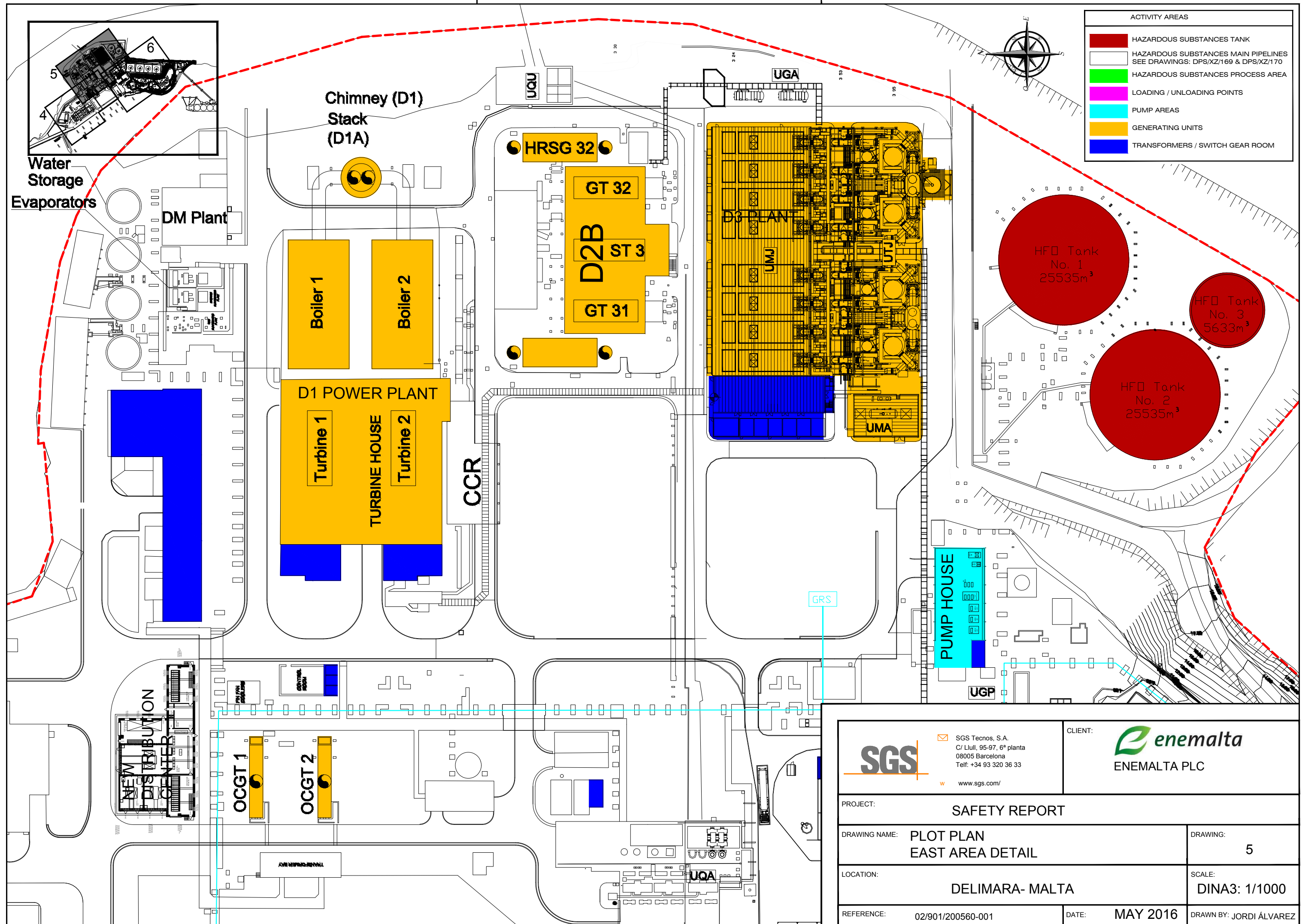
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PROJECT: SAFETY REPORT			
DRAWING NAME: LAND USE		DRAWING: 2	
LOCATION: DELIMARA- MALTA		SCALE: NOT SCALED	
REFERENCE: 02/901/200560-001-Rev.03	DATE: SEP 2016	DRAWN BY: JORDI ÁLVAREZ	

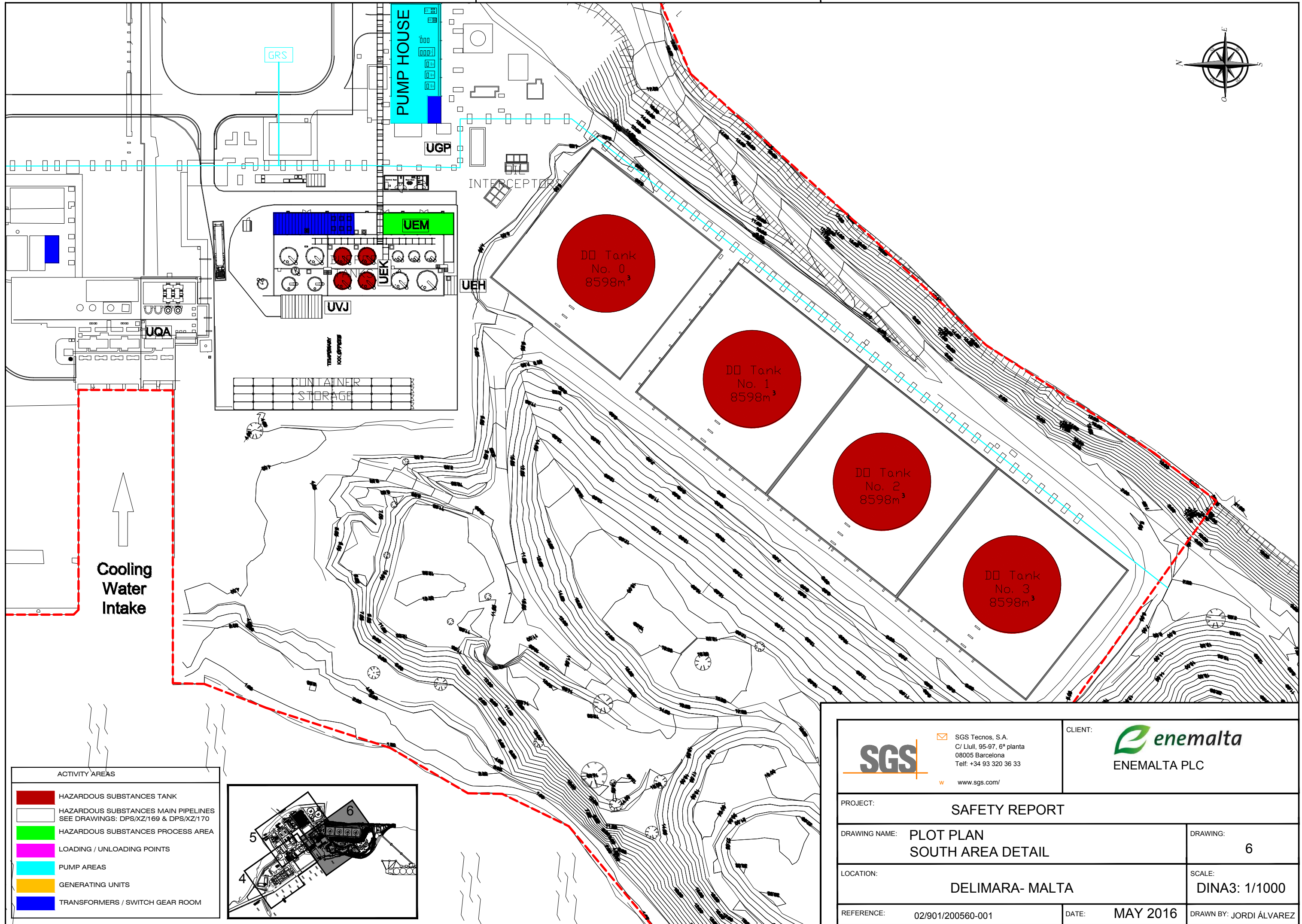


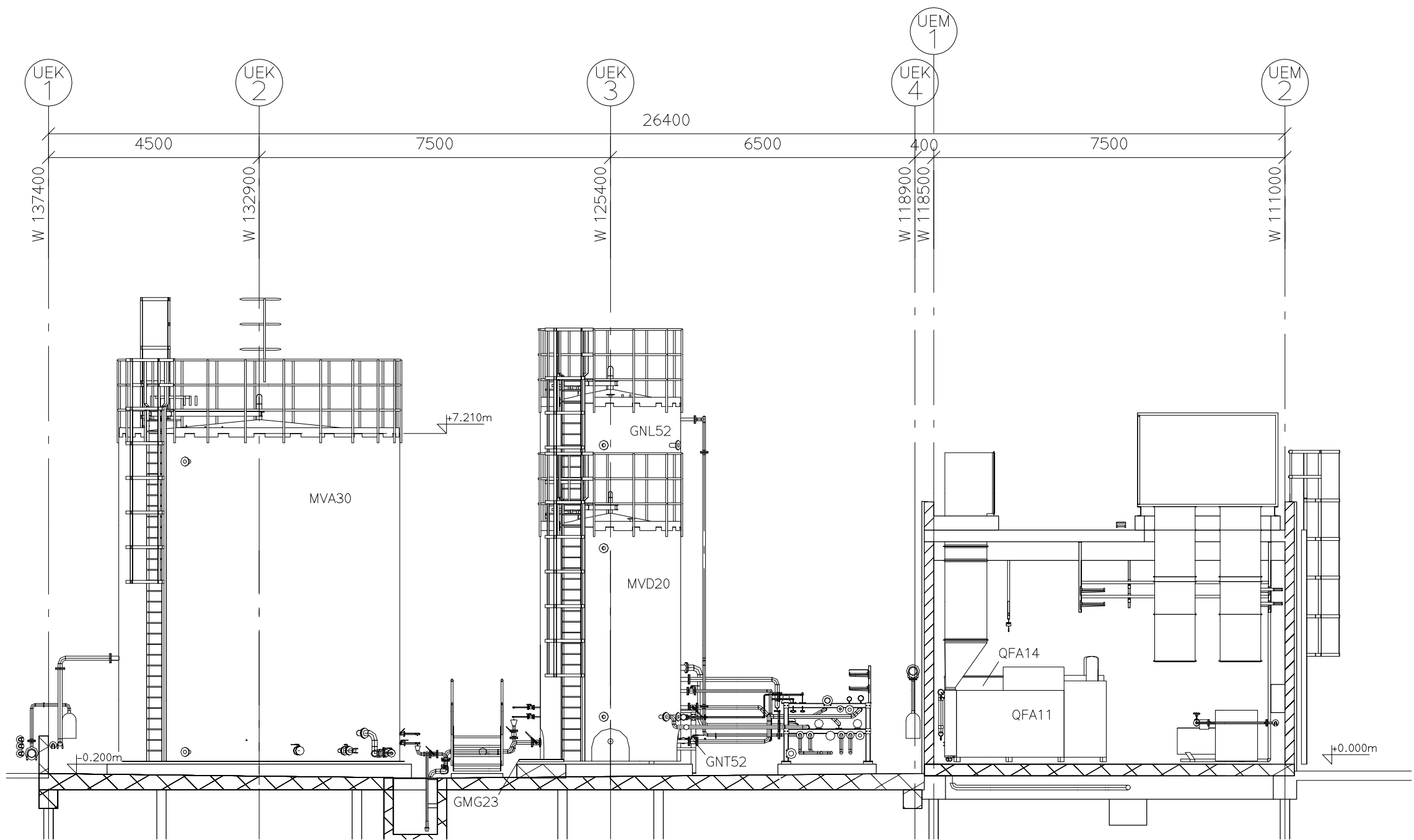
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<p>SGS Tecnos, S.A. C/ Llull, 95-97, 6ª planta 08005 Barcelona Telf: +34 93 320 36 33 www.sgs.com/</p>		<p>SGS</p>	
<p>PROJECT: SAFETY REPORT</p>			
<p>DRAWING NAME: PLOT PLAN</p>		<p>DRAWING: 3</p>	
<p>LOCATION: DELIMARA- MALTA</p>		<p>SCALE: DINA3: 1/3000</p>	
<p>REFERENCE: 02/901/200560-001</p>		<p>DATE: MAY 2016</p>	
<p>DRAWN BY: JORDI ÀLVAREZ</p>			



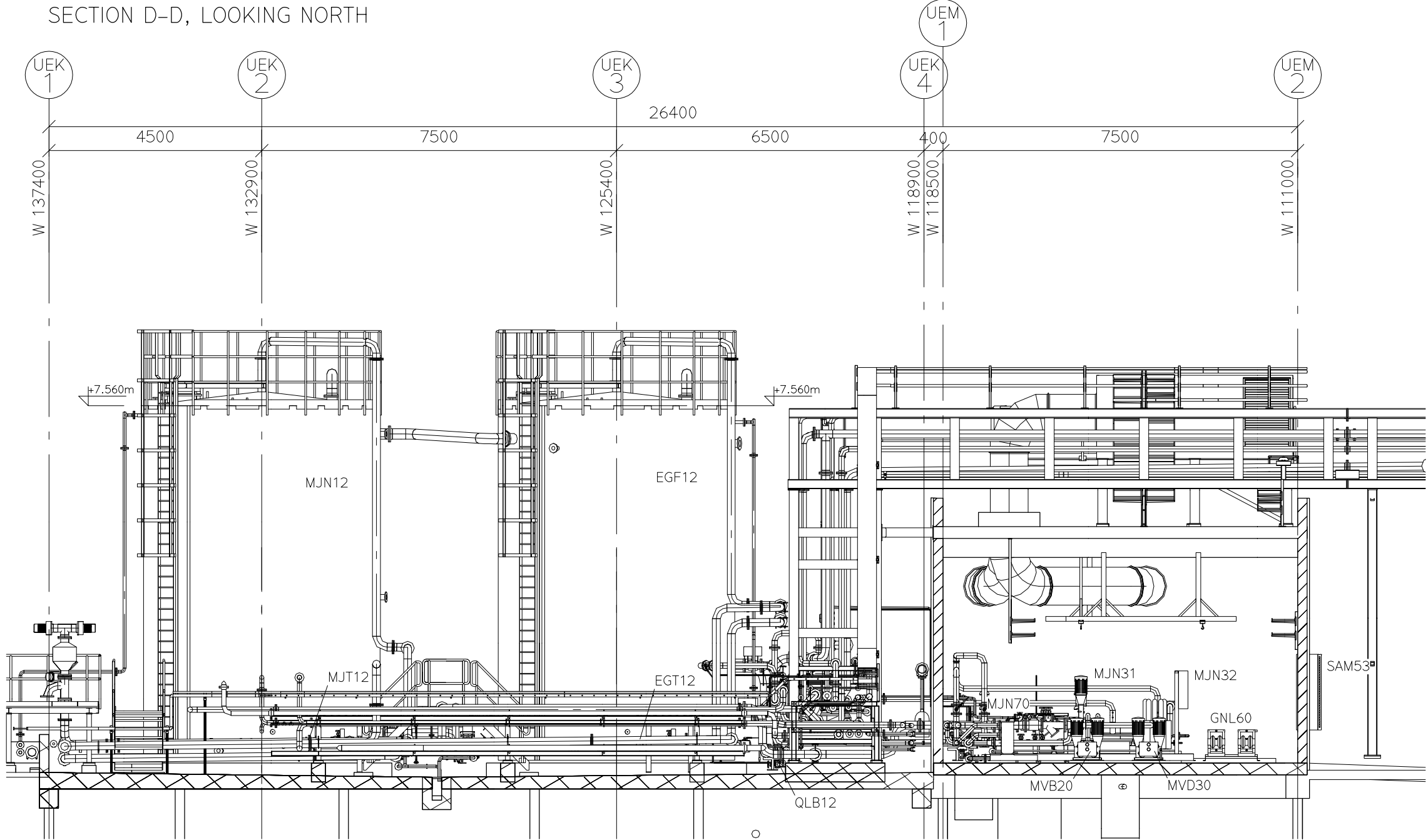
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PROJECT:		SAFETY REPORT	
DRAWING NAME: PLOT PLAN NORTH AREA DETAIL		DRAWING: 4	
LOCATION: DELIMARA- MALTA		SCALE: DINA3: 1/1000	
REFERENCE: 02/901/200560-001		DATE: MAY 2016	DRAWN BY: JORDI ÁLVAREZ



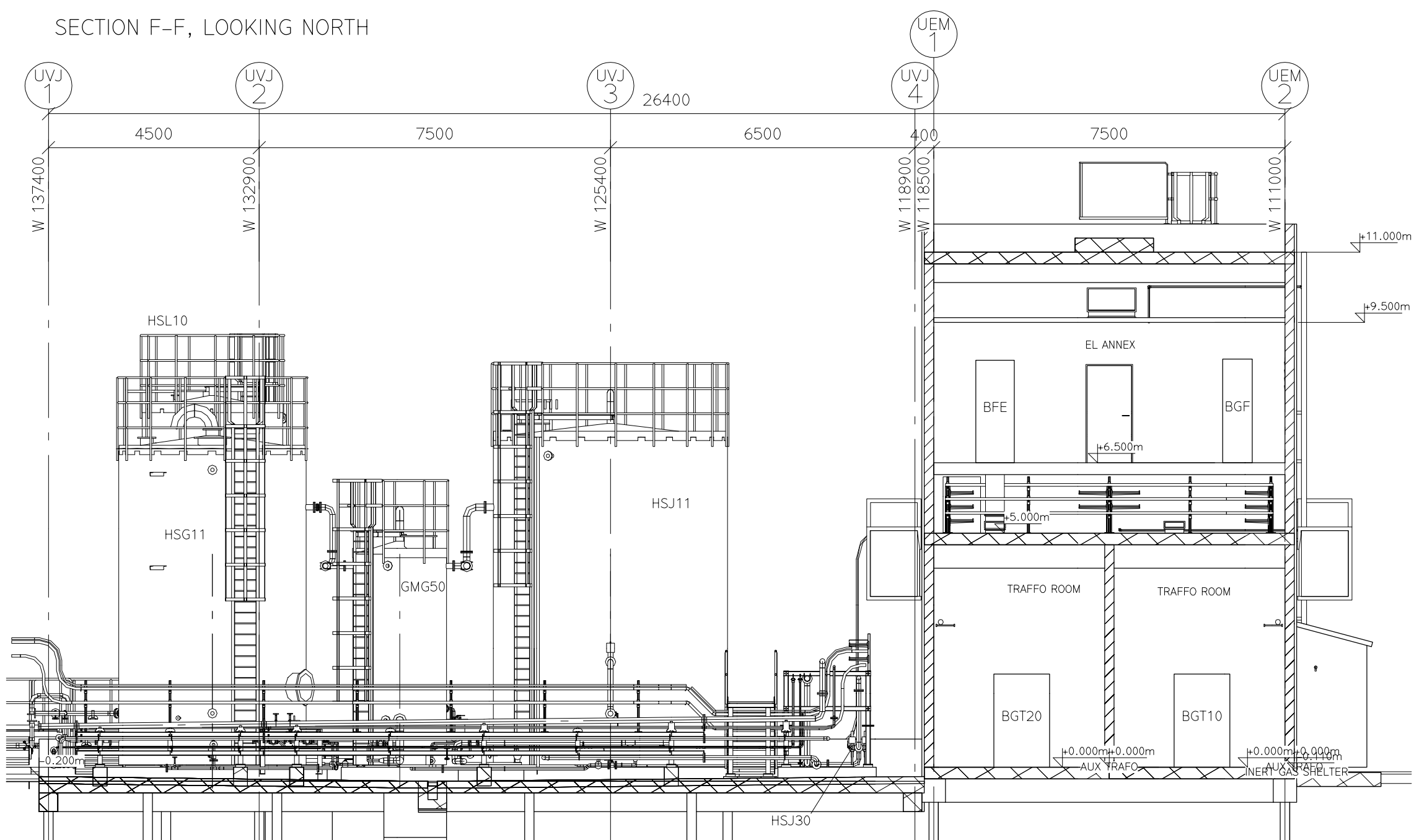




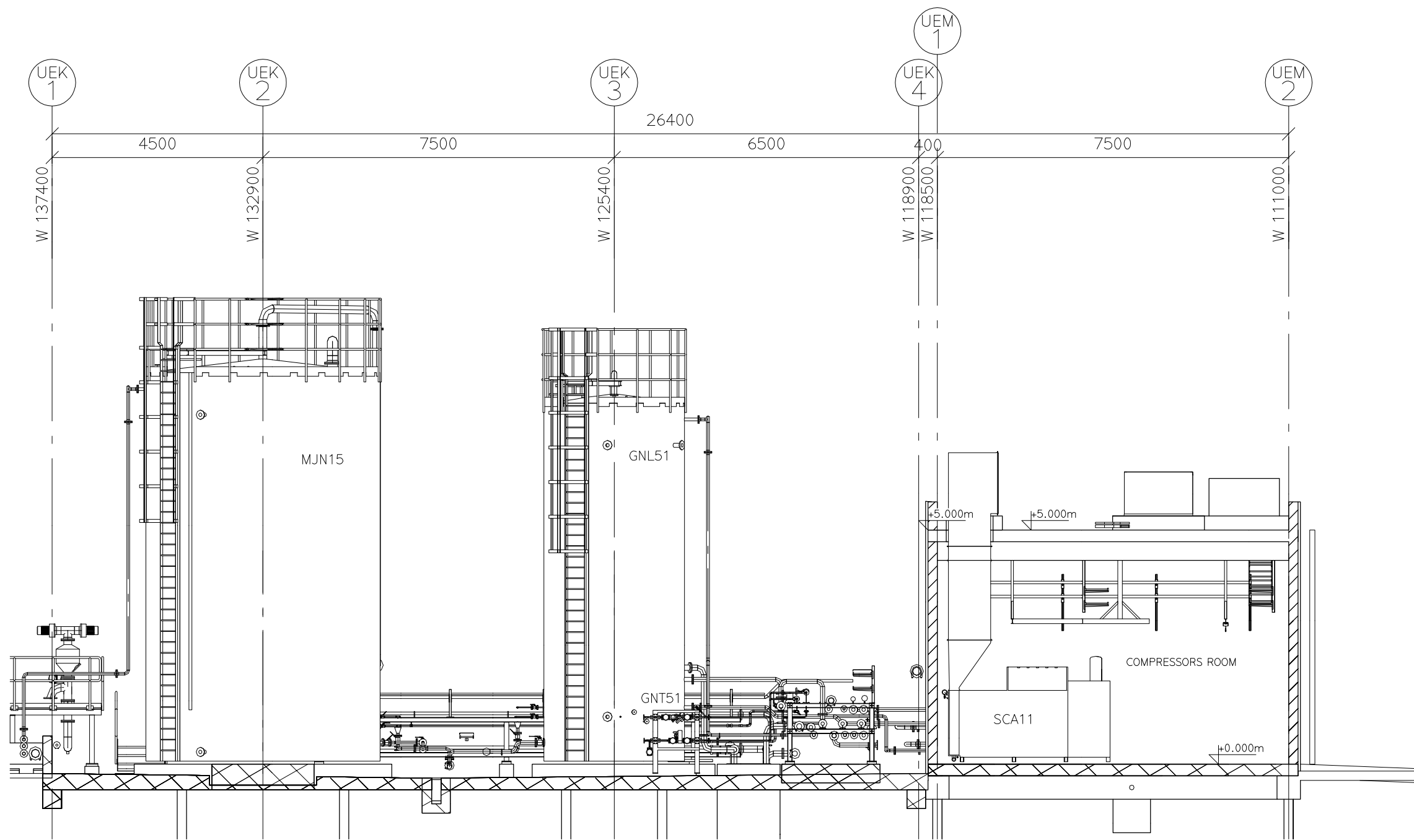
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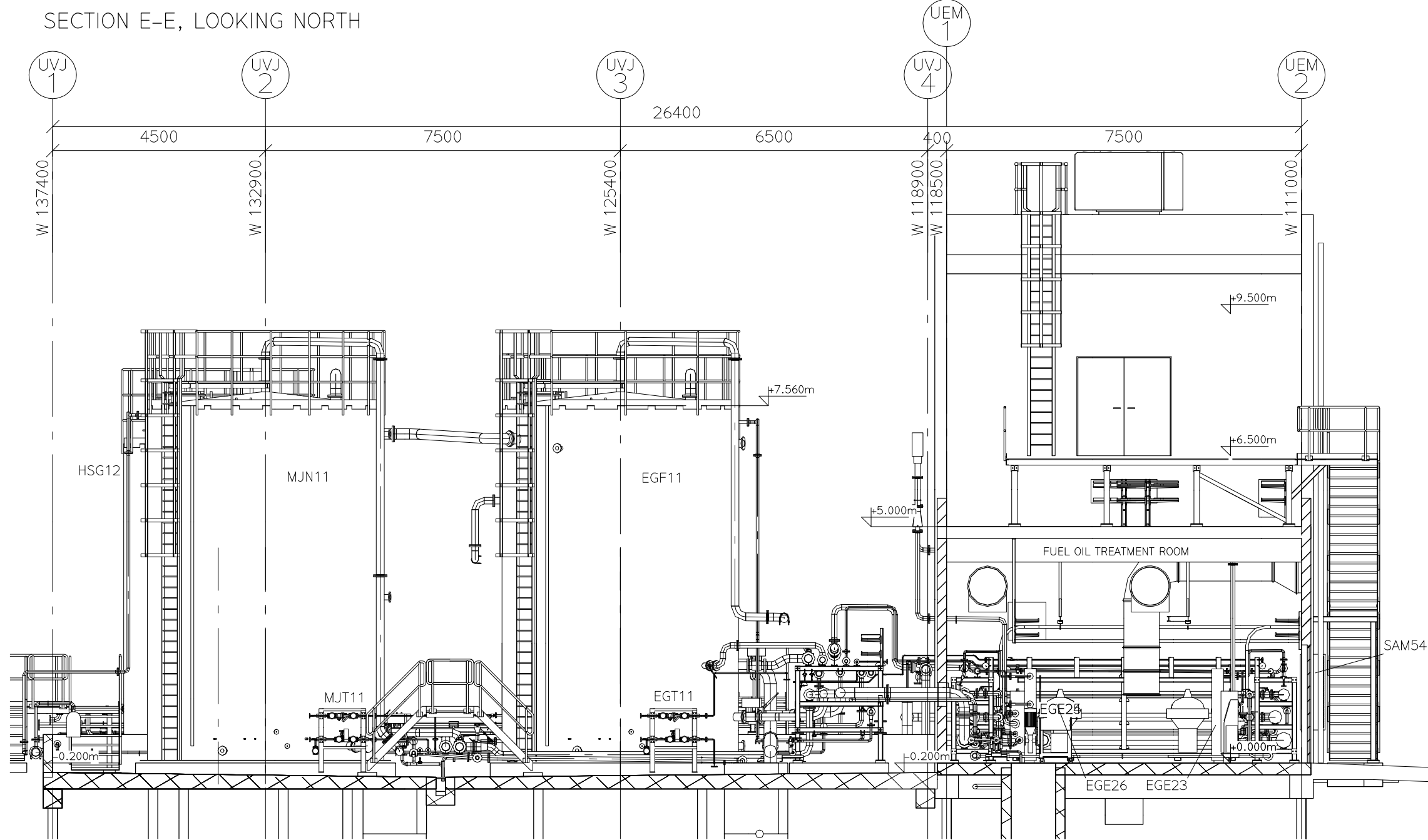
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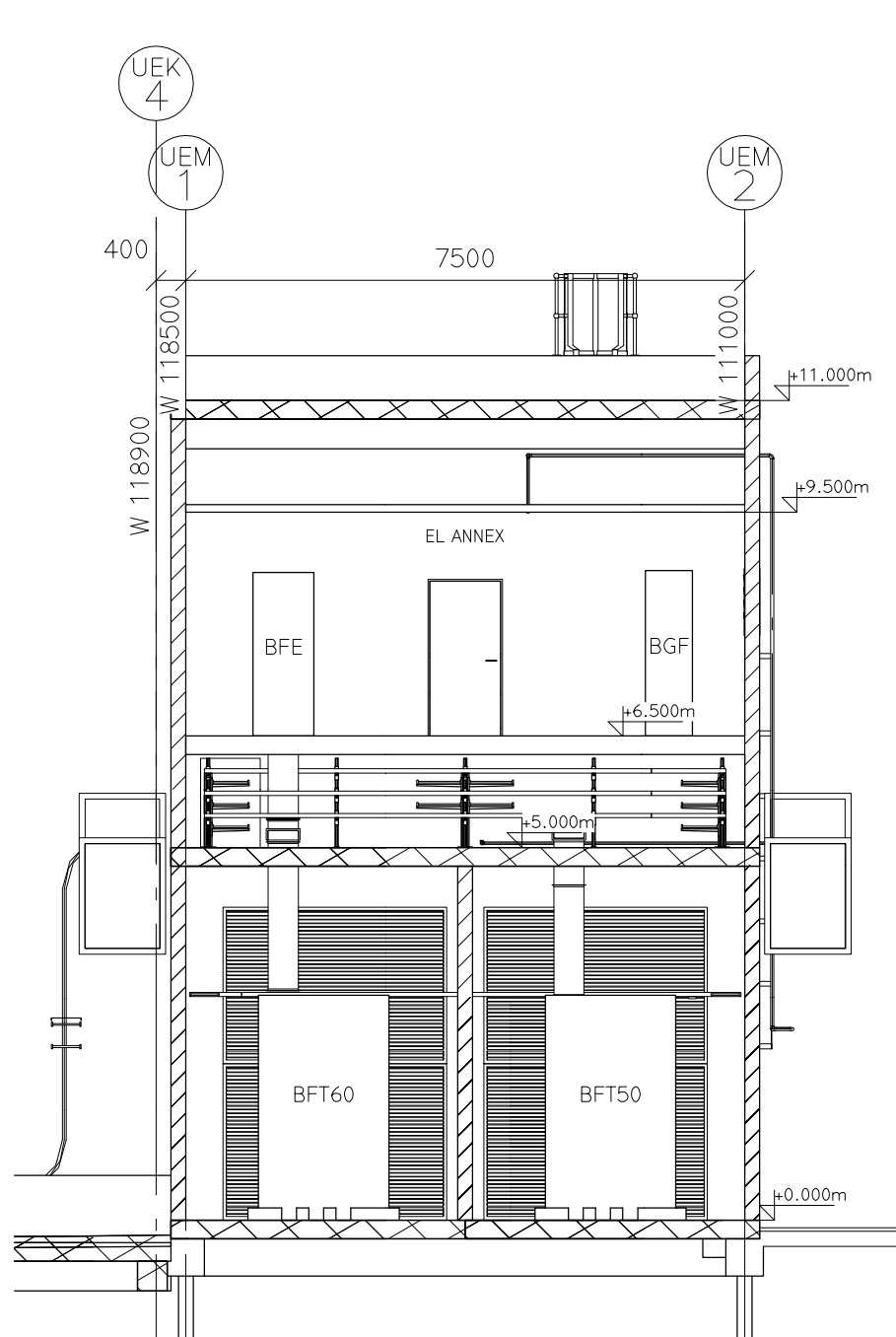
SECTION H-H, LOOKING NORTH



SECTION E-E, LOOKING NORTH



SECTION G-G, LOOKING NORTH



SECTION I-I, LOOKING NORTH

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MECHANICAL EQUIPMENT			WEIGHT
EGT11	STEAM TRAP UNIT, TYPE 2		120 kg
EGE23	FO SEPARATOR NO.3		2080 kg
EGE24	FO SEPARATOR NO.4		2080 kg
EGE25	FO SEPARATOR NO.5		2080 kg
EGE26	FO SEPARATOR NO.6		2080 kg
EGF11	HFO BUFFER TANK NO.1: 125m ³ ø5.000mm		156000 kg
EGF12	HFO BUFFER TANK NO.2: 125m ³ ø5.000mm		156000 kg
EGT12	STEAM TRAP UNIT, TYPE 2		120 kg
GMG21	FOT BUILDING OILY WATER PUMP UNIT		100 kg
GMG23	SERVICE TF OILY WATER PIT PUMP UNIT		50 kg
GMG50	UREA SPILLAGE TANK		16000 kg
GNL51	SLUDGE STORAGE TANK NO.1		55000 kg
GNL52	SLUDGE STORAGE TANK NO.2		35000 kg
GNL60	SLUDGE TRANSFER PUMP UNIT		100 kg
GNT51	STEAM TRAP UNIT, TYPE 2		120 kg
GNT52	STEAM TRAP UNIT, TYPE 2		120 kg
HSG11	UREA DISSOLVING TANK NO.1		83000 kg
HSG12	UREA DISSOLVING TANK NO.2		83000 kg
HSJ11	UREA STORAGE TANK NO.1		155000 kg
HSJ30	UREA PRESSURE CONTROL UNIT		75 kg
HSL10	DEMINEALIZED WATER TANK		58000 kg
MJN11	HFO SERVICE TANK NO.1: 125m ³ ø5.000mm		156000 kg
MJN12	HFO SERVICE TANK NO.2: 125m ³ ø5.000mm		156000 kg
MJN15	DO SERVICE TANK: 140m ³ , D=5.000mm		172000 kg
MJN31	HFO FEEDER PUMP UNIT		3900 kg
MJN32	DO FEEDER PUMP UNIT		850 kg
MJN70	DO FILTER UNIT		300 kg
MJT11	STEAM TRAP UNIT, TYPE 2		120 kg
MJT12	STEAM TRAP UNIT, TYPE 2		120 kg
MVA30	LO STORAGE TANK		208000 kg
MVB20	LO TRANSFER PUMP UNIT		400 kg
MVD20	MAINTENANCE LUBE OIL DRAIN TANK		55000 kg
MVD30	MAINTENANCE LUBE OIL PUMP UNIT		400 kg
QEA13	STARTING AIR COMPRESSOR NO.3 UNIT		1250 kg
QFA11	CONTROL AIR COMPRESSOR NO.1 UNIT		2720 kg
QFA14	CONTROL AIR COMPRESSOR NO.4 UNIT		2720 kg
QLB12	STEAM TRAP UNIT, TYPE 4		60 kg
SAA10	VENTILATION INLET LOUVRE		1500 kg
SAA20	SEPARATOR ROOM EXHAUST UNIT		1000 kg
SAA22	VENTILATION,UAT 42 TRAFQ ROOM		584 kg
SAA23	VENTILATION,UAT 41 TRAFQ ROOM		584 kg
SAM53	INLET LOUVRE		200 kg
SAM54	INLET LOUVRE		200 kg
SCA11	SERVICE AIR COMPRESSOR NO.1 UNIT		2720 kg

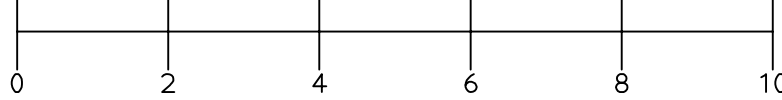
ELECTRICAL EQUIPMENT			WEIGHT
BFE	690 V MAIN SWITCHBOARD 2		9500 kg
BFT50	UNIT AUXILIARY TRANSFORMER UAT45		12535 kg
BFT60	UNIT AUXILIARY TRANSFORMER UAT46		12535 kg
BGF	COMMON/FUEL TREATMENT SWITCHBOARD		4000 kg
BGT10	AUX. TRANSFORMER 41		2055 kg
BGT20	AUX. TRANSFORMER 42		2055 kg
SAA22	VENTILATION,UAT 42 TRAFQ ROOM		584 kg




AS BUILT

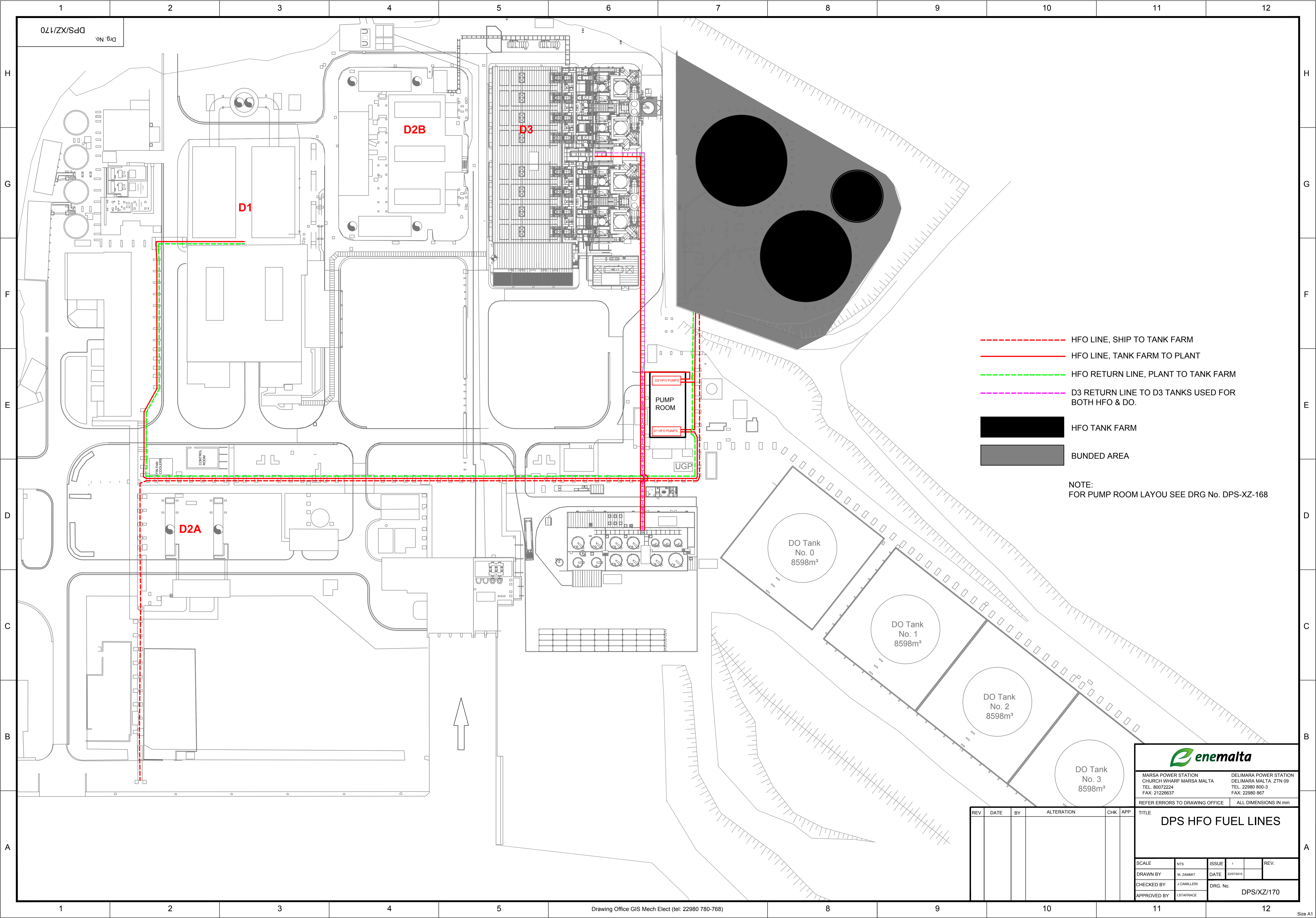
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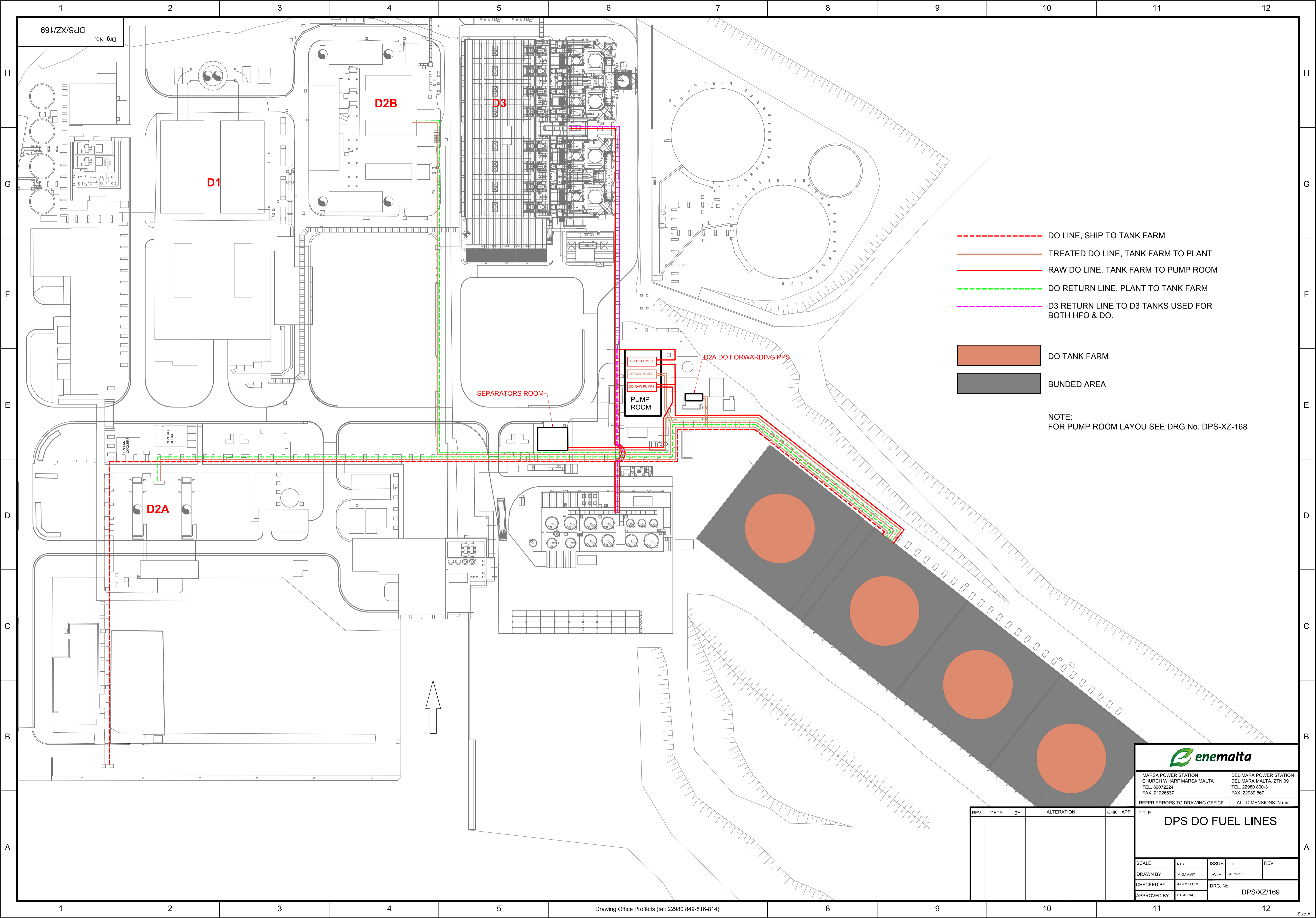
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NO.: 2. ALL LEVELS ARE RELATIVE IN METRE


METRE



4	2012.07.12	MOMA	JNJ		WSH
2	2010.03.19	JAV	JES	CROSS DISCIPLINARY REVIEWED	CHH
1	2010.01.08	JES	JVS	NEW FOT LAYOUT INCL. NEW FIRST FLOOR.	CHH
0	2009.10.30	JES	CHH		JNJ
REV	DATE	DRAWN BY	ISSUED/VERIFIED BY	DESCRIPTION	APPROVED BY
OWNER					
				Enemalta Corporation CENTRAL ADMINISTRATION BUILDING CHURCH WARRF, MARSA MRS 1000 MALTA TEL.: +356 2298 0755 FAX: +356 2125 1241	
CONTRACT		DRAWING No.		Sht. No.	REV
PROJECT					
 BURMEISTER & WAIN SCANDINAVIAN CONTRACTOR A/S DENMARK				POST OFFICE BOX 235 DK 3450 ALLERØD, DENMARK TELEPHONE :+45 48140022 TELEFAX :+45 48140150	
SUBJECT					
FOT BUILDING (UEM), SERVICE T. F. (UEK) & UREA T. F. (UVJ) LAYOUT SECTIONS, LOOKING NORTH					
SCALE		DWG. NO.			
A1=1:100 A3=1:200		2970.D2.612.001 PROJECT NO. GR. NO. SHT.		4 REV.	







MARSA POWER STATION
CHURCH WHARF MARSA MALTA
TEL: 80072224
FAX: 21228637

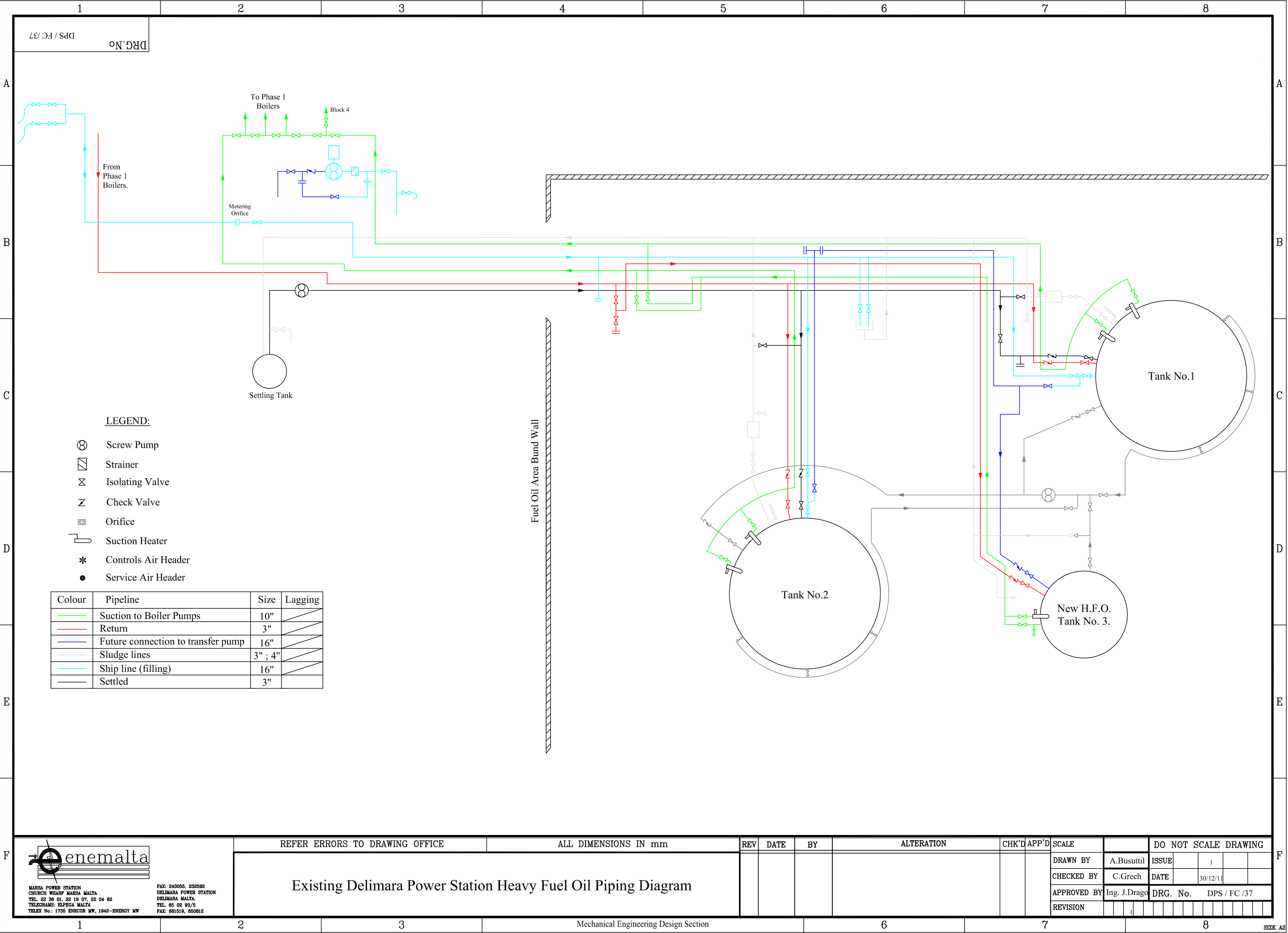
DELIMARA POWER STATION
DELIMARA MALTA, ZTN 09
TEL: 22980 800-3
FAX: 22980 867

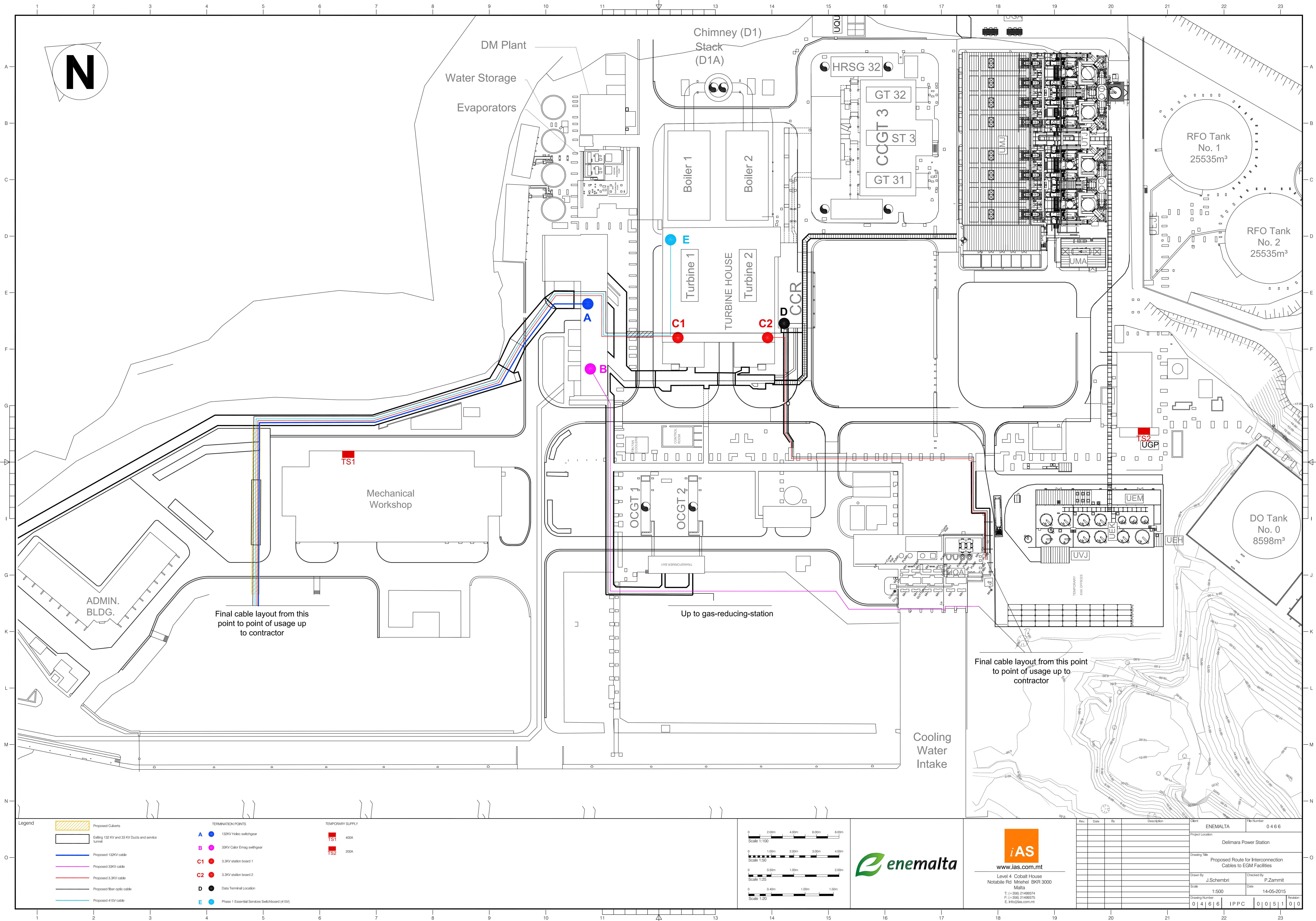
REFER ERRORS TO DRAWING OFFICE

ALL DIMENSIONS IN mm

REV	DATE	BY	ALTERATION	CHK	APP	TITLE
						DPS DO FUEL LINES

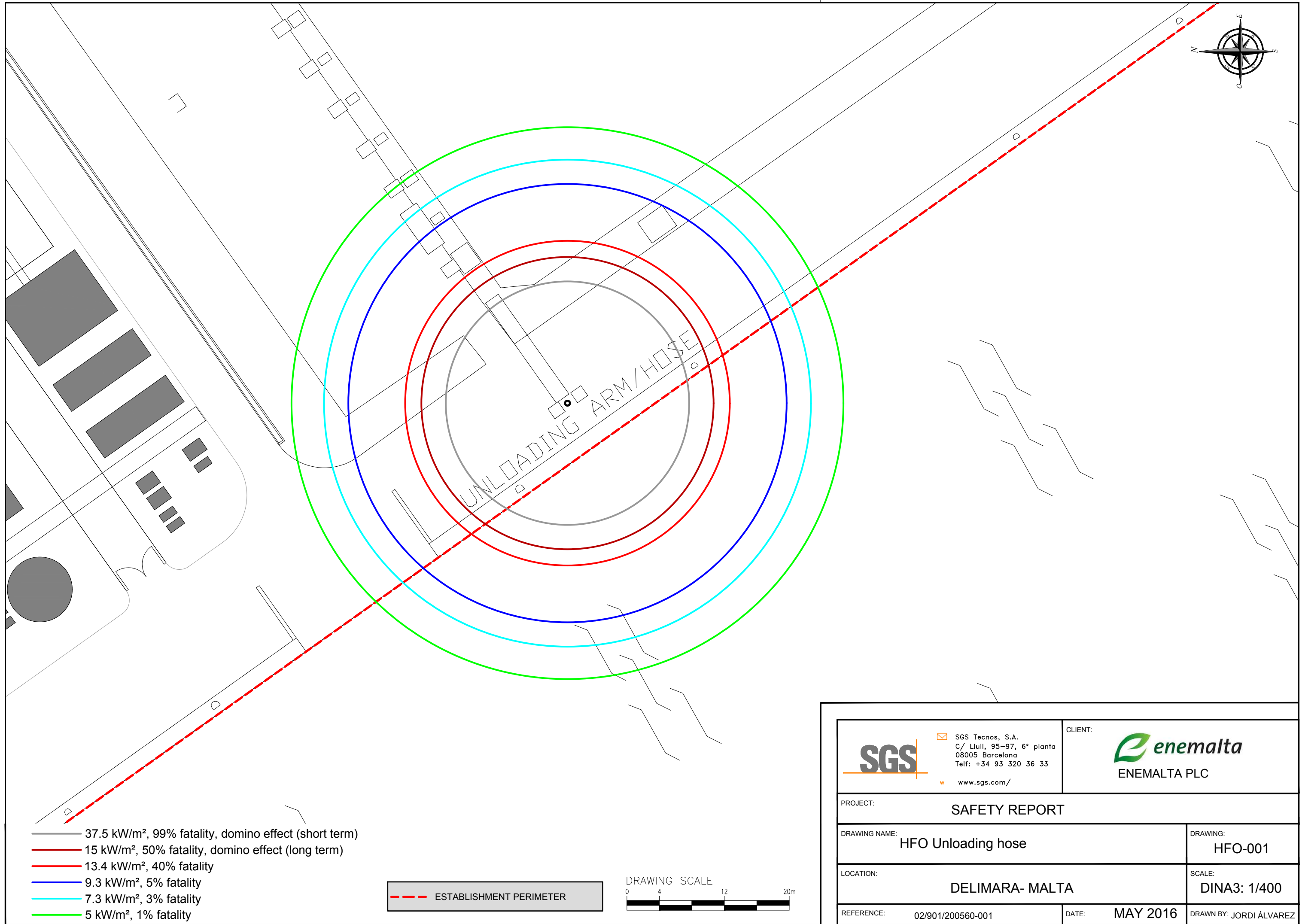
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DRAWN BY	M. ZAMMIT	DATE	23/07/2015	
CHECKED BY	J. CAMILLERI	DRG. No.	DPS/XZ/169	
APPROVED BY	I. STAFRACE			





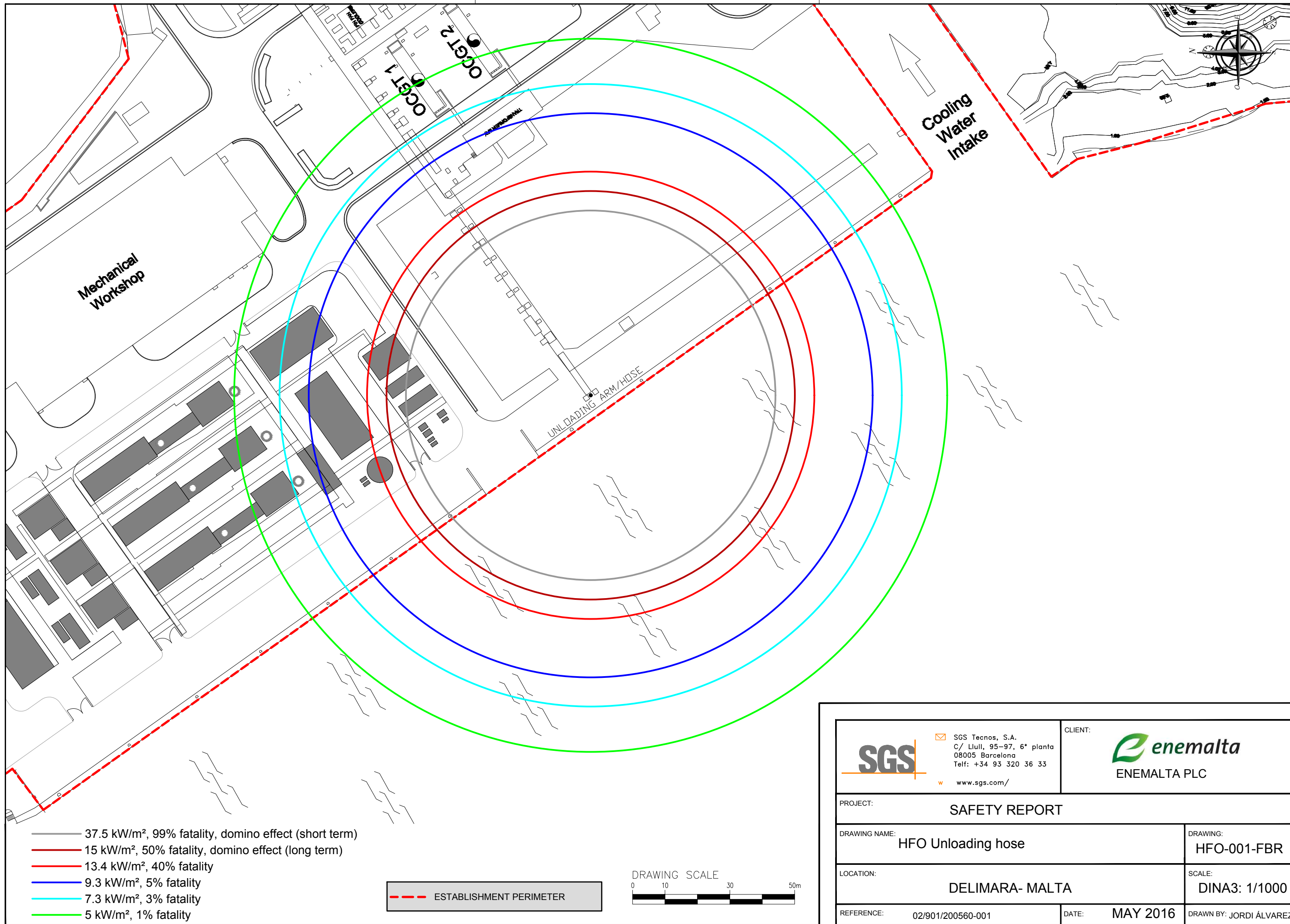




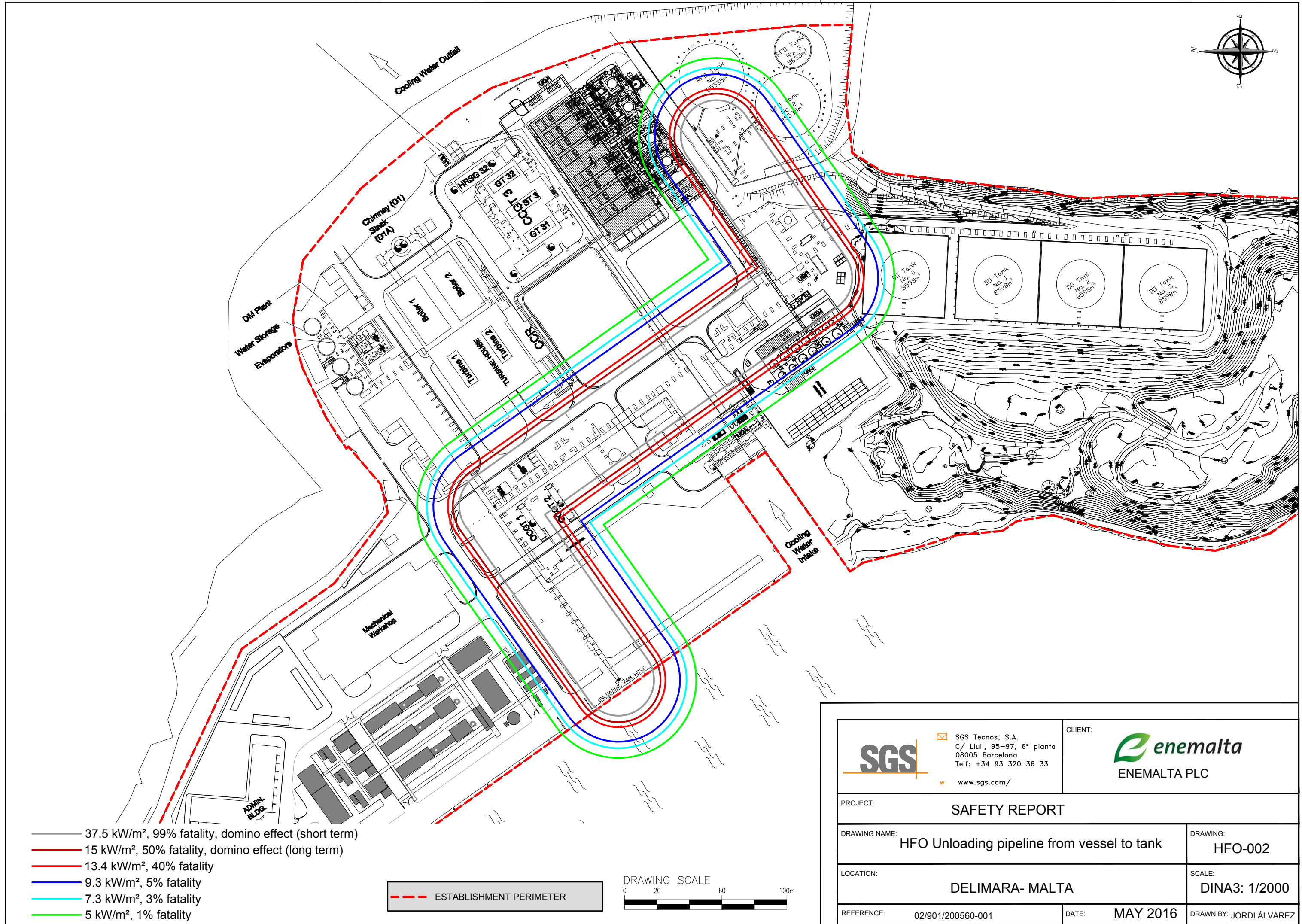
ANNEX 3. CONSEQUENCES MAPS

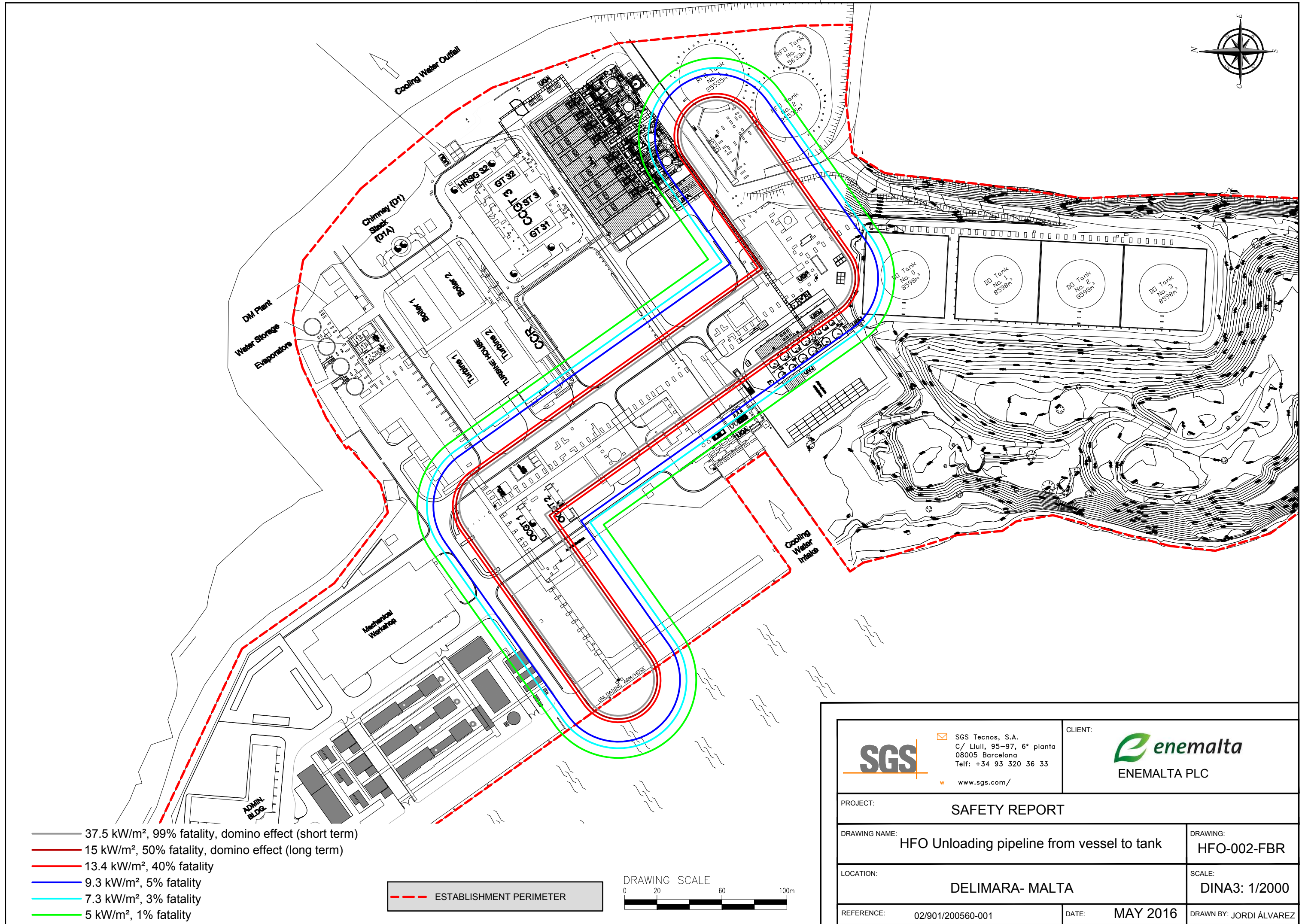


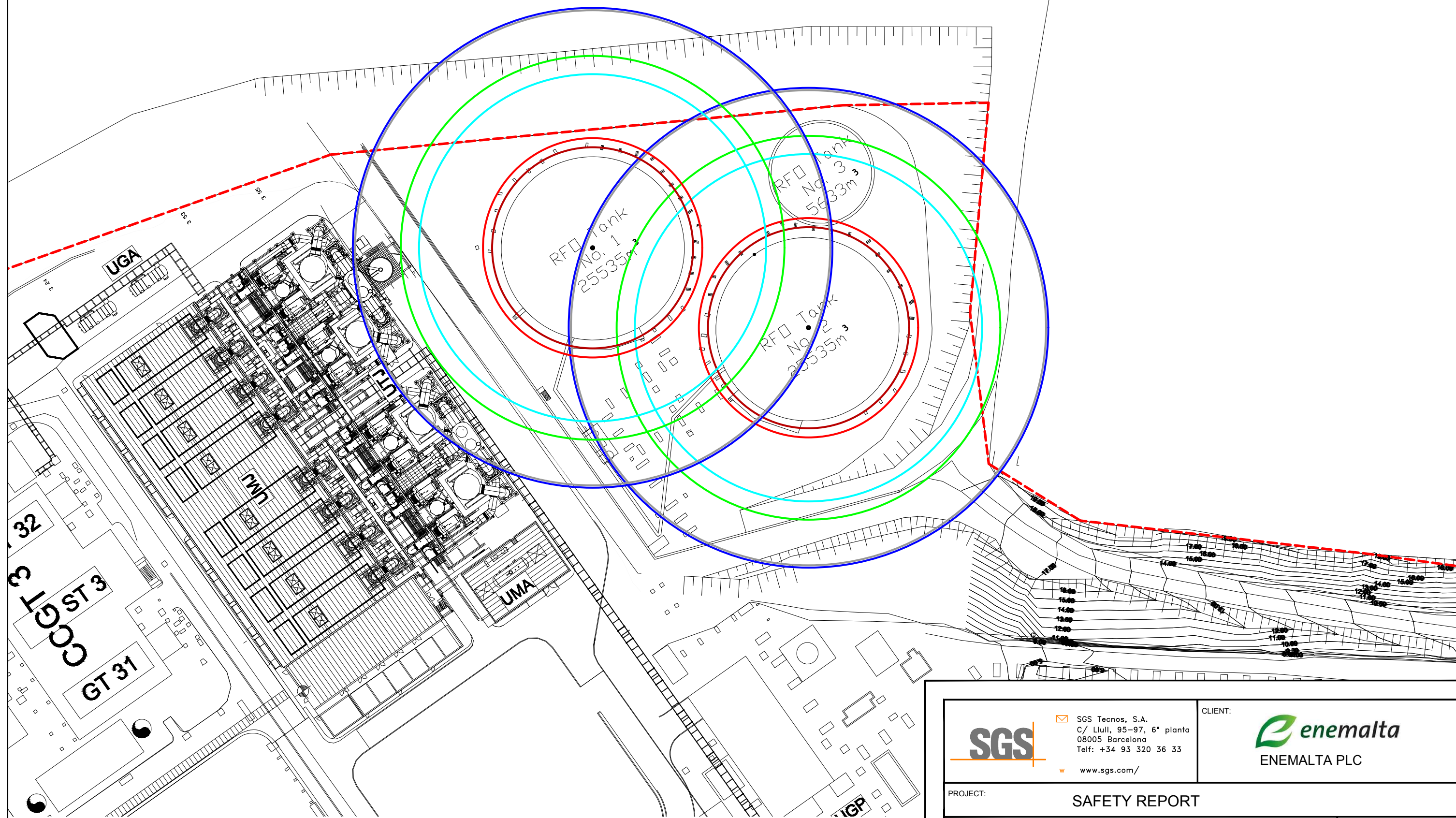
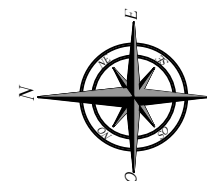
 <div>SGS Tecnos, S.A. C/ Lluís, 95-97, 6ª planta 08005 Barcelona Telf: +34 93 320 36 33 www.sgs.com/</div>		CLIENT:  ENEMALTA PLC	
PROJECT: SAFETY REPORT			
DRAWING NAME: HFO Unloading hose		DRAWING: HFO-001	
LOCATION: DELIMARA- MALTA		SCALE: DINA3: 1/400	
REFERENCE: 02/901/200560-001		DATE: MAY 2016 DRAWN BY: JORDI ÁLVAREZ	



<div><div><div>SGS</div></div><div><div><div></div><div>SGS Tecnos, S.A.</div><div>C/ Lluís, 95-97, 6ª planta</div><div>08005 Barcelona</div><div>Tel: +34 93 320 36 33</div><div>www.sgs.com/</div></div></div></div>		CLIENT: <div><div></div><div>enemalta</div><div>ENEMALTA PLC</div></div>	
PROJECT:		SAFETY REPORT	
DRAWING NAME:		HFO Unloading hose	DRAWING: HFO-001-FBR
LOCATION:		DELIMARA- MALTA	SCALE: DINA3: 1/1000
REFERENCE:		02/901/200560-001	DATE: MAY 2016
		DRAWN BY: JORDI ÁLVAREZ	







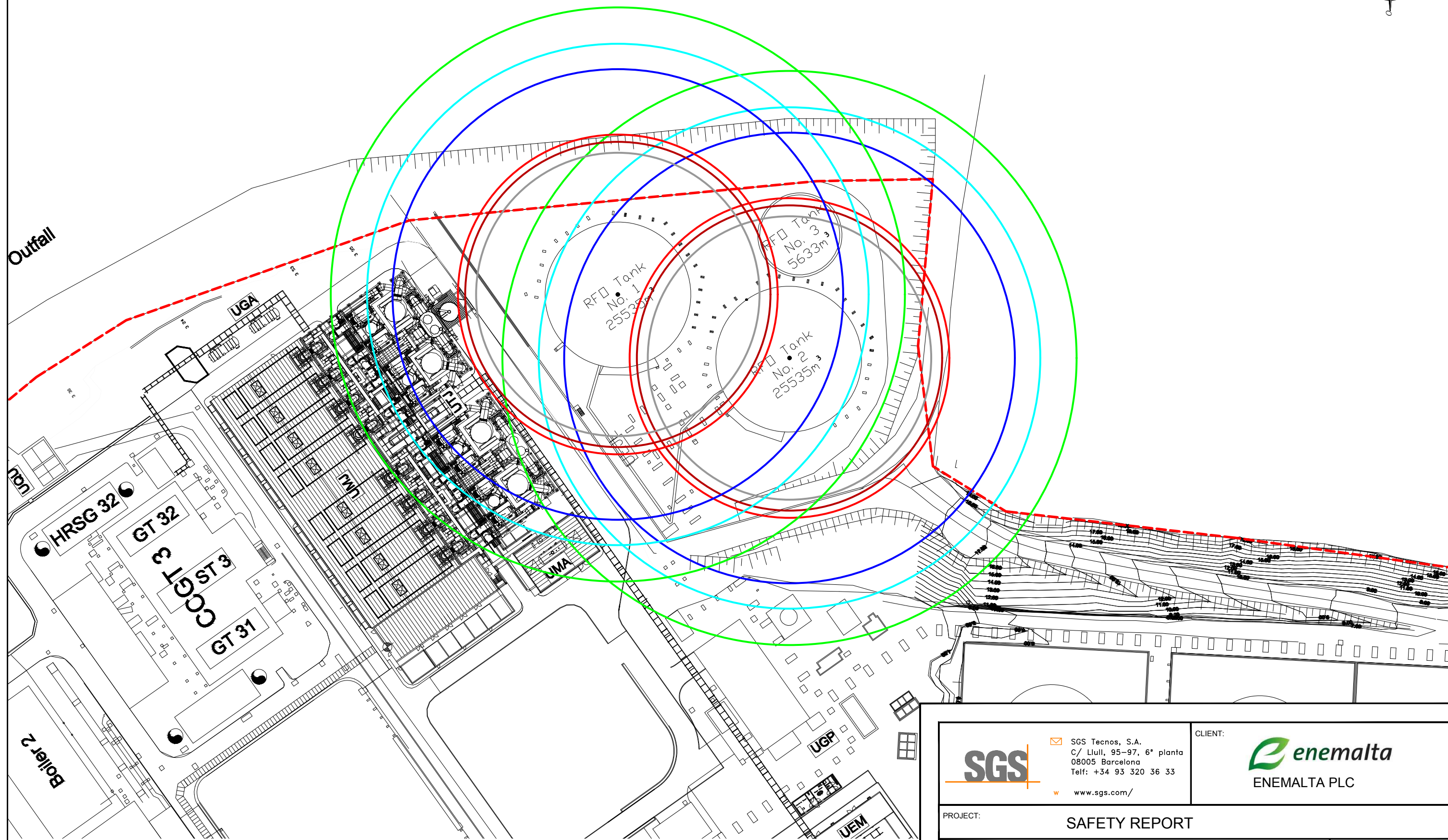
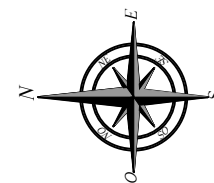


- 37.5 kW/m², 99% fatality, domino effect (short term)
- 15 kW/m², 50% fatality, domino effect (long term)
- 13.4 kW/m², 40% fatality
- 9.3 kW/m², 5% fatality
- 7.3 kW/m², 3% fatality
- 5 kW/m², 1% fatality

ESTABLISHMENT PERIMETER





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PROJECT:		SAFETY REPORT	
DRAWING NAME:		HFO Storage tank n. 1 and 2	DRAWING: HFO-003
LOCATION:		DELIMARA- MALTA	SCALE: DINA3: 1/800
REFERENCE:		02/901/200560-001	DATE: MAY 2016 DRAWN BY: JORDI ÁLVAREZ

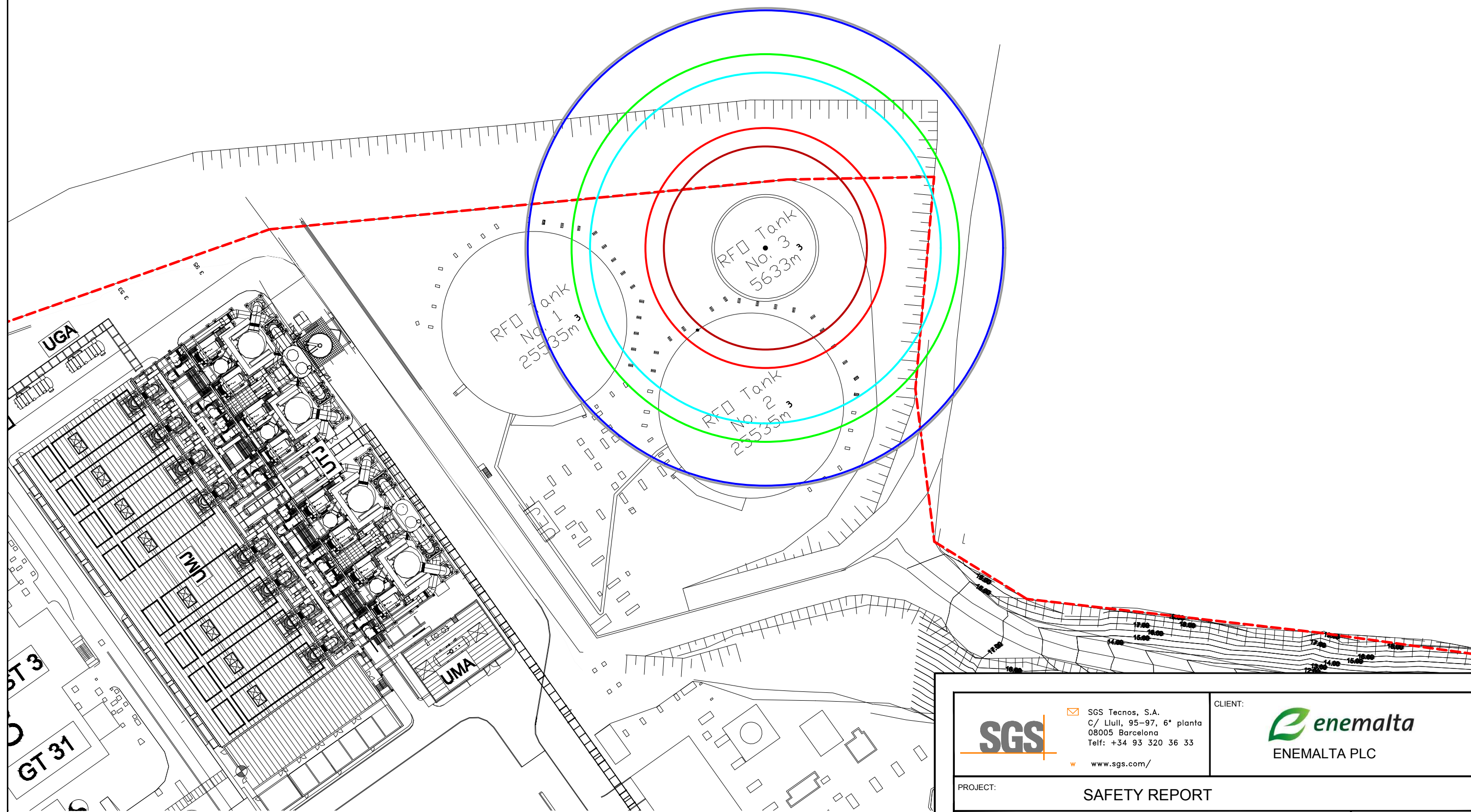
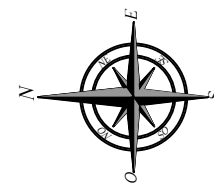


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- 15 kW/m², 50% fatality, domino effect (long term)
- 13.4 kW/m², 40% fatality
- 9.3 kW/m², 5% fatality
- 7.3 kW/m², 3% fatality
- 5 kW/m², 1% fatality

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 <div>SGS Tecnos, S.A. C/ Lluís, 95-97, 6ª planta 08005 Barcelona Telf: +34 93 320 36 33 www.sgs.com/</div>		CLIENT:  ENEMALTA PLC	
PROJECT: SAFETY REPORT			
DRAWING NAME: HFO Storage tank n. 1 and 2		DRAWING: HFO-003-CF	
LOCATION: DELIMARA- MALTA		SCALE: DINA3: 1/1000	
REFERENCE: 02/901/200560-001	DATE: MAY 2016	DRAWN BY: JORDI ÀLVAREZ	

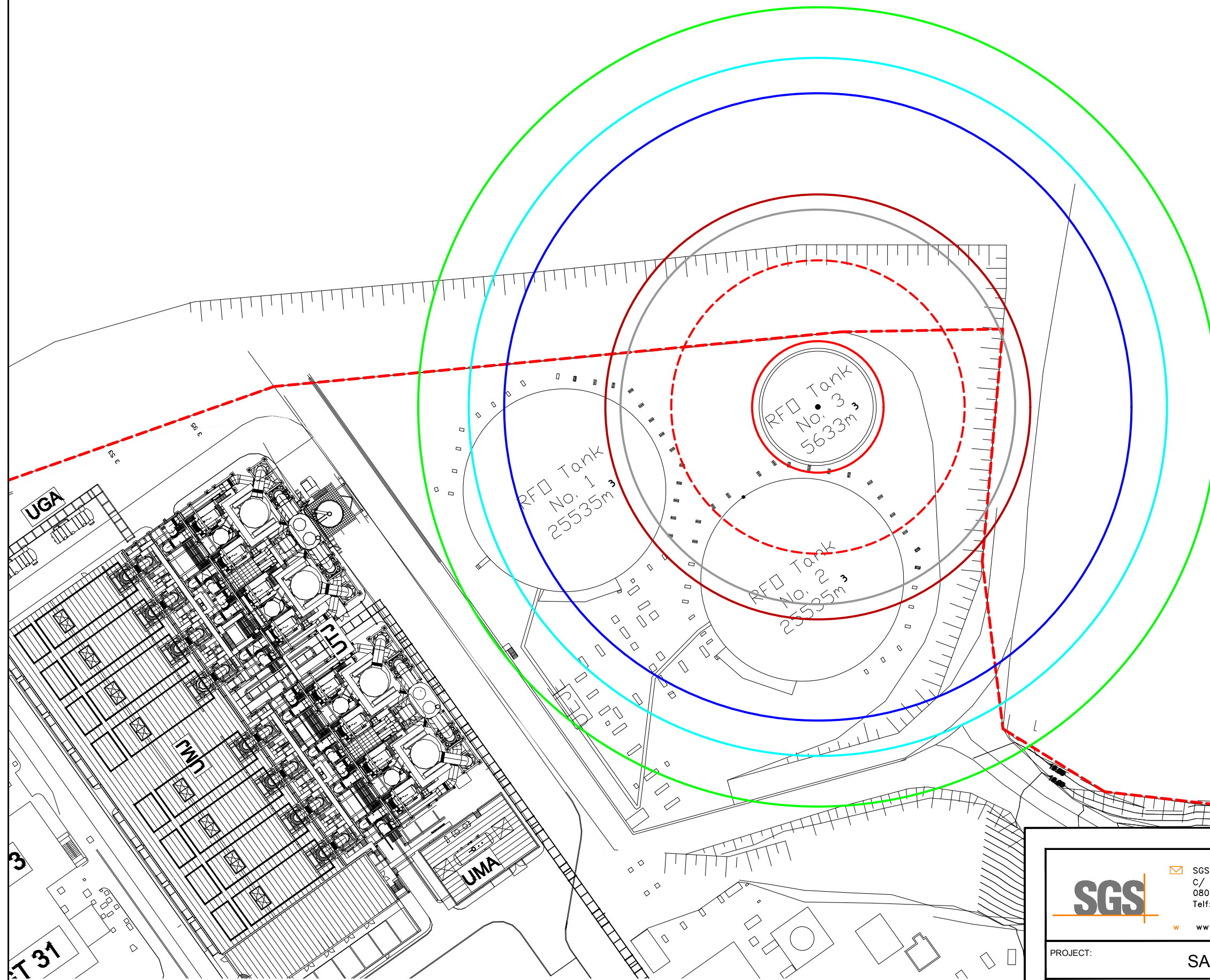
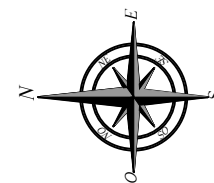


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- 15 kW/m², 50% fatality, domino effect (long term)
- 13.4 kW/m², 40% fatality
- 9.3 kW/m², 5% fatality
- 7.3 kW/m², 3% fatality
- 5 kW/m², 1% fatality

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PROJECT:		SAFETY REPORT	
DRAWING NAME:		HFO Storage tank n. 3	DRAWING: HFO-004
LOCATION:		DELIMARA- MALTA	SCALE: DINA3: 1/800
REFERENCE:		02/901/200560-001	DATE: MAY 2016 DRAWN BY: JORDI ÁLVAREZ

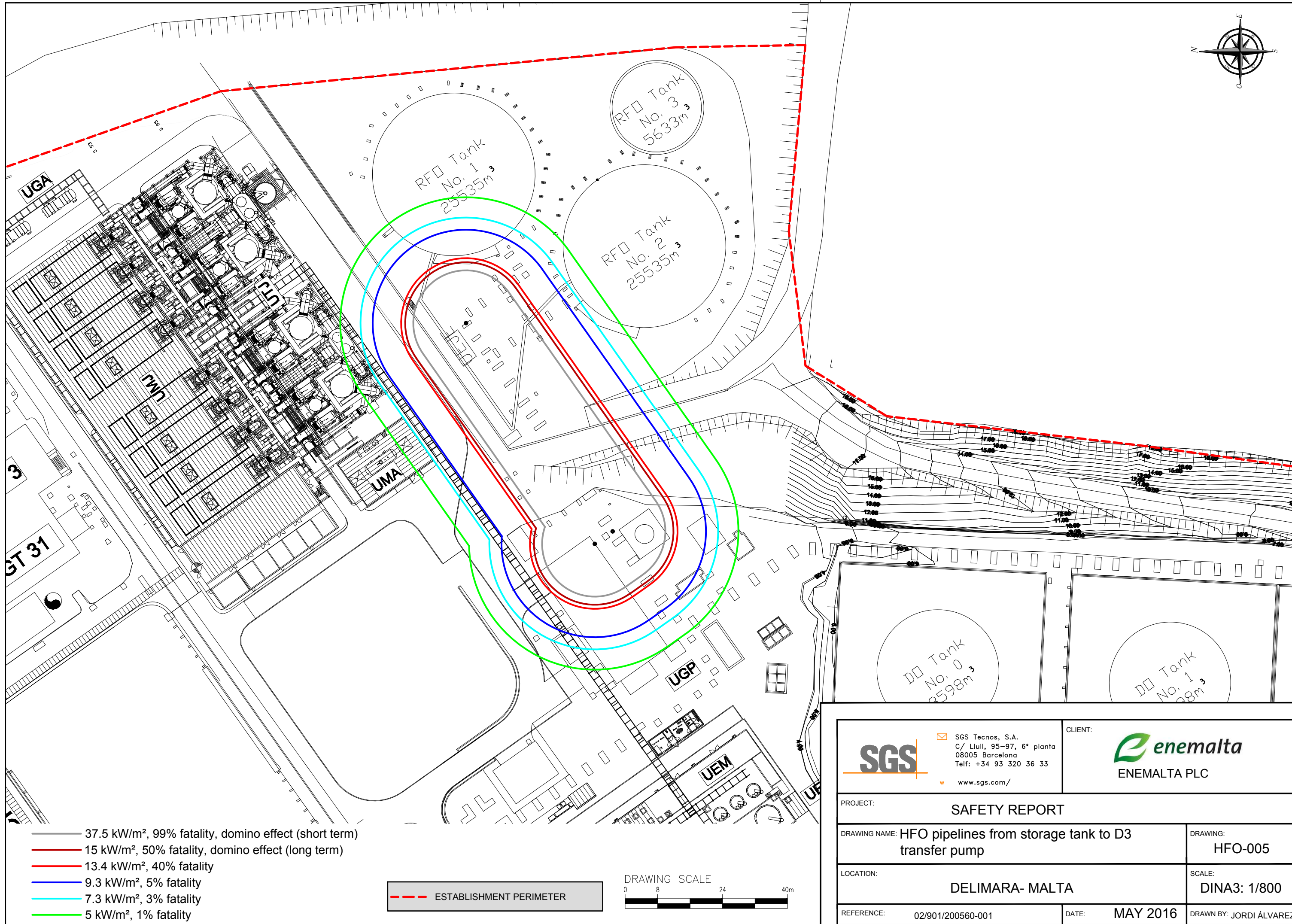




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- 15 kW/m², 50% fatality, domino effect (long term)
- 13.4 kW/m², 40% fatality
- 9.3 kW/m², 5% fatality
- 7.3 kW/m², 3% fatality
- 5 kW/m², 1% fatality

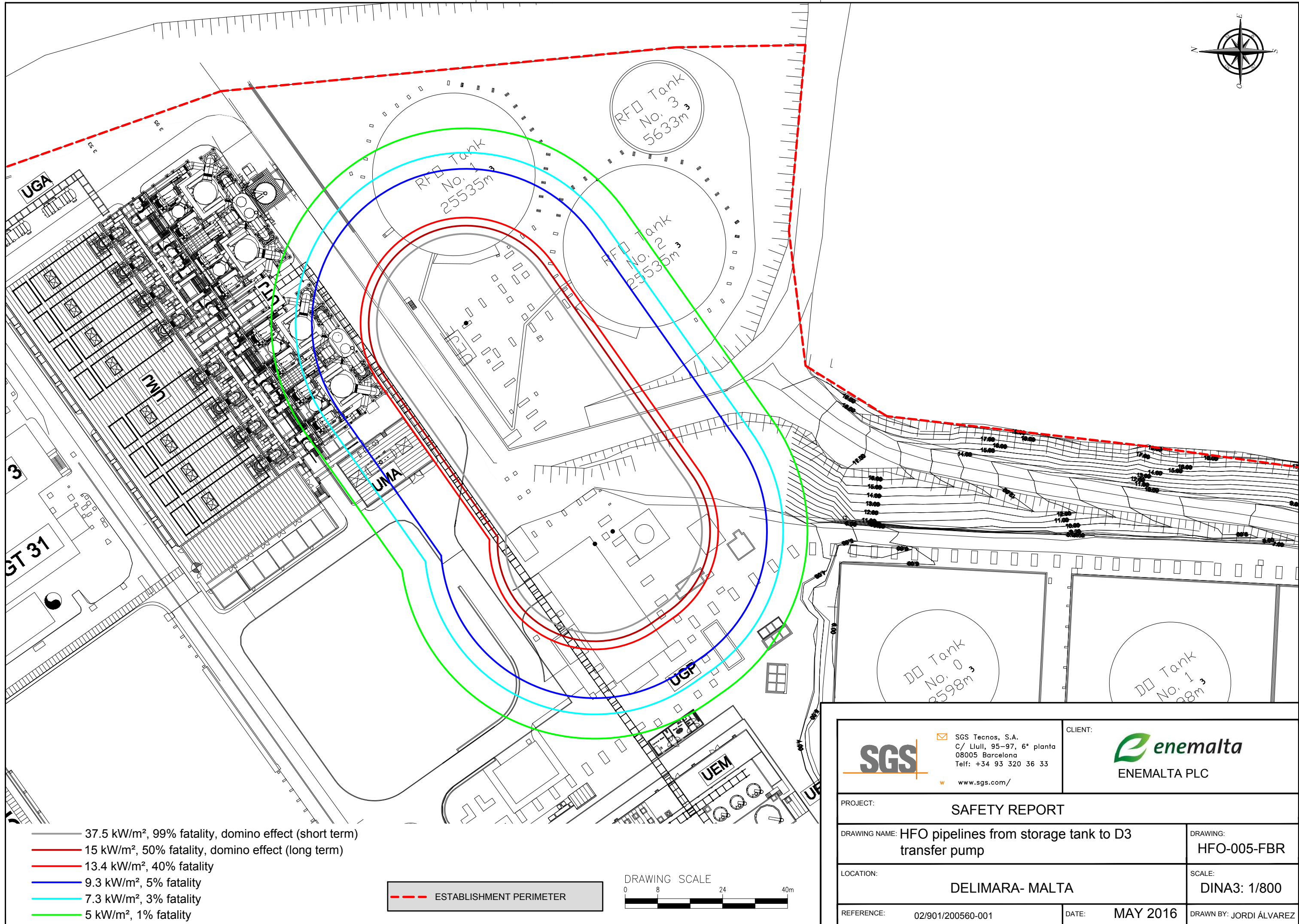
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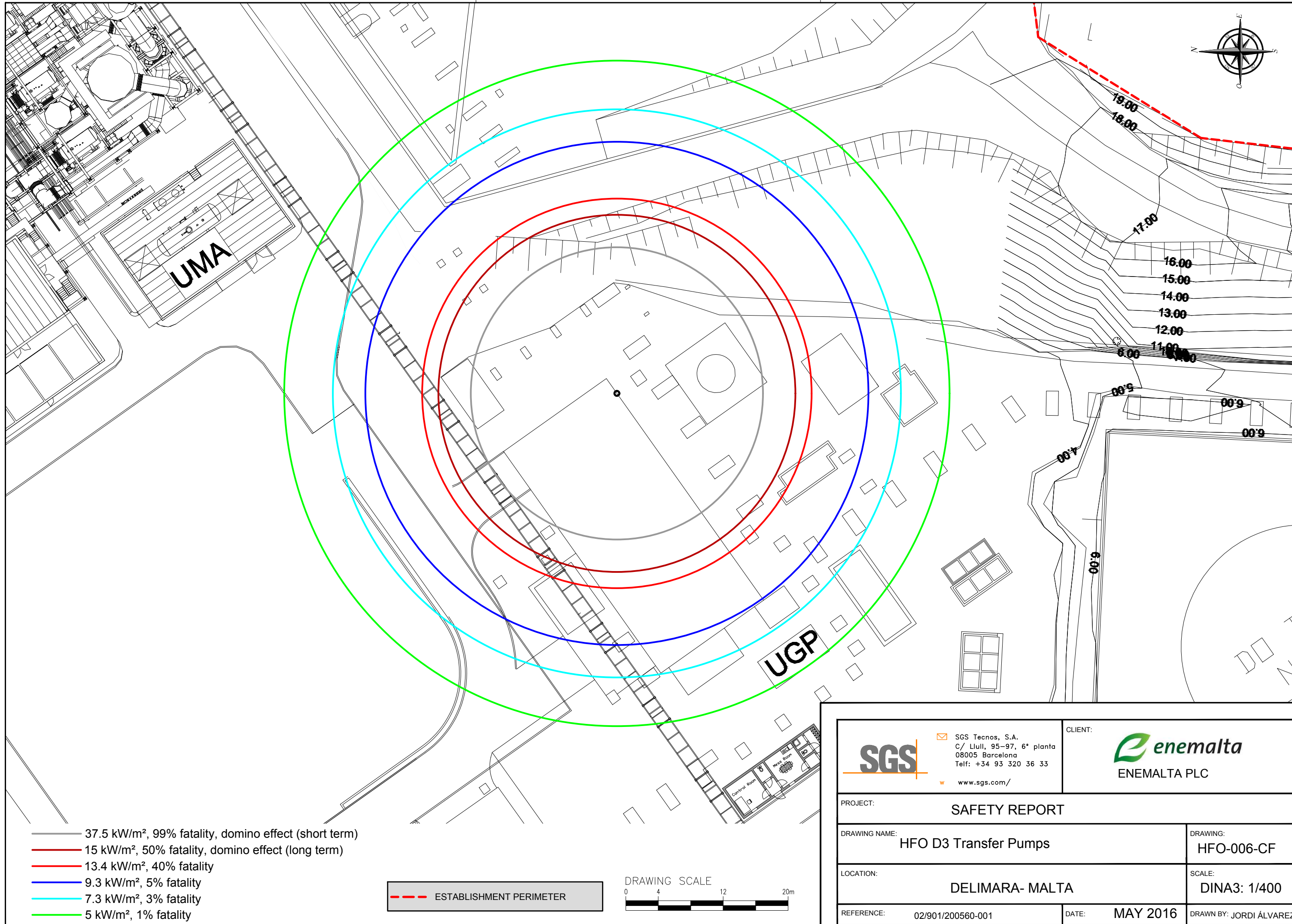


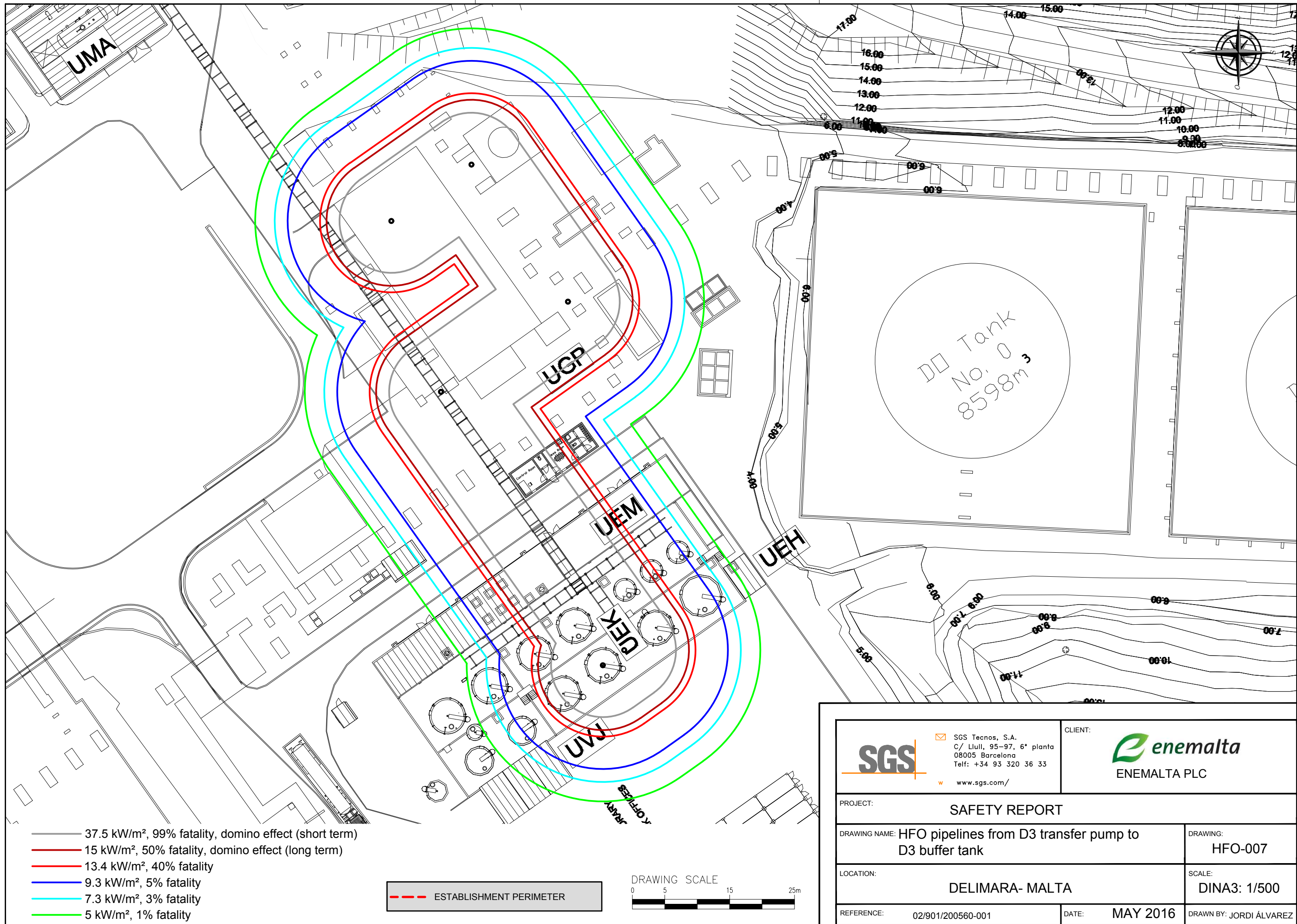
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PROJECT:		SAFETY REPORT	
DRAWING NAME:		HFO Storage tank n. 3	DRAWING: HFO-004-CF
LOCATION:		DELIMARA- MALTA	SCALE: DINA3: 1/800
REFERENCE:		02/901/200560-001	DATE: MAY 2016 DRAWN BY: JORDI ÁLVAREZ

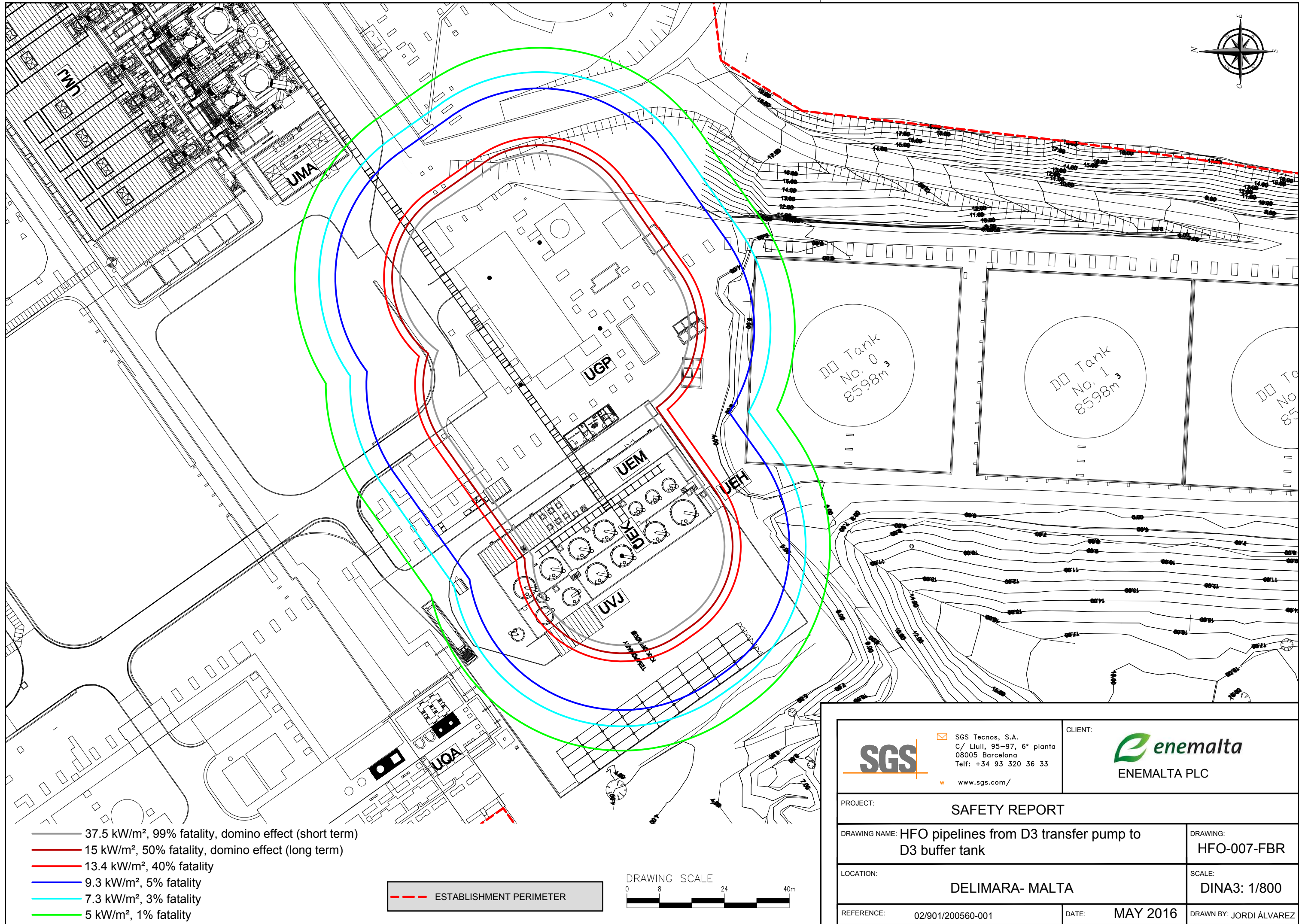


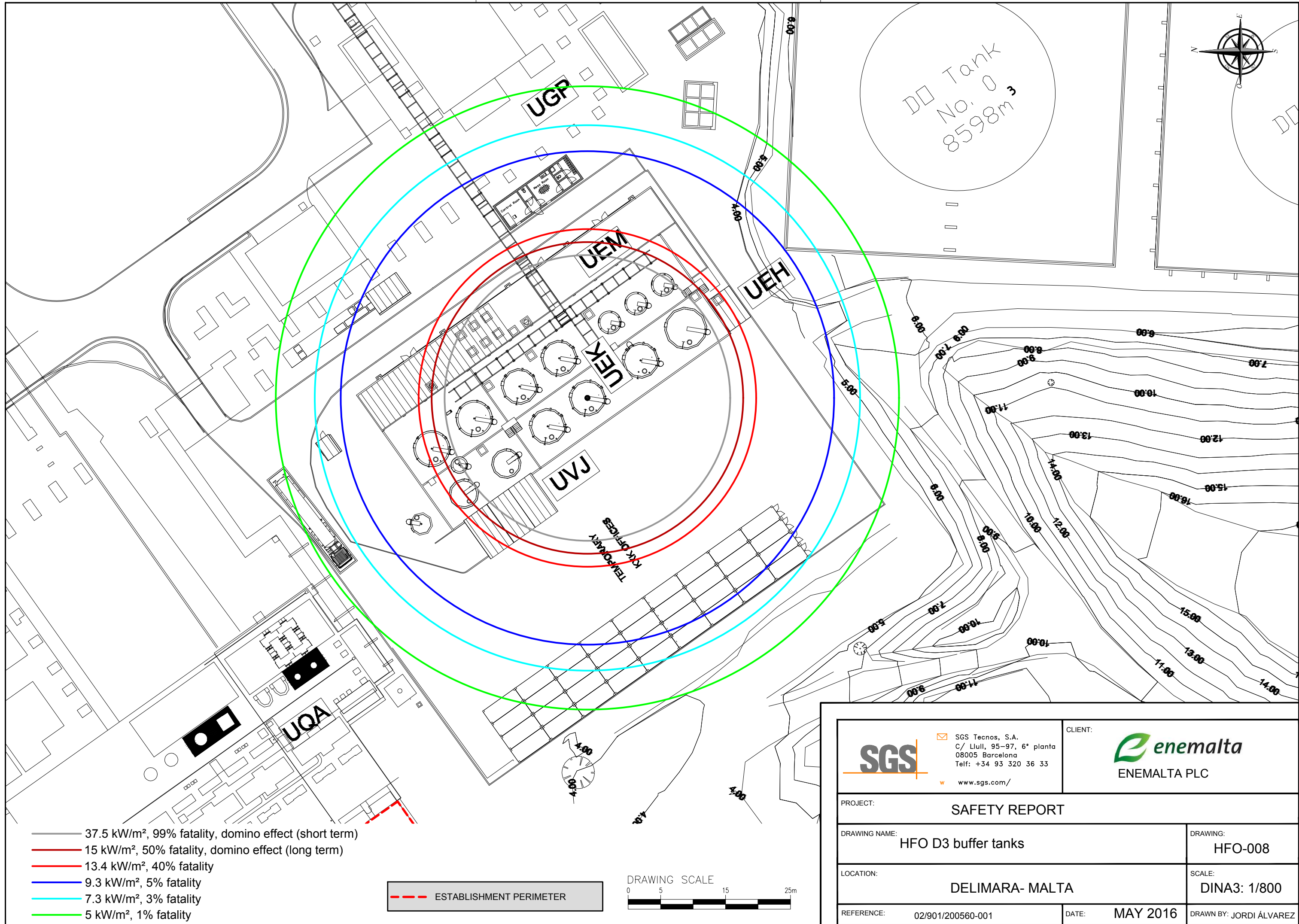
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PROJECT: SAFETY REPORT			
DRAWING NAME: HFO pipelines from storage tank to D3 transfer pump		DRAWING: HFO-005	
LOCATION: DELIMARA- MALTA		SCALE: DINA3: 1/800	
REFERENCE: 02/901/200560-001	DATE: MAY 2016	DRAWN BY: JORDI ÀLVAREZ	

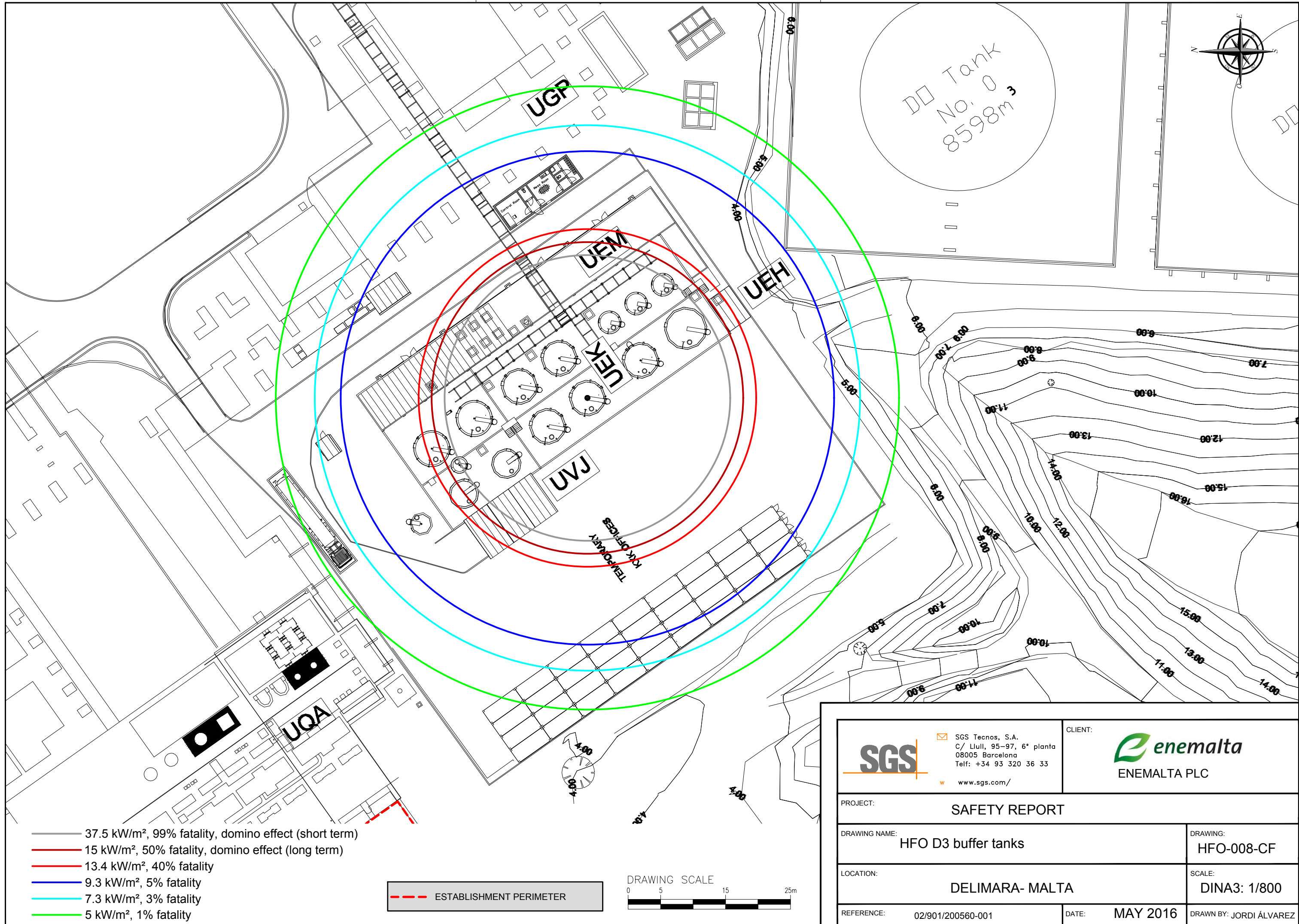






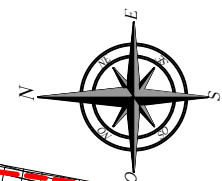
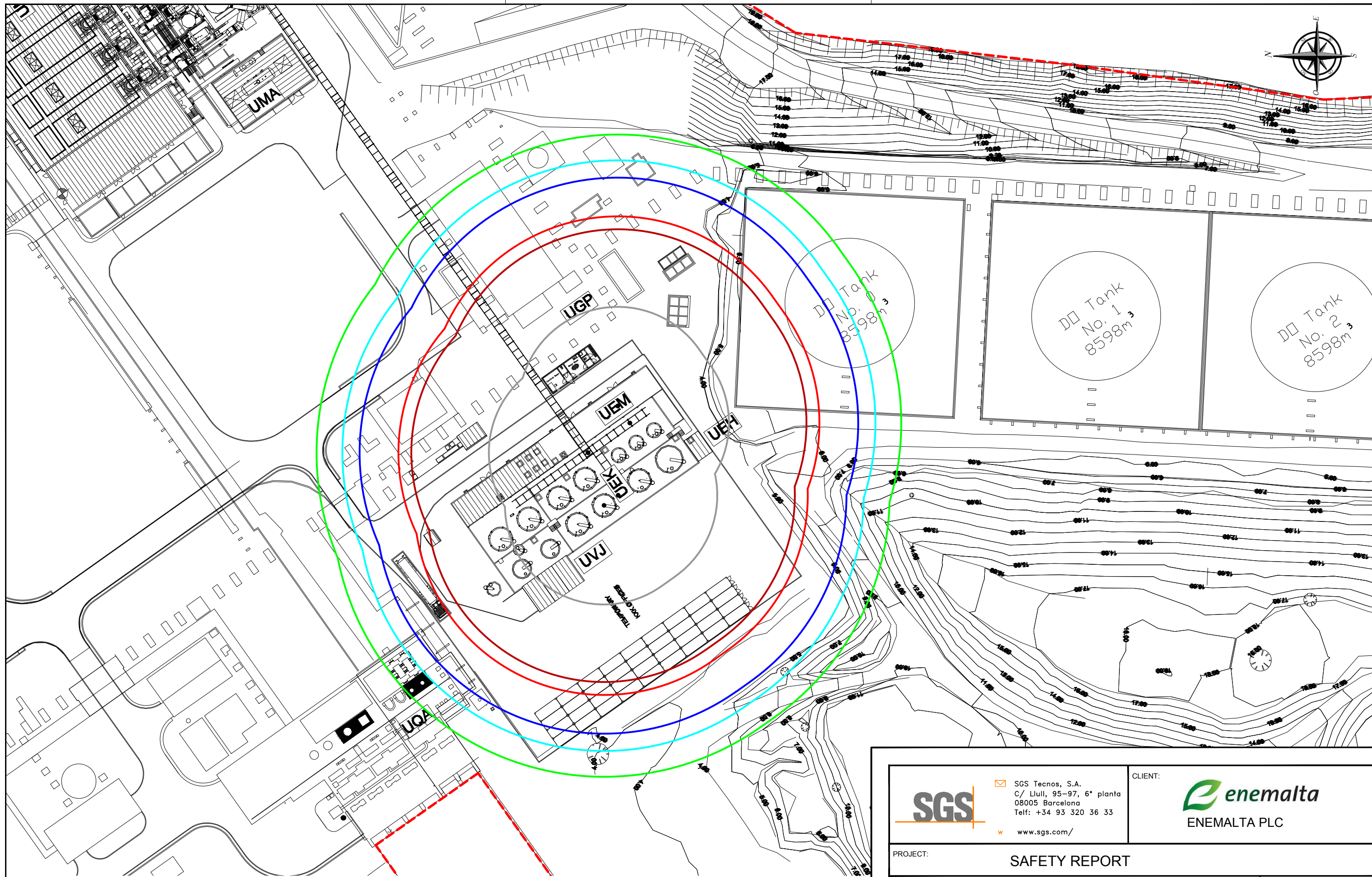










 <div>SGS Tecnos, S.A. C/ Lluís, 95-97, 6ª planta 08005 Barcelona Telf: +34 93 320 36 33 www.sgs.com/</div>		CLIENT:  ENEMALTA PLC	
PROJECT:		SAFETY REPORT	
DRAWING NAME:		HFO D3 buffer tanks	DRAWING: HFO-008-CF
LOCATION:		DELIMARA- MALTA	SCALE: DINA3: 1/800
REFERENCE: 02/901/200560-001		DATE: MAY 2016	DRAWN BY: JORDI ÁLVAREZ

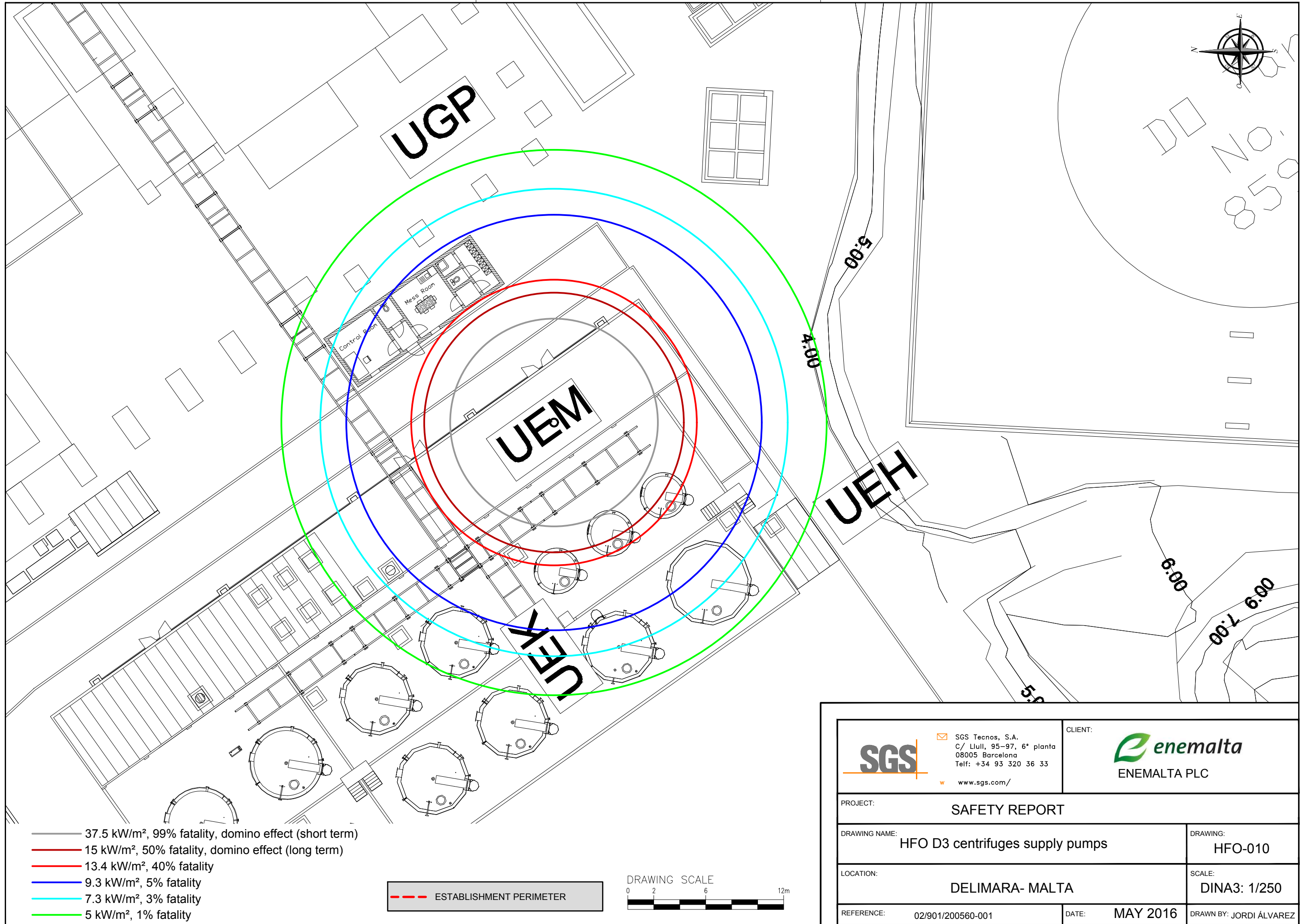


- 37.5 kW/m², 99% fatality, domino effect (short term)
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- 13.4 kW/m², 40% fatality
- 9.3 kW/m², 5% fatality
- 7.3 kW/m², 3% fatality
- 5 kW/m², 1% fatality

--- ESTABLISHMENT PERIMETER



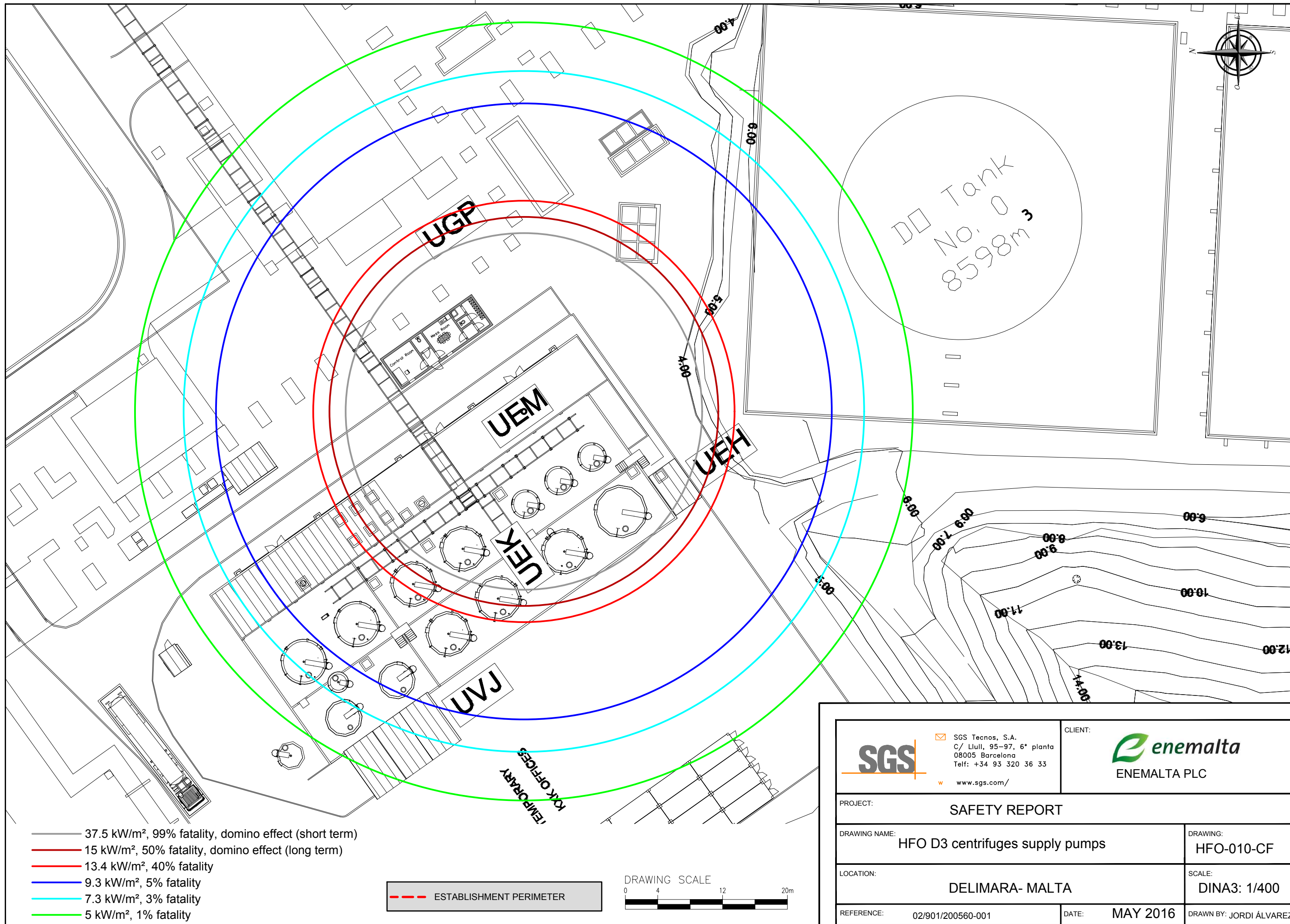
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PROJECT: SAFETY REPORT			
DRAWING NAME: HFO pipelines from D3 buffer tank to D3 centrifuges supply pump		DRAWING: HFO-009-FBR	
LOCATION: DELIMARA- MALTA		SCALE: DINA3: 1/800	
REFERENCE: 02/901/200560-001	DATE: MAY 2016	DRAWN BY: JORDI ÀLVAREZ	





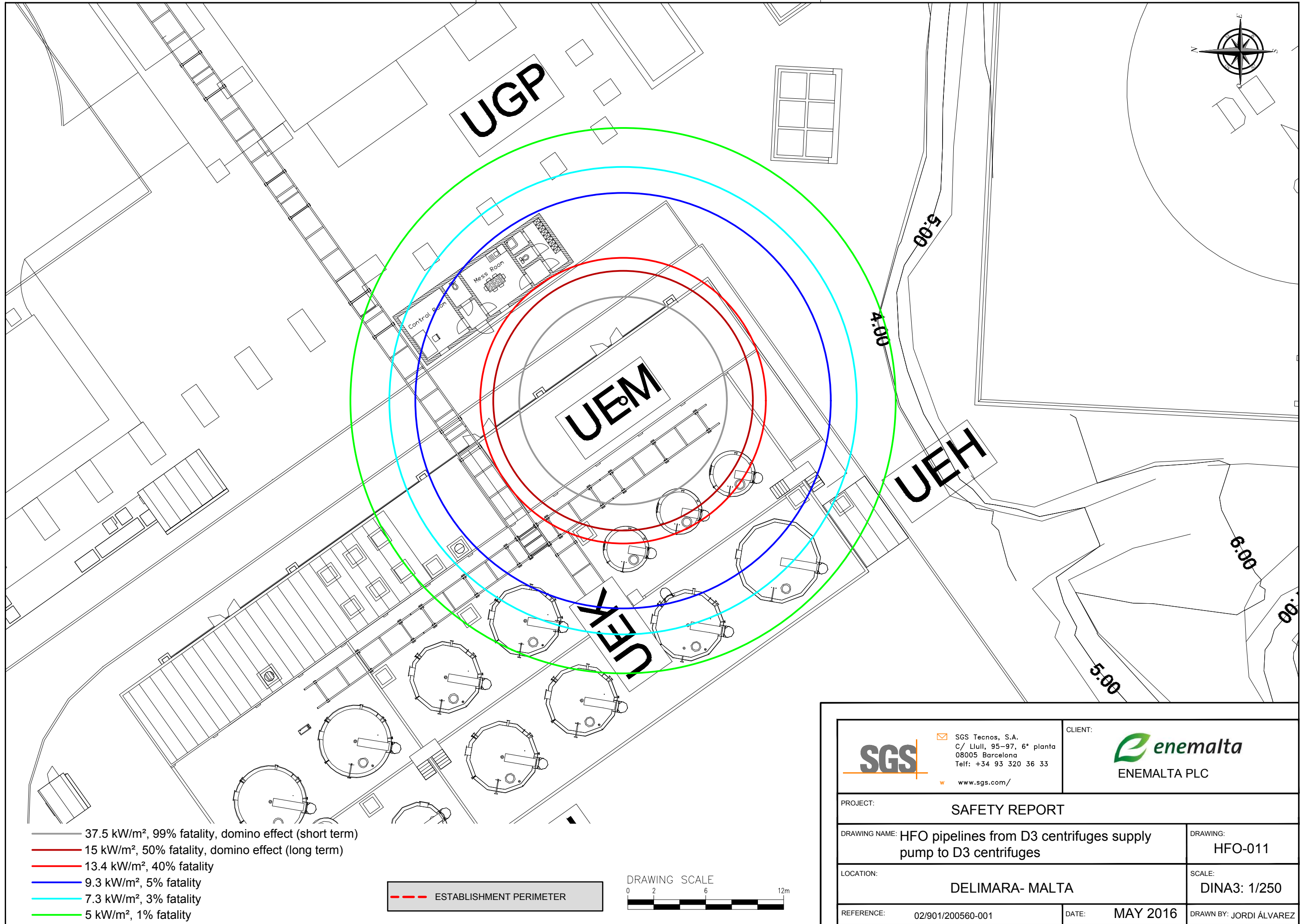
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Telf: +34 93 320 36 33
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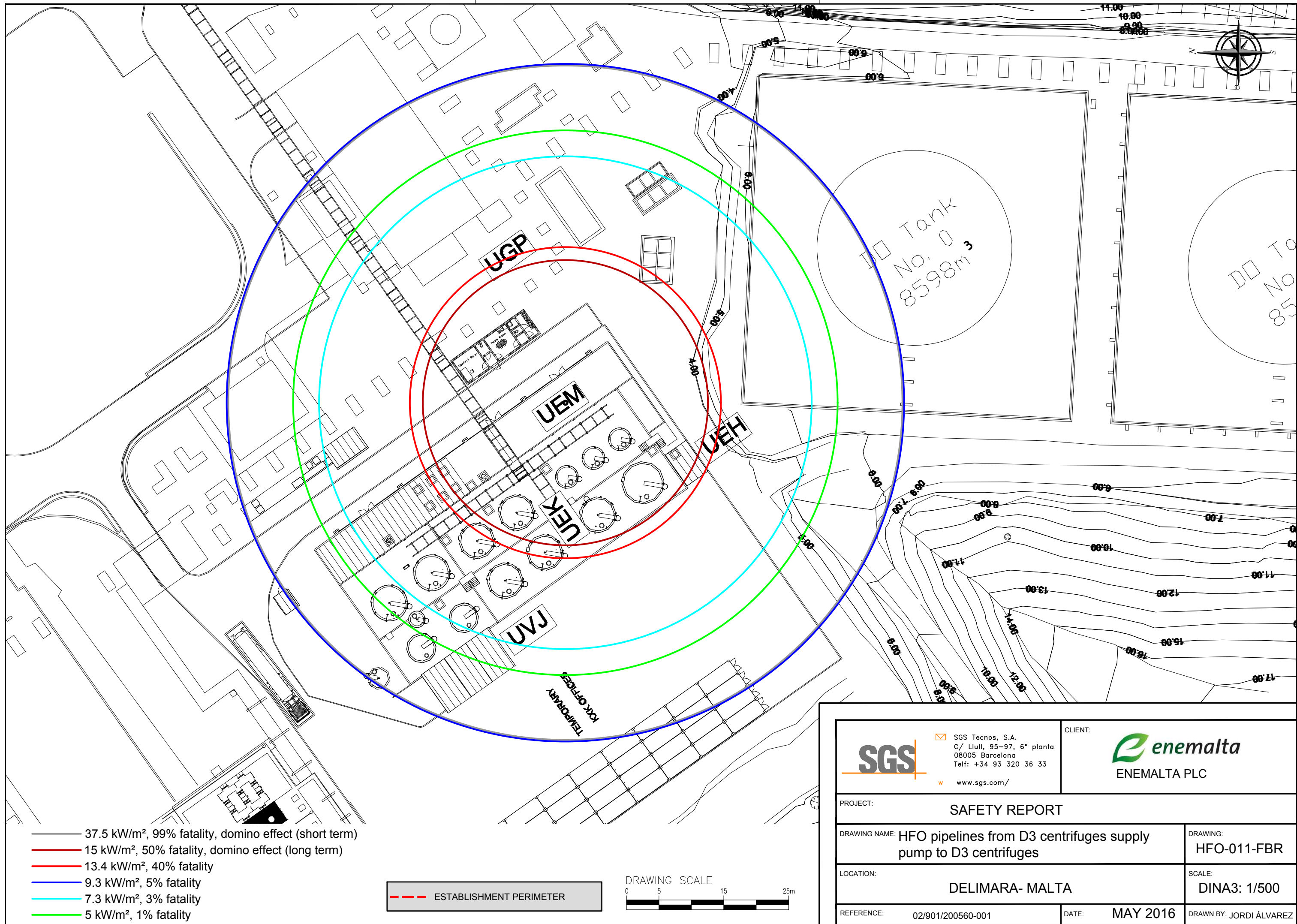






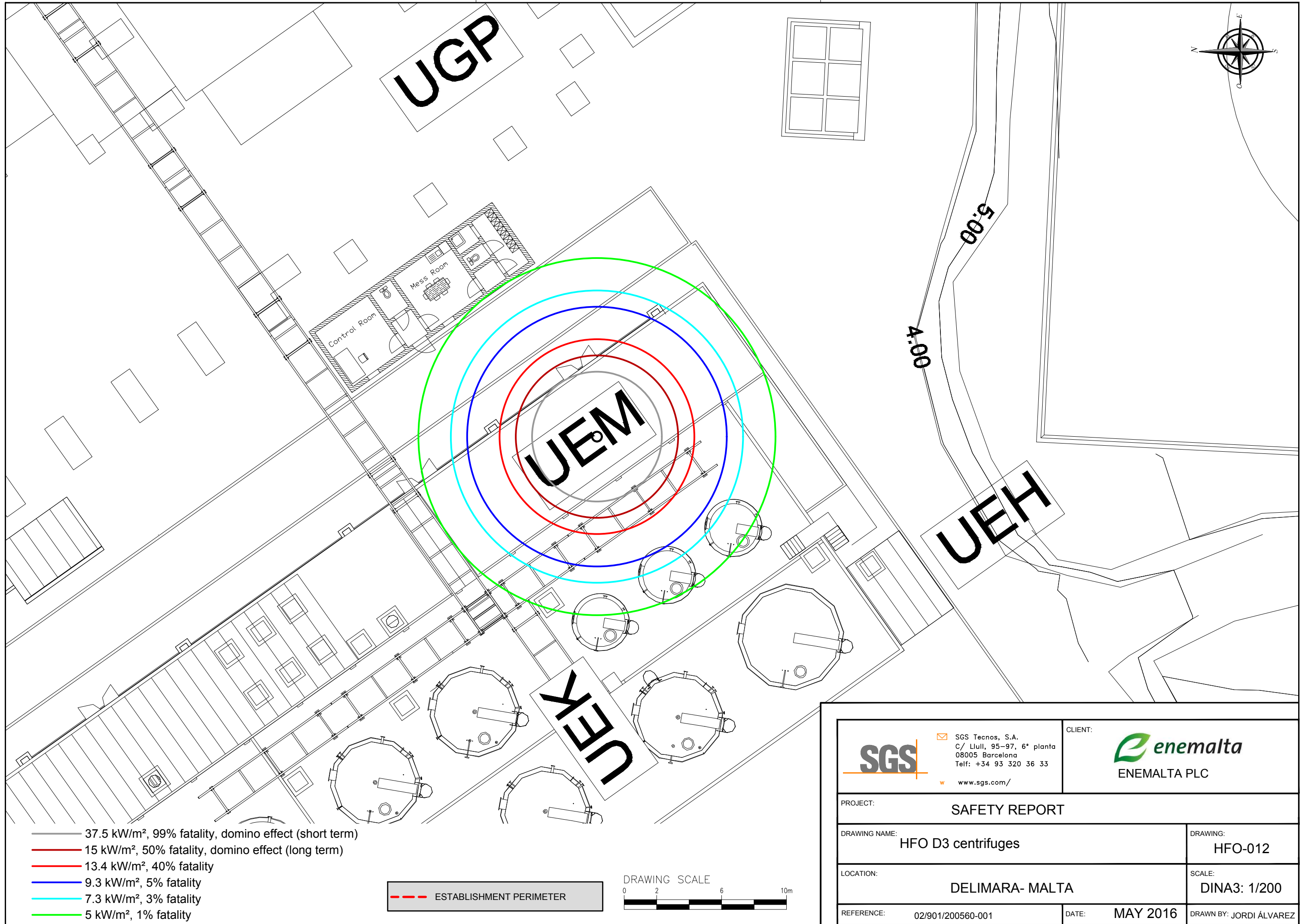
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PROJECT:		SAFETY REPORT	
DRAWING NAME:		HFO D3 centrifuges supply pumps	DRAWING: HFO-010-CF
LOCATION:		DELIMARA- MALTA	SCALE: DINA3: 1/400
REFERENCE:		02/901/200560-001	DATE: MAY 2016 DRAWN BY: JORDI ÀLVAREZ

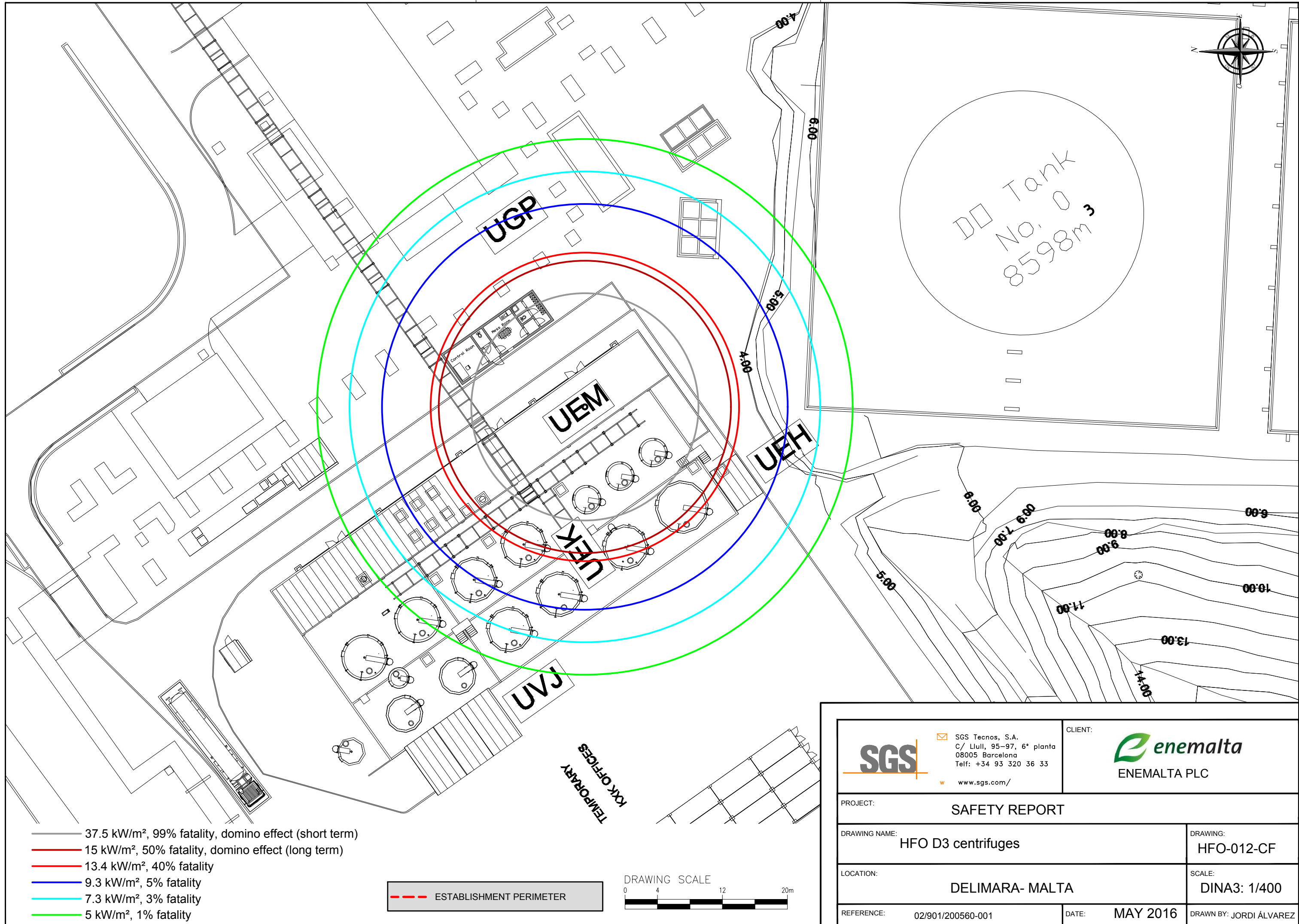


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PROJECT: SAFETY REPORT			
DRAWING NAME: HFO pipelines from D3 centrifuges supply pump to D3 centrifuges		DRAWING: HFO-011	
LOCATION: DELIMARA- MALTA		SCALE: DINA3: 1/250	
REFERENCE: 02/901/200560-001	DATE: MAY 2016	DRAWN BY: JORDI ÀLVAREZ	

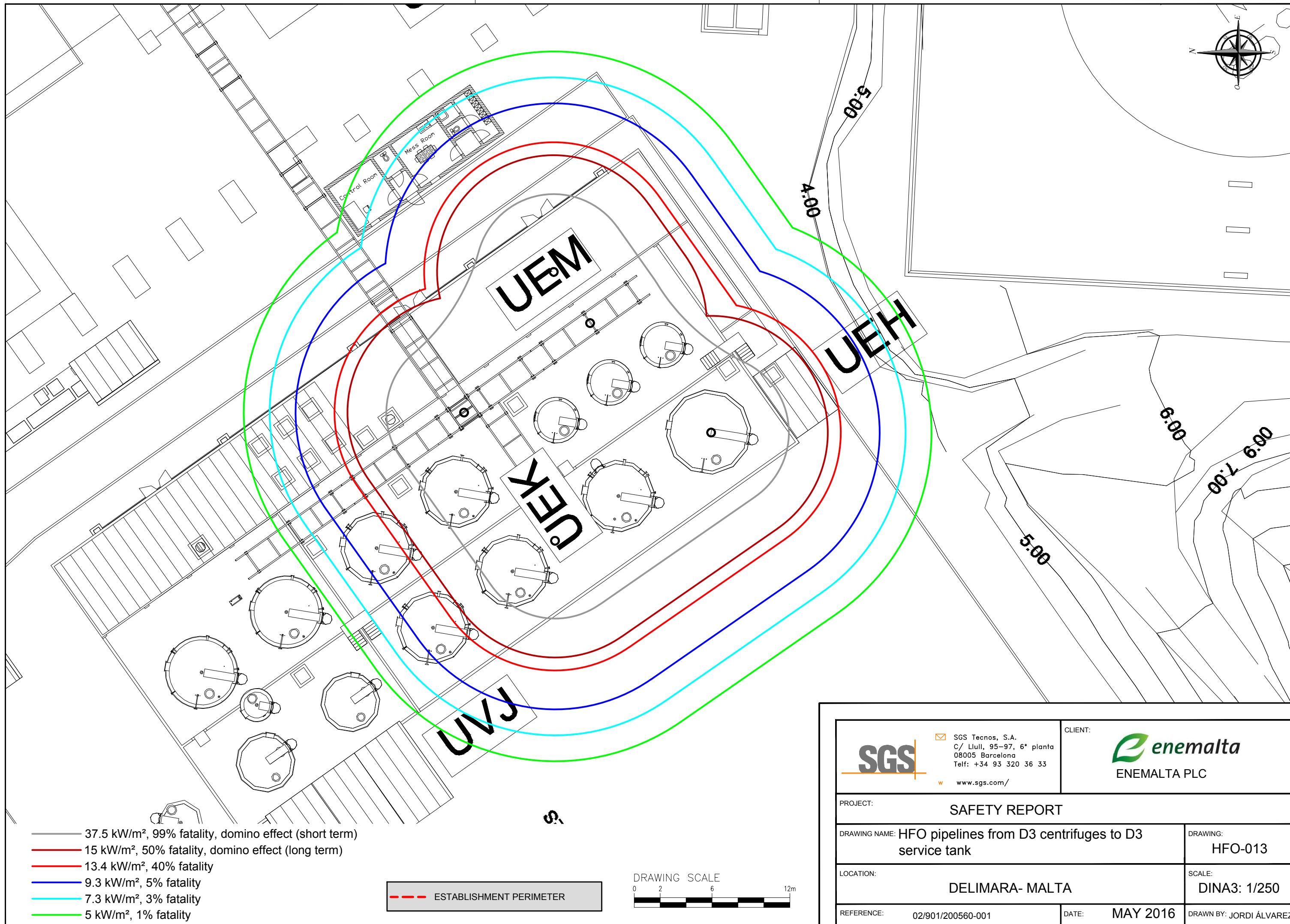


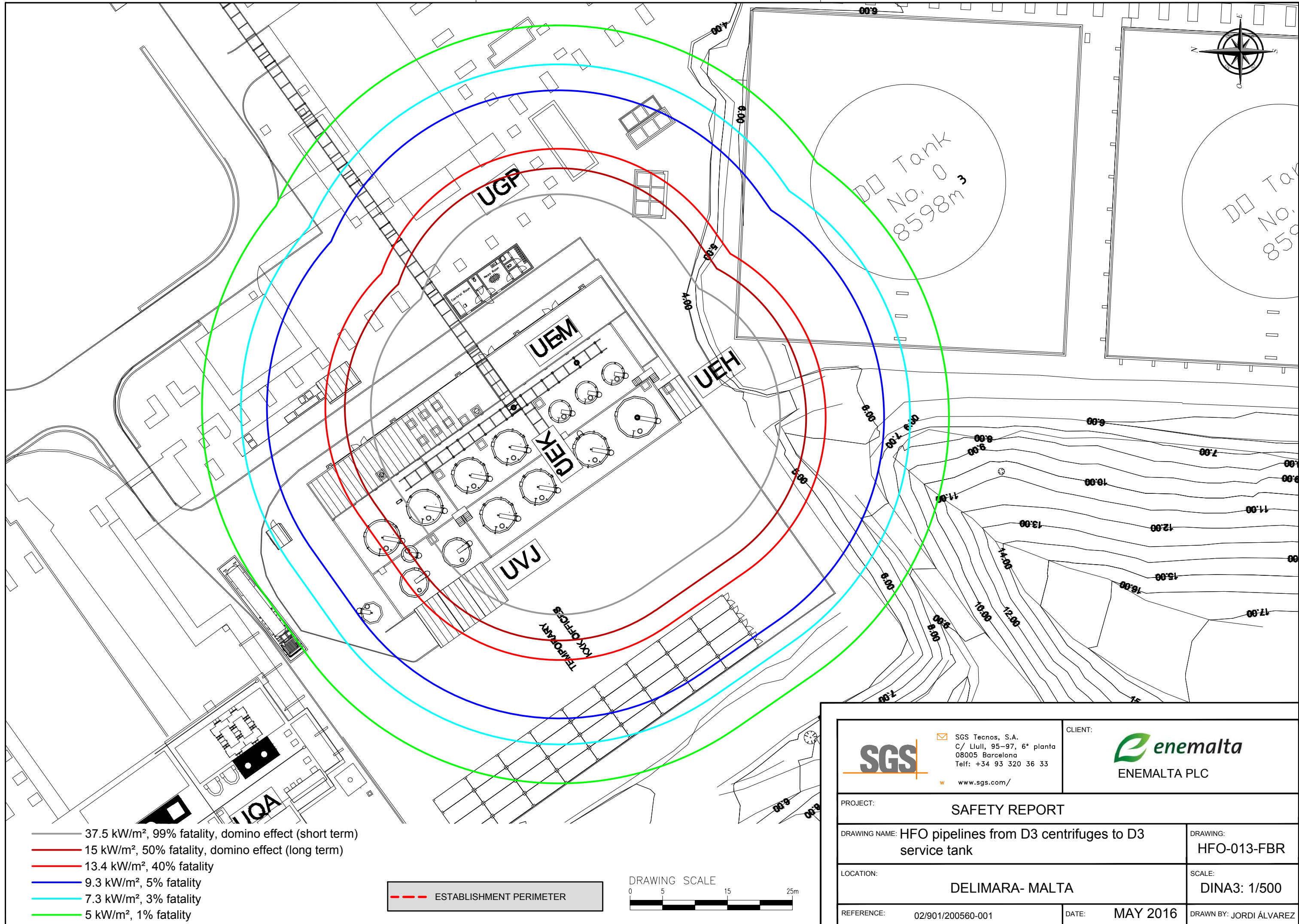
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PROJECT:		SAFETY REPORT	
DRAWING NAME:		HFO pipelines from D3 centrifuges supply pump to D3 centrifuges	DRAWING: HFO-011-FBR
LOCATION:		DELIMARA- MALTA	SCALE: DINA3: 1/500
REFERENCE:		02/901/200560-001	DATE: MAY 2016
			DRAWN BY: JORDI ÀLVAREZ





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PROJECT: SAFETY REPORT			
DRAWING NAME: HFO D3 centrifuges		DRAWING: HFO-012-CF	
LOCATION: DELIMARA- MALTA		SCALE: DINA3: 1/400	
REFERENCE: 02/901/200560-001		DATE: MAY 2016	DRAWN BY: JORDI ÀLVAREZ







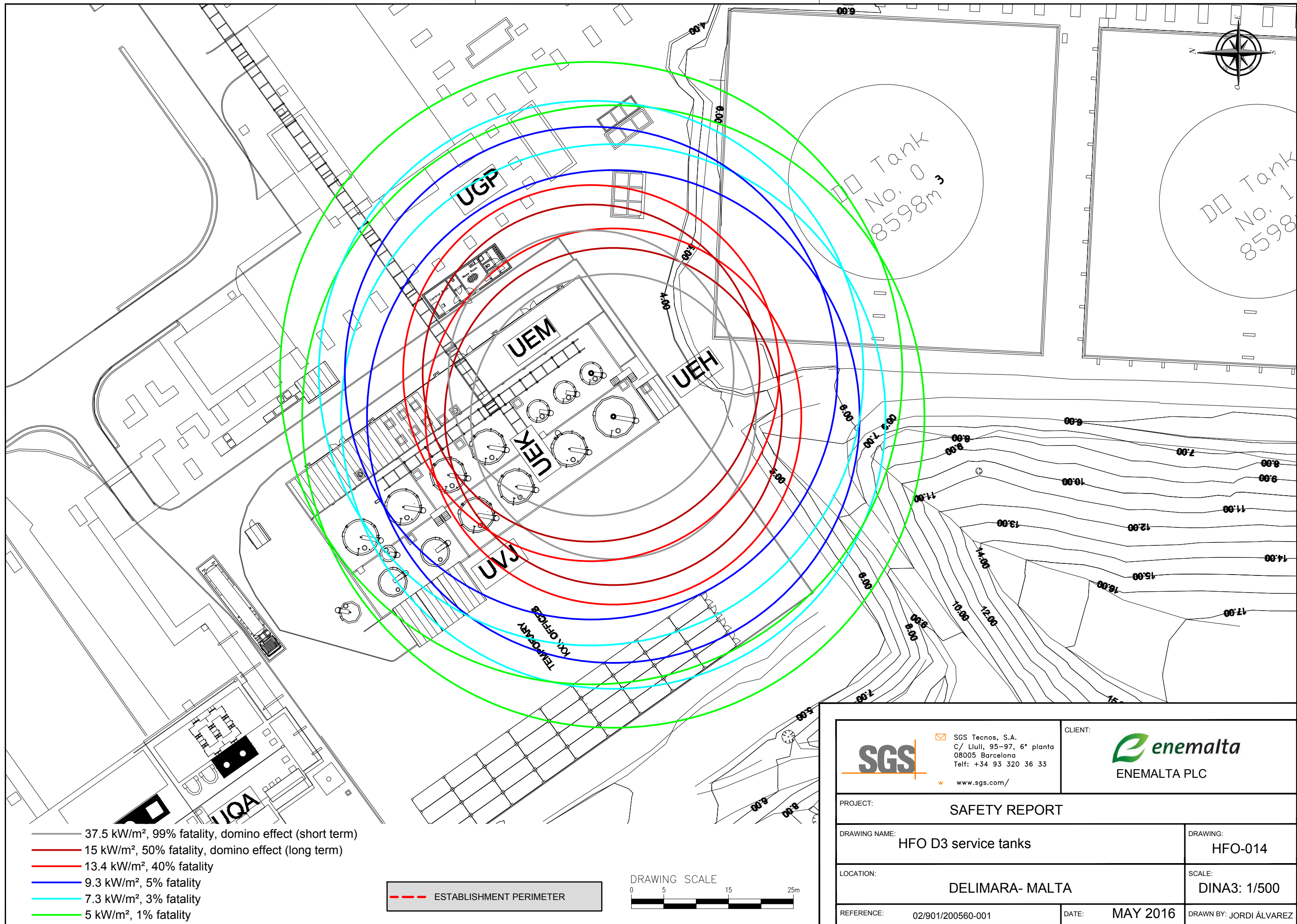


- 37.5 kW/m², 99% fatality, domino effect (short term)
- 15 kW/m², 50% fatality, domino effect (long term)
- 13.4 kW/m², 40% fatality
- 9.3 kW/m², 5% fatality
- 7.3 kW/m², 3% fatality
- 5 kW/m², 1% fatality

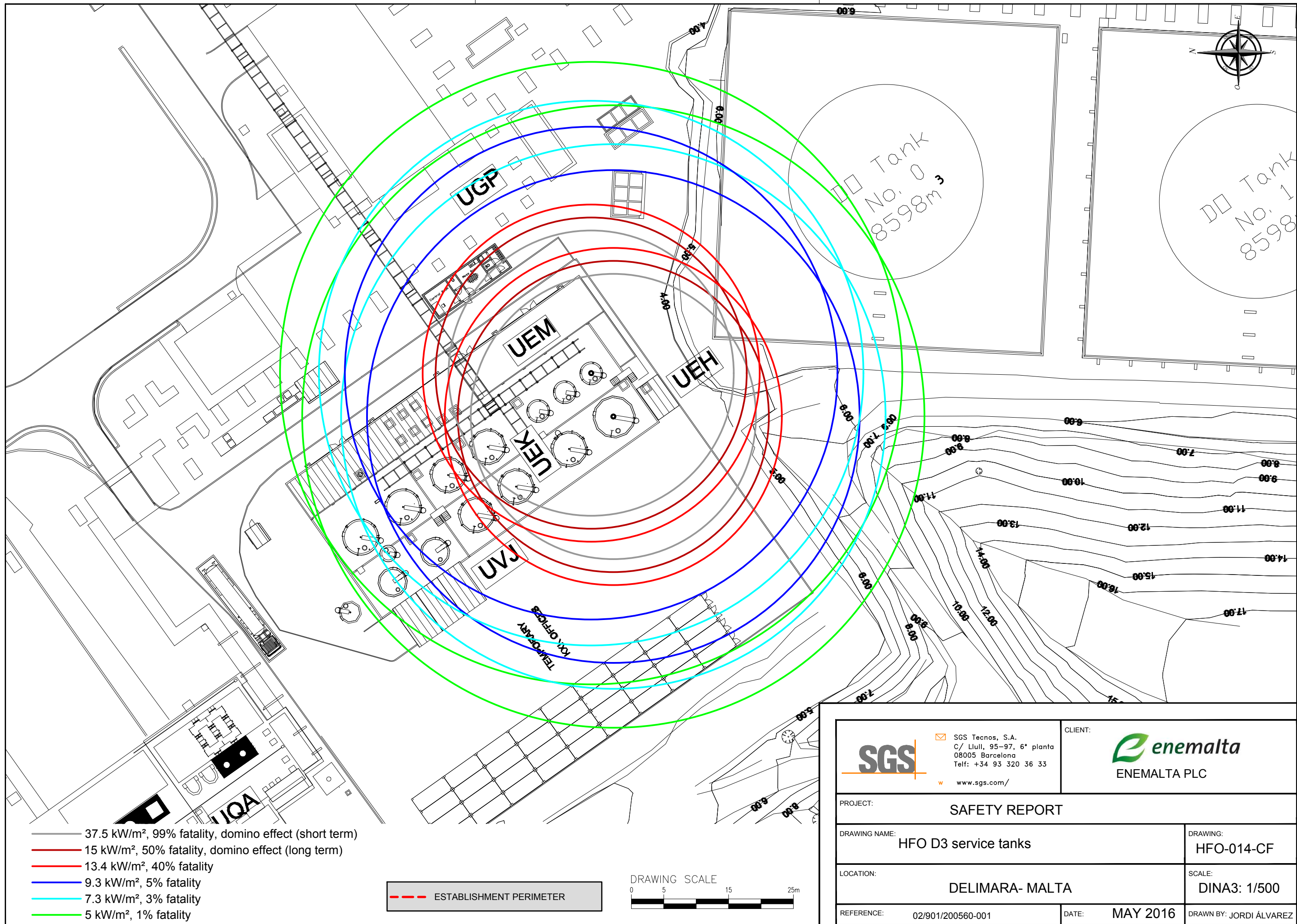
ESTABLISHMENT PERIMETER

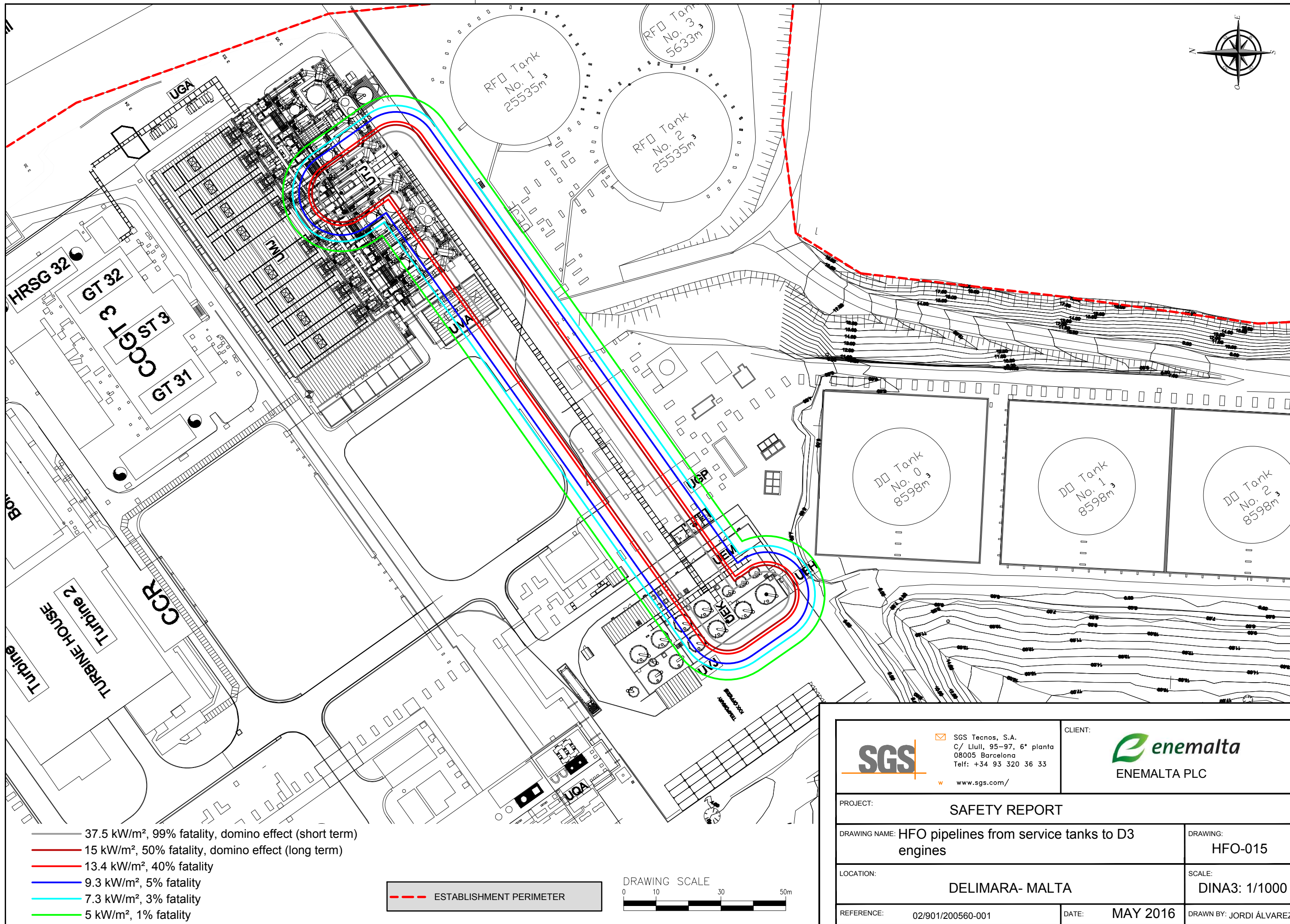


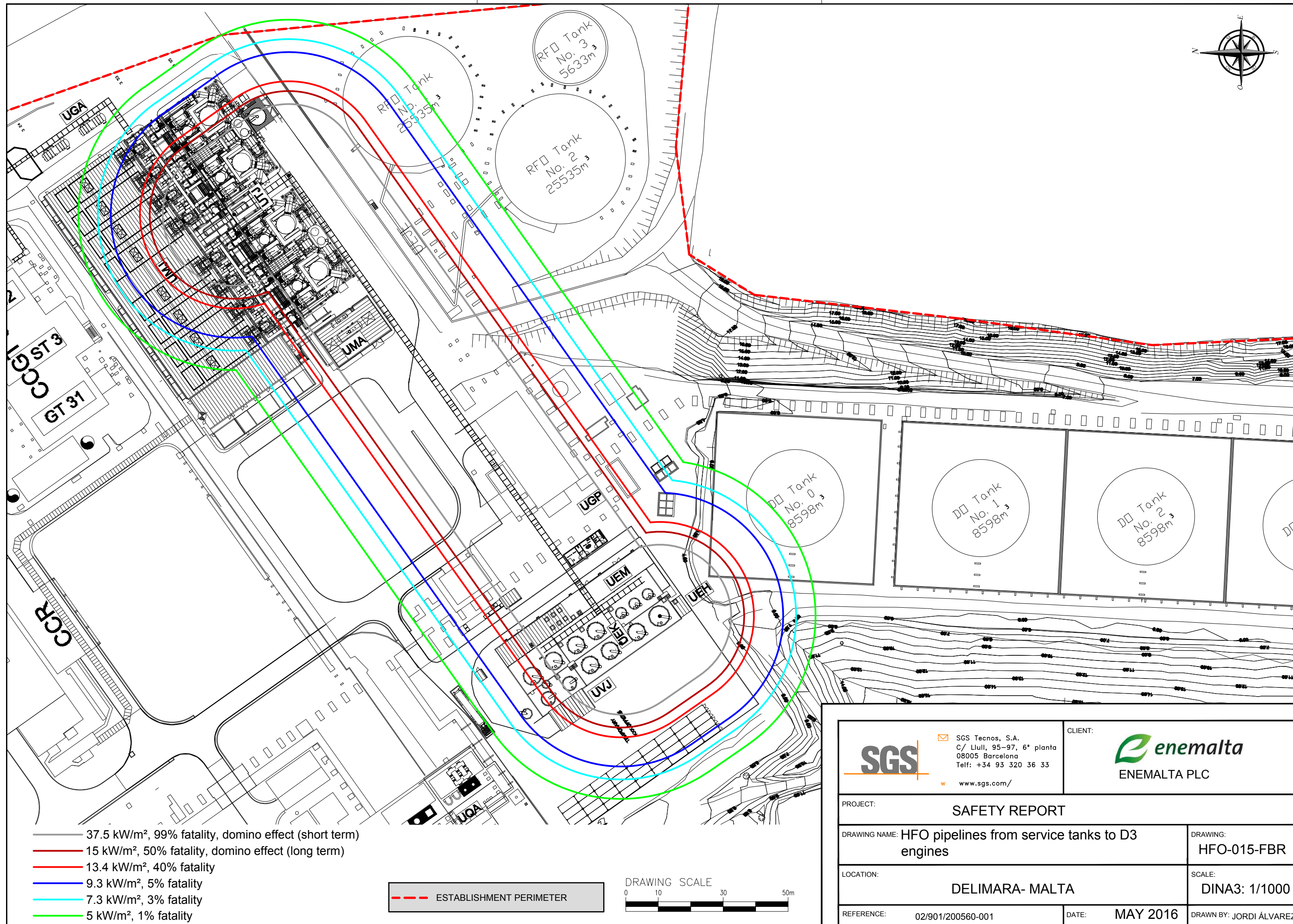
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PROJECT: SAFETY REPORT			
DRAWING NAME: HFO pipelines from D3 centrifuges to D3 service tank		DRAWING: HFO-013-FBR	
LOCATION: DELIMARA- MALTA		SCALE: DINA3: 1/500	
REFERENCE: 02/901/200560-001	DATE: MAY 2016	DRAWN BY: JORDI ÀLVAREZ	



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PROJECT: SAFETY REPORT			
DRAWING NAME: HFO D3 service tanks		DRAWING: HFO-014	
LOCATION: DELIMARA- MALTA		SCALE: DINA3: 1/500	
REFERENCE: 02/901/200560-001	DATE: MAY 2016	DRAWN BY: JORDI ÀLVAREZ	







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CLIENT:

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ENEMALTA PLC

PROJECT:

SAFETY REPORT

DRAWING NAME: HFO pipelines from service tanks to D3 engines

DRAWING:

HFO-015-FBR

LOCATION:

DELIMARA- MALTA

SCALE:

DINA3: 1/1000

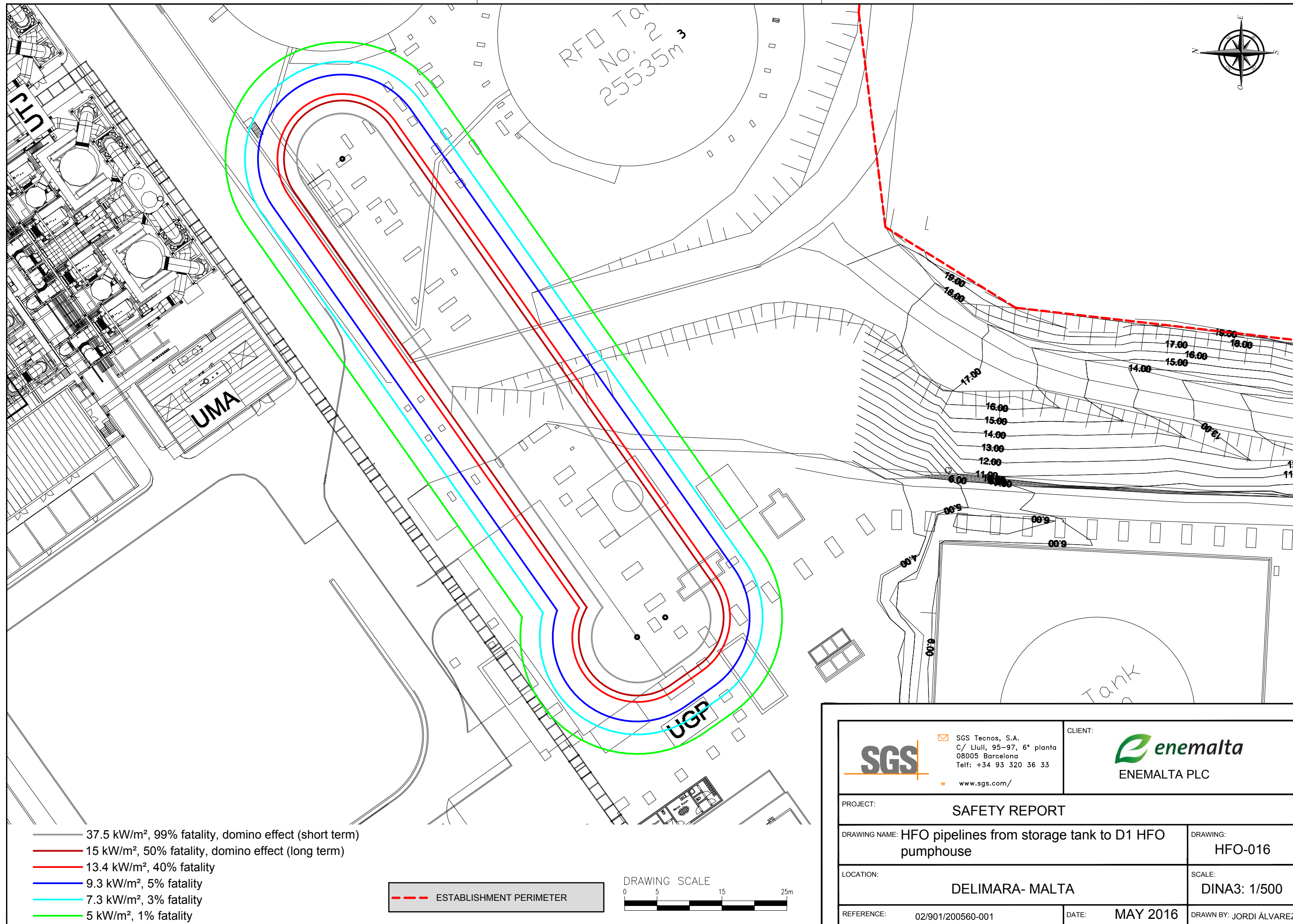
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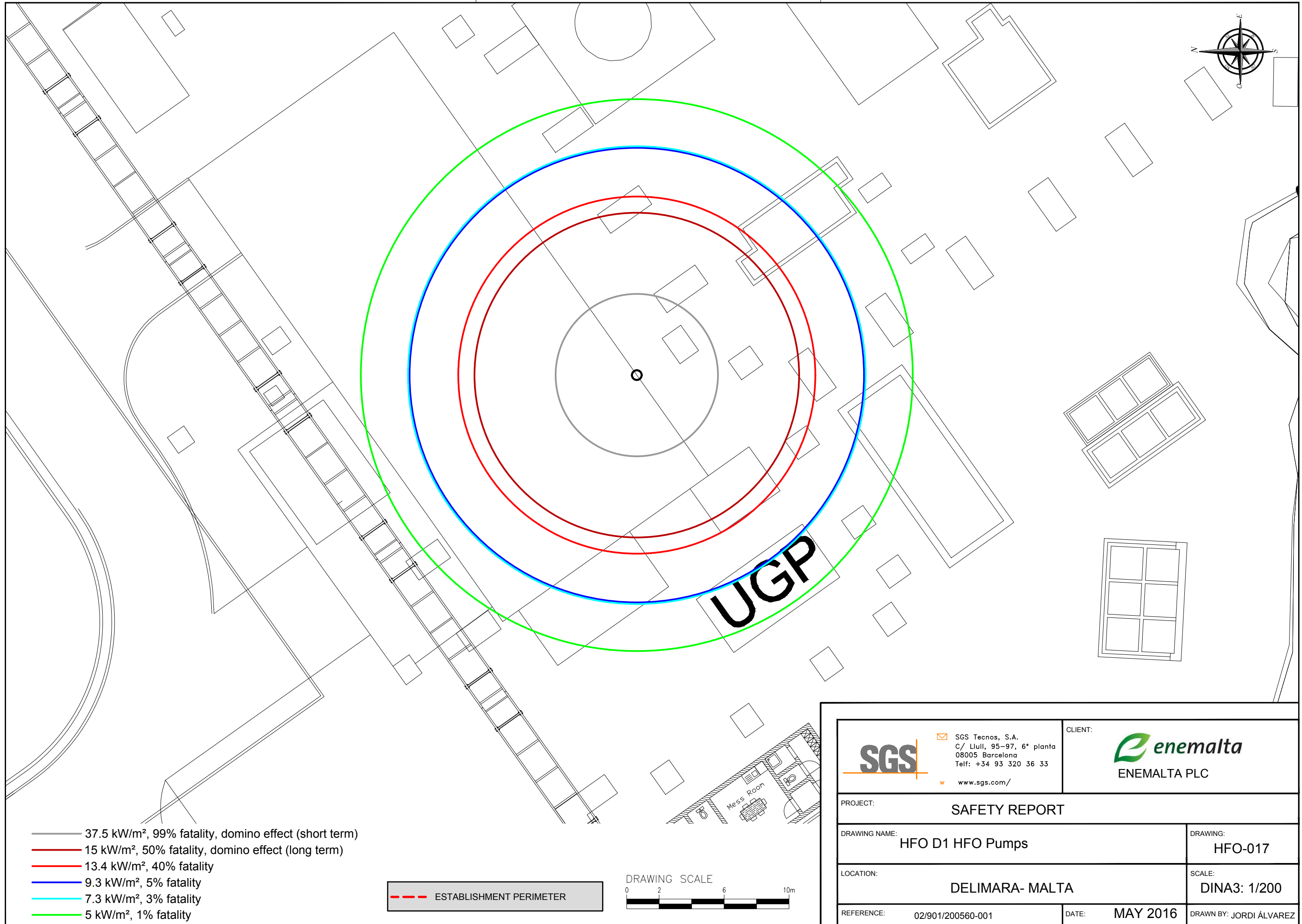
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DATE:

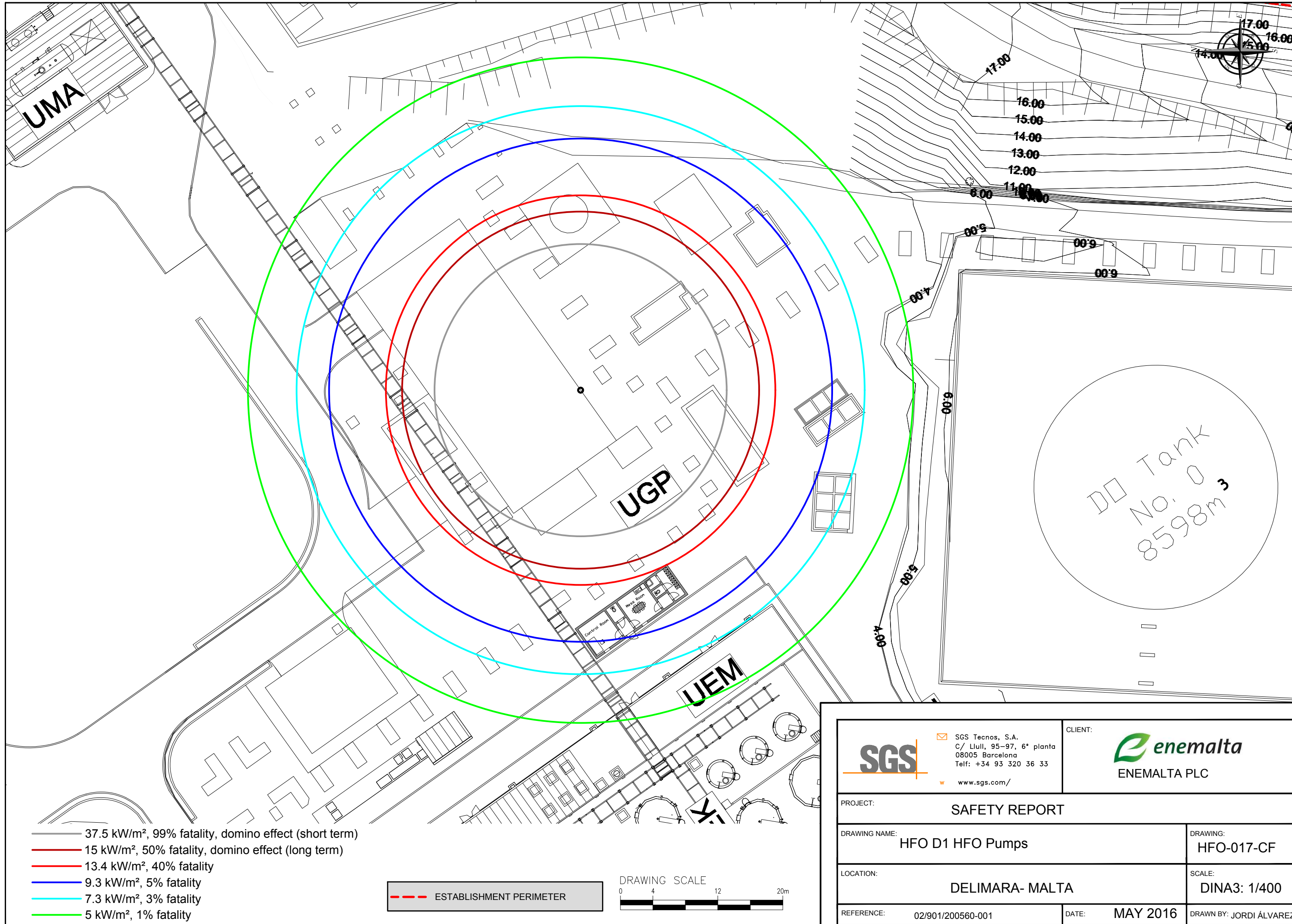
MAY 2016



DRAWN BY: JORDI ÀLVAREZ

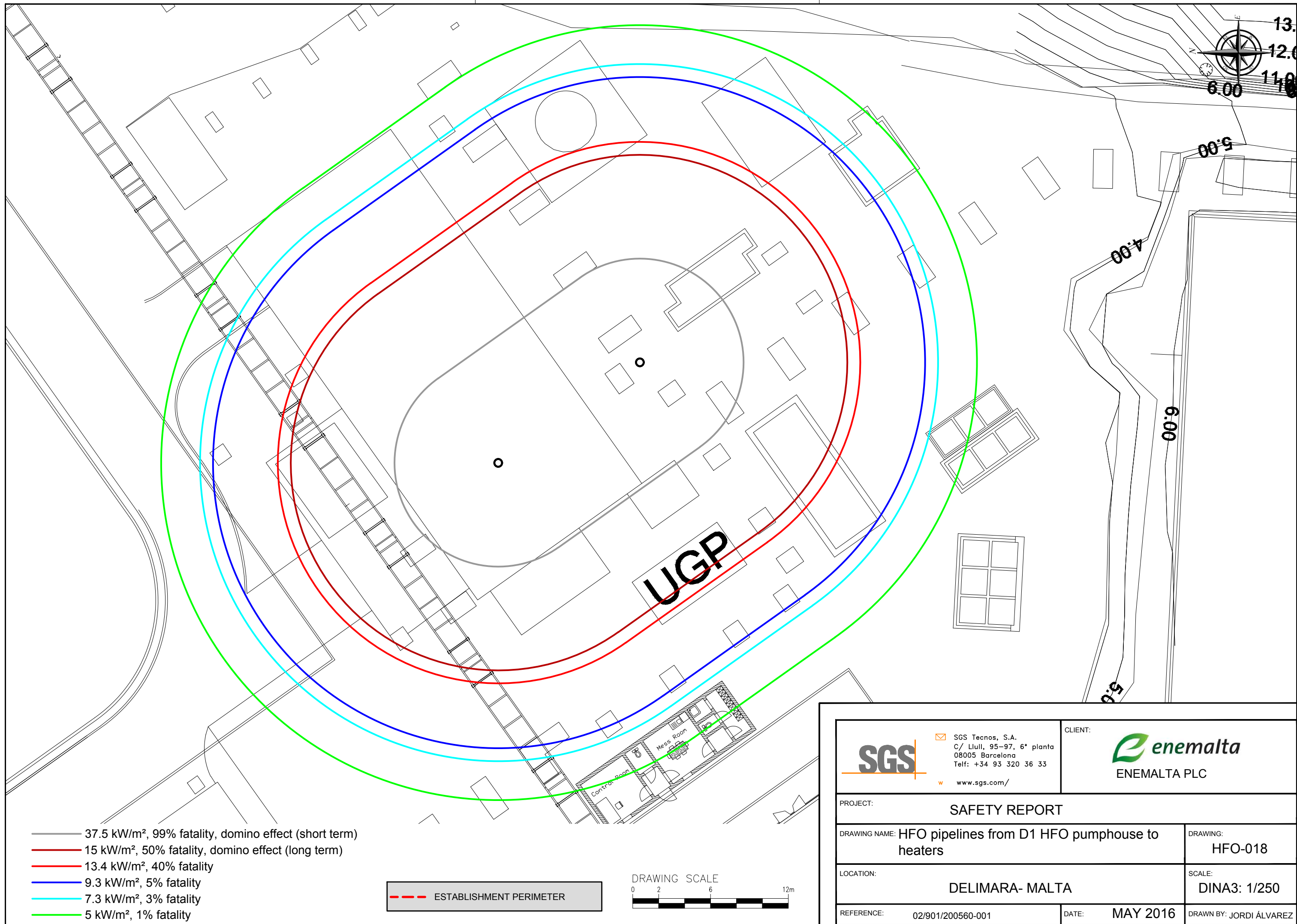


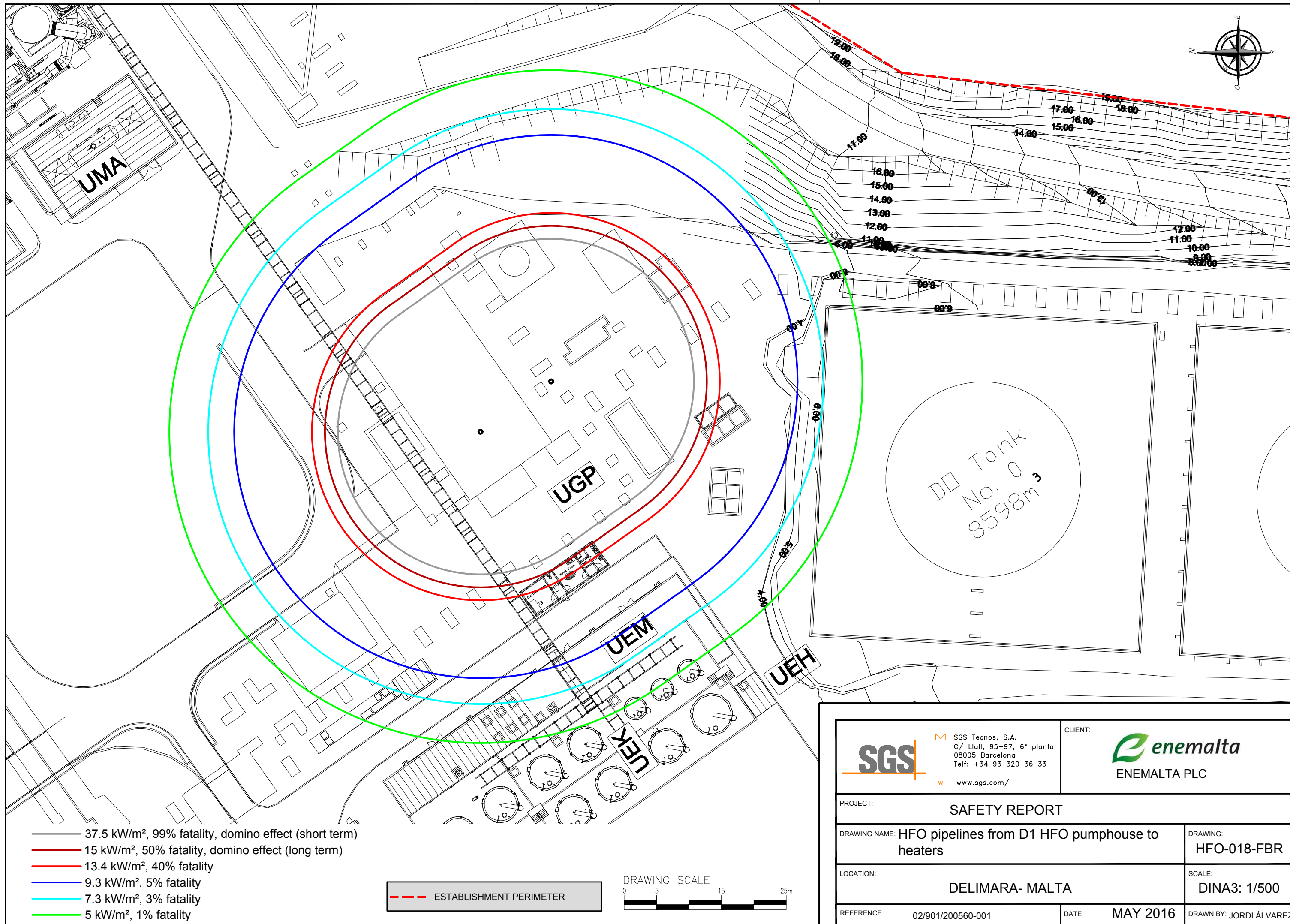


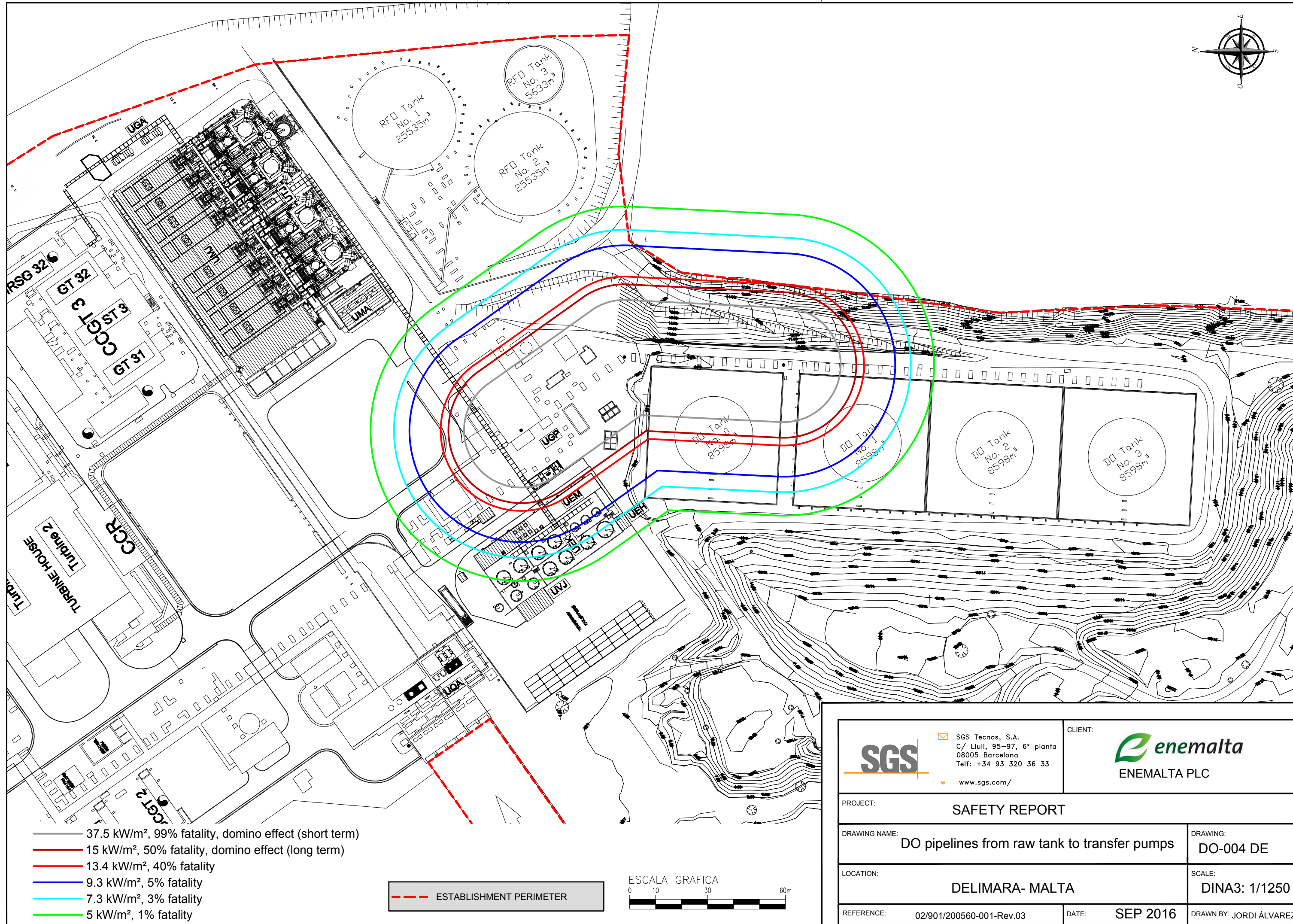
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PROJECT: SAFETY REPORT			
DRAWING NAME: HFO D1 HFO Pumps		DRAWING: HFO-017	
LOCATION: DELIMARA- MALTA		SCALE: DINA3: 1/200	
REFERENCE: 02/901/200560-001		DATE: MAY 2016 DRAWN BY: JORDI ÀLVAREZ	



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PROJECT:		SAFETY REPORT	
DRAWING NAME:		HFO D1 HFO Pumps	DRAWING: HFO-017-CF
LOCATION:		DELIMARA- MALTA	SCALE: DINA3: 1/400
REFERENCE:		02/901/200560-001	DATE: MAY 2016
			DRAWN BY: JORDI ÀLVAREZ









- 37.5 kW/m², 99% fatality, domino effect (short term)
- 15 kW/m², 50% fatality, domino effect (long term)
- 13.4 kW/m², 40% fatality
- 9.3 kW/m², 5% fatality
- 7.3 kW/m², 3% fatality
- 5 kW/m², 1% fatality

ESTABLISHMENT PERIMETER



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PROJECT: SAFETY REPORT			
DRAWING NAME: DO pipelines from raw tank to transfer pumps		DRAWING: DO-004 DE	
LOCATION: DELIMARA- MALTA		SCALE: DINA3: 1/1250	
REFERENCE: 02/901/200560-001-Rev.03	DATE: SEP 2016	DRAWN BY: JORDI ÀLVAREZ	



ANNEX 4. CALCULATIONS

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units		
		HFO Unloading hose		Units					
HFO-001	Leak in unloading hose with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	HFO		Confined release		Yes	--	
		Maximum volume	25000	m3	Bund dimensions			m2	
		Maximum capacity	24775	t	Roughness legh description		Concrete	--	
		Hose diameter	10	inch	Roughness		10,00	cm	
		Length	35	m	Soil temperature		19,00	°C	
		Design pressure	na	bar	Meteo station		Malta airport	--	
		Operating pressure	8	bar	Ambient relative humidity		75,00	%	
		Rupture pressure	na	bar	Ambient temperature		19,00	°C	
		Design temperature	na	°C	Meteorological condition 1		D / 4	-- / m/s	
		Operating temperature	45	°C	Meteorological condition 2		F / 2	-- / m/s	
		Flow rate	1000	t/h	RELEASE DATA				
		Release mass flow [3]	27,78	kg/s	Release duration		120	s	
					Mass flow rate		27,78	kg/s	
					Total mass released		3333	kg	
					Total volume released [1]		3	m3	
					EVAPORATION & DISPERSION DATA				
					Pool area [2]		673	m²	
					Evaporation rate 5D		29,273	kg/s	
					Evaporation rate 2F		29,273	kg/s	
					Evaporation duration 5D		1,2073	s	
					Evaporation duration 2F		1,2074	s	
					POOL FIRE DAMAGE ZONES				
					LC99% - 37,5 kW/m2		15	m	
					LC50% - 15 kW/m2		18	m	
					LC40% - 13,4 kW/m2		20	m	
					LC5% - 9,3 kW/m2		27	m	
					LC3% - 7,3 kW/m2		30	m	
					LC01% - 5 kW/m2		34	m	
					FLASH FIRE & EXPLOSION DAMAGE ZONES				
					Length of cloud (between LEL) 5D		0	m	
					Length of cloud (between LEL) 2F		0	m	
					ENVIRONMENTAL SPILLAGE DATA				
					Oil interceptor		NA	--	
					Oil interceptor capacity		0	m3	
					Oil interceptor efficiency		NA	--	
					Total volume released to water		3	m3	

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on water) = 5 mm

[3] Equivalent to the 10% of the flow rate

Case description: Scenario 1 - evap d

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 1 - evap f

Parameters

Inputs	Scenario 1 - evap d	Scenario 1 - evap f
Chemical name (DIPPR)	n-EICOSANE (DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	First 20% average (flammable)	First 20% average (flammable)
Evaporation from land or water	Water	Water
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	27,78	27,78
Duration of the release (s)	120	120
Total mass released (kg)		
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land		
Type of pool growth on Water	Confined water surface	Confined water surface
Temperature of the pool (°C)	45	45
Maximum pool surface area (m2)	673	673
Temperature of the subsoil (°C)		
Temperature of the water (°C)	19	19
Max temperature difference between pool and water (K)	500	500
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil		
Subsoil roughness description		
Maximum evaluation time for evaporation (s)	1800	1800

Results	Scenario 1 - evap d	Scenario 1 - evap f
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	1799,5	1799,5
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	0,00014058	0,000145
Purple book representative evaporation duration (s)	765,52	642,93
Representative temperature (°C)	60,159	67,741
Representative pool diameter (m)	29,273	29,273
Density after mixing with air (kg/m3)	1,2073	1,2074
Total evaporated mass (kg)	0,10761	0,093223
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	673	673

Other information

Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1F\andrea_silvasantos at 05/11/2015 10:56:42

Chemical source date	14/09/2010
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Effects report created by ESLR2RH1F\andrea_silvasantos at 04/11/2015 15:53:07

Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1F\andrea_silvasantos at 04/11/2015 15:37:41

Case description: scenario 1 - PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 1 - evap d)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 1 - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 1 - evap d)

Parameters

Inputs

	LC05 (linked to Pool evaporation -	PFIRE LC40,
	n-EICOSANE (DIPPR)	(DIPPR)
Chemical name (DIPPR)	Confined	Confined
Pool size determination	3333,3	3333,3
Total mass released (kg)	0,00014058	0,00014058
Mass flow rate of the source (kg/s)	765,52	765,52
Duration of the release (s)	673	673
Pool surface poolfire (m2)	0	0
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)		
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	45	45
Pool burning rate	Calculate/Default	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	Calculate/Default	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		

Results

	LC05 (linked to Pool evaporation -	PFIRE LC40,
Max Diameter of the Pool Fire (m)	29,273	29,273
Heat radiation at X (kW/m2)	0,00090872	0,00090872
Heat radiation first contour at (m)	34,276	19,99
Heat radiation second contour at (m)	29,896	18,358
Heat radiation third contour at (m)	26,548	14,637
Combustion rate (kg/s)	23,168	23,168
Duration of the pool fire (s)	143,87	143,87
Heat emission from fire surface (kW/m2)	20,299	20,299
Flame tilt (deg)	50,818	50,818
View factor (%)	0,011187	0,011187
Atmospheric transmissivity (%)	40,016	40,016
Flame temperature (°C)	504,26	504,26
Height of the Flame (m)	18,38	18,38
Calculated pool surface area (m2)	673	673
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97

Other information

Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 08/04/2016 12:44:34

Chemical source date	14/09/2010
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Effects report created by ESLR2RH1Flandrea_silvasantos at 04/11/2015 15:54:03

Case description: scenario 1 - explosive mass D (linked to Pool evaporation - Scenario 1 - evap d)

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 1 - explosive mass F (linked to Pool evaporation - Scenario 1 - evap f)

Parameters

Inputs	explosive mass	explosive mass
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
<i>Total mass released (kg)</i>		
Mass flow rate of the source (kg/s)	0,00014058	0,000145
Duration of the release (s)	765,52	642,93
<i>Initial liquid mass fraction (%)</i>		
Fixed pool surface (m2)	673	673
<i>Diameter of expanded jet (m)</i>		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
<i>Z-coordinate (height) of release (m)</i>		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	2
<i>Inverse Monin-Obukhov length (1/L) (1/m)</i>		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation,
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	explosive mass	explosive mass
Explosive mass at time t (kg)	0	0
Height to LEL at time t (m)	0	0
Length of cloud (between LEL) at time t (m)	0	0
Width of cloud (between LEL) at time t (m)	0	0
Offset between release location and LEL at time t (m)	0	0
Maximum explosive mass (kg)	0	0
...at time tmem (s)	0	0
Start time where 95% of maximum of explosive mass is reached (s)	0	0
Time where explosive mass starts decreasing below 95% of max (s)	0	0
Length of cloud (between LEL) at time tmem (m)	0	0
Width of cloud (between LEL) at time tmem (m)	0	0
Offset between release location and LEL at time tmem (m)	0	0
Maximum area of explosive cloud (m2)	0	0
...at time tmac (s)	0	0
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0	0
Width of cloud (between LEL) at time tmac (m)	0	0
Offset between release location and LEL at time tmac (m)	0	0
Offset between release centre and cloud centre at time tmac (m)	0	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0,096426

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1F\andrea_silvasantos at 05/11/2015 10:57:25

Chemical source date 14/09/2010

Effects report created by ESLR2RH1F\andrea_silvasantos at 04/11/2015 15:55:07

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units		
		HFO Unloading hose		Units					
HFO-001 FBR	Rupture of unloading hose	Substance	HFO		Confined release		Yes	--	
		Maximum volume	25000	m3	Bund dimensions			m2	
		Maximum capacity	24775	t	Roughness legh description		Concrete	--	
		Hose diameter	10	inch	Roughness		10,00	cm	
		Length	35	m	Soil temperature		19,00	°C	
		Design pressure	na	bar	Meteo station		Malta airport	--	
		Operating pressure	8	bar	Ambient relative humidity		75,00	%	
		Rupture pressure	na	bar	Ambient temperature		19,00	°C	
		Design temperature	na	°C	Meteorological condition 1		D / 4	-- / m/s	
		Operating temperature	45	°C	Meteorological condition 2		F / 2	-- / m/s	
		Flow rate	1000	t/h	RELEASE DATA				
		Release mass flow [3]	416,67	kg/s	Release duration		120	s	
					Mass flow rate		416,67	kg/s	
					Total mass released		50000	kg	
					Total volume released [1]		50	m3	
					EVAPORATION & DISPERSION DATA				
					Pool area [2]		10091	m²	
					Evaporation rate 5D		113,35	kg/s	
					Evaporation rate 2F		113,35	kg/s	
					Evaporation duration 5D		1,2076	s	
					Evaporation duration 2F		1,2081	s	
					POOL FIRE DAMAGE ZONES				
					LC99% - 37,5 kW/m2		57	m	
					LC50% - 15 kW/m2		63	m	
					LC40% - 13,4 kW/m2		69	m	
					LC5% - 9,3 kW/m2		87	m	
					LC3% - 7,3 kW/m2		96	m	
					LC01% - 5 kW/m2		110	m	
					FLASH FIRE & EXPLOSION DAMAGE ZONES				
					Length of cloud (between LEL) 5D		0	m	
					Length of cloud (between LEL) 2F		0	m	
					ENVIRONMENTAL SPILLAGE DATA				
					Oil interceptor		NA	--	
					Oil interceptor capacity		0	m3	
					Oil interceptor efficiency		NA	--	
					Total volume released to water		50	m3	

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on water) = 5 mm

[3] Equivalent to the 1,5 x flow rate

Case description: Scenario 1A - evap d

Model: Pool evaporation

version: 5.16 (04/04/2016)

Reference: Yellow Book CPR14E 2nd Edition - Chapter 5: Evaporation

compared to: Scenario 1A - evap f

Parameters

Inputs	Scenario 1A - evap d	Scenario 1A - evap f
Chemical name (DIPPR)	n-EICOSANE (DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	First 20% average (flammable)	First 20% average (flammable)
Evaporation from land or water	Water	Water
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	416,67	416,67
Duration of the release (s)	120	120
Total mass released (kg)		
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land		
Type of pool growth on Water	Confined water surface	Confined water surface
Temperature of the pool (°C)	45	45
Maximum pool surface area (m2)	10091	10091
Temperature of the subsoil (°C)		
Temperature of the water (°C)	19	19
Max temperature difference between pool and water (K)	500	500
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil		
Subsoil roughness description		
Maximum evaluation time for evaporation (s)	1800	1800

Results

	Scenario 1A - evap d	Scenario 1A - evap f
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	137	137
Time until pool has totally evaporated (s)	0	0
Purple book representative evaporation rate (kg/s)	0,0024953	0,0022658
Purple book representative evaporation duration (s)	713,52	618,25
Representative temperature (°C)	63,335	69,749
Representative pool diameter (m)	113,35	113,35
Density after mixing with air (kg/m3)	1,2076	1,2081
Total evaporated mass (kg)	1,7804	1,4008
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	10091	10091

Other information

Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1F\andrea_silvasantos at 04/04/2016 13:01:31

Chemical source date	14/09/2010
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Effects report created by ESLR2RH1F\andrea_silvasantos at 04/11/2015 15:53:07

Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1F\andrea_silvasantos at 04/11/2015 15:37:41

Case description: scenario 1A - PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 1A - evap d)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 1A - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 1A - evap d)

Parameters

Inputs	LC01, LC03, LC05	LC40, LC50, LC99
Chemical name (DIPPR)	n-EICOSANE (DIPPR)	n-EICOSANE (DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	50000	50000
Mass flow rate of the source (kg/s)	0,0024953	0,0024953
Duration of the release (s)	713,52	713,52
Pool surface poolfire (m2)	10091	10091
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	45	45
Pool burning rate	Calculate/Default	Calculate/Default
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	Calculate/Default	Calculate/Default
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		

Results

	LC01, LC03, LC05	LC40, LC50, LC99
Max Diameter of the Pool Fire (m)	113,35	113,35
Heat radiation at X (kW/m2)	0,012091	0,012091
Heat radiation first contour at (m)	109,81	68,501
Heat radiation second contour at (m)	96,379	63,447
Heat radiation third contour at (m)	86,521	56,676
Combustion rate (kg/s)	347,39	347,39
Duration of the pool fire (s)	143,93	143,93
Heat emission from fire surface (kW/m2)	21,481	21,481
Flame tilt (deg)	45,47	45,47
View factor (%)	0,13935	0,13935
Atmospheric transmissivity (%)	40,393	40,393
Flame temperature (°C)	515,12	515,12
Height of the Flame (m)	49,717	49,717
Calculated pool surface area (m2)	10091	10091
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97

Other information

Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 08/04/2016 12:57:32

Case description: scenario 1A - explosive mass D (linked to Pool evaporation - Scenario 1A - evap d)

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (04/04/2016)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 1A - explosive mass F (linked to Pool evaporation - Scenario 1A - evap f)

Parameters

Inputs	mass D (linked to Pool	mass F (linked to Pool
Chemical name (DIPPR)	n-EICOSANE (DIPPR)	n-EICOSANE (DIPPR)
Type of release	release	release
Total mass released (kg)		
Mass flow rate of the source (kg/s)	0,0024953	0,0022658
Duration of the release (s)	713,52	618,25
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	10091	10091
Diameter of expanded jet (m)		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	2
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	vegetation, no	vegetation, no
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	mass D (linked to Pool	mass F (linked to Pool
Explosive mass at time t (kg)	0	0
Height to LEL at time t (m)	0	0
Length of cloud (between LEL) at time t (m)	0	0
Width of cloud (between LEL) at time t (m)	0	0
Offset between release location and LEL at time t (m)	0	0
Maximum explosive mass (kg)	0	0
...at time tmem (s)	0	0
Start time where 95% of maximum of explosive mass is reached (s)	0	0
Time where explosive mass starts decreasing below 95% of max (s)	0	0
Length of cloud (between LEL) at time tmem (m)	0	0
Width of cloud (between LEL) at time tmem (m)	0	0
Offset between release location and LEL at time tmem (m)	0	0
Maximum area of explosive cloud (m2)	0	0
...at time tmac (s)	0	0
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0	0
Width of cloud (between LEL) at time tmac (m)	0	0
Offset between release location and LEL at time tmac (m)	0	0
Offset between release centre and cloud centre at time tmac (m)	0	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0,096426

Other information

Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1F\andrea_silvasantos at 04/04/2016 13:06:43

Chemical source date 14/09/2010

Effects report created by ESLR2RH1F\andrea_silvasantos at 04/11/2015 15:55:07

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Unloading pipeline	HFO	Units			
HFO-002	Pipeline from unloading point to tanks. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	HFO		Confined release	No	--
		Mass flow	27.78	kg/s	Bund dimensions	--	--
		Pipeline diameter	16	inch	Roughness legh description	Concrete	--
		Pipeline length	NA	m	Roughness	10.00	cm
		Operation pressure	8	bar	Soil temperature	19.00	°C
		Operation temperature	45	°C	Meteo station	Malta airport	--
		Hole diameter	1.6	inch	Ambient relative humidity	75.00	%
					Ambient temperature	19.00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
		RELEASE DATA					
					Release duration	1800	s
					Mass flow rate [3]	27.78	kg/s
					Total mass released	50000	kg
					Total volume released [1]	50	m³
		EVAPORATION & DISPERSION DATA					
					Pool area [2]	5045	m²
					Evaporation rate 4D	0.0000996	kg/s
					Evaporation rate 5D	0.000060645	kg/s
					Evaporation duration 5D	1172.2	s
					Evaporation duration 2F	1132.9	s
		POOL FIRE DAMAGE ZONES					
					LC99% - 37.5 kW/m2	25	m
					LC50% - 15 kW/m2	26	m
					LC40% - 13.4 kW/m2	29	m
					LC5% - 9.3 kW/m2	38	m
					LC3% - 7.3 kW/m2	42	m
					LC01% - 5 kW/m2	48	m
		FLASH FIRE & EXPLOSION ZONES					
					Length of cloud (between LEL) 5D	0	m
					Length of cloud (between LEL) 2F	0	m
		ENVIRONMENTAL SPILLAGE DATA					
					Oil interceptor	1	--
					Oil interceptor capacity	24	m³
					Oil interceptor efficiency	NA	--
					Total volume released to water	27	m³

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm

[3] Equivalent to the 10% of the flow rate

Case description: Scenario 2 - evap d

Model: Pool evaporation
version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2nd Edition - Chapter 5: Evaporation

compared to: Scenario 2 - evap f

Parameters	Scenario 2 - evap d	Scenario 2 - evap f
Inputs		
Chemical name (DIPPR)	n-EICOSANE (DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	First 20% average (flammable)	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	27.78	27.78
Duration of the release (s)	1800	1800
Total mass released (kg)		
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	Spreading in bunds	Spreading in bunds
Type of pool growth on Water		
Temperature of the pool (°C)	45	45
Maximum pool surface area (m2)	1500	1500
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	flat sandy soil, concrete, tiles, plant-yard	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800
Results	Scenario 2 - evap d	Scenario 2 - evap f
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	208,5	208,5
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	9,96E-05	6,06E-05
Purple book representative evaporation duration (s)	1172,2	1132,9
Representative temperature (°C)	49,721	51,723
Representative pool diameter (m)	43,702	43,702
Density after mixing with air (kg/m3)	1,2072	1,2073
Total evaporated mass (kg)	0,11675	0,068707
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	1500	1500
Other information		
Main program	Effects 8.1 8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 10:59:21

Case description: scenario 2 - PFIRE LC01, LC03, LC05

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 2 - PFIRE LC40, LC50, LC99

Parameters	scenario 2 - PFIRE LC01, LC03, LC05	scenario 2 - PFIRE LC40, LC50, LC99
Inputs		
Chemical name (DIPPR)	n-EICOSANE (DIPPR)	n-EICOSANE (DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	50000	50000
Mass flow rate of the source (kg/s)		
Duration of the release (s)		
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	45	45
Pool burning rate	Calculate/Default	Calculate/Default
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	Calculate/Default	Calculate/Default
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	scenario 2 - PFIRE LC01, LC03, LC05	scenario 2 - PFIRE LC40, LC50, LC99
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0019392	0,0019392
Heat radiation first contour at (m)	48,436	26,799
Heat radiation second contour at (m)	42,179	26,179
Heat radiation third contour at (m)	37,558	21,852
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	968,27	968,27
Heat emission from fire surface (kW/m2)	20,633	20,633
Flame tilt (deg)	49,28	49,28
View factor (%)	0,02345	0,02345
Atmospheric transmissivity (%)	40,08	40,08
Flame temperature (°C)	507,38	507,38
Height of the Flame (m)	24,676	24,676
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	Effects 8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/02/2010	

Effects report created by ESLR2RH1FAndrea_silvasantos at 08/04/2016 12:50:07



Case description: scenario 2 - explosive mass D (linked to Pool evaporation - Scenario 2 - evap d)

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 2 - explosive mass F (linked to Pool evaporation - Scenario 2 - evap f)

Parameters

Inputs

Chemical name (DIPPR)	scenario 2 - explosive mass D (linked to Pool evaporation - Scenario 2 - evap d)	scenario 2 - explosive mass F (linked to Pool evaporation - Scenario 2 - evap f)
Type of release	n-EICOSANE (DIPPR)	n-EICOSANE (DIPPR)
Total mass released (kg)	Evaporating pool release	Evaporating pool release
Mass flow rate of the source (kg/s)	9.96E-05	9.96E-05
Duration of the release (s)	1172.2	1172.2
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	1500	1500
Diameter of expanded jet (m)		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	D (Neutral)
Wind speed at 10 m height (m/s)	5	5
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	Mud flats, snow, no vegetation, no obstacles.	Mud flats, snow, no vegetation, no obstacles.
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

Explosive mass at time t (kg)	scenario 2 - explosive mass D (linked to Pool evaporation - Scenario 2 - evap d)	scenario 2 - explosive mass F (linked to Pool evaporation - Scenario 2 - evap f)
Height to LEL at time t (m)	0	0
Length of cloud (between LEL) at time t (m)	0	0
Width of cloud (between LEL) at time t (m)	0	0
Offset between release location and LEL at time t (m)	0	0
Maximum explosive mass (kg)	0	0
...at time tmem (s)	0	0
Start time where 95% of maximum of explosive mass is reached (s)	0	0
Time where explosive mass starts decreasing below 95% of max (s)	0	0
Length of cloud (between LEL) at time tmem (m)	0	0
Width of cloud (between LEL) at time tmem (m)	0	0
Offset between release location and LEL at time tmem (m)	0	0
Maximum area of explosive cloud (m2)	0	0
...at time tmac (s)	0	0
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0	0
Width of cloud (between LEL) at time tmac (m)	0	0
Offset between release location and LEL at time tmac (m)	0	0
Offset between release centre and cloud centre at time tmac (m)	0	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0

Other information

Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fandrea_silvasantos at 05/11/2015 11:00:01

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Unloading pipeline	HFO	Units			
HFO-002 FBR	Pipeline from unloading point to tanks. Rupture in the pipeline	Substance	HFO		Confined release	No	--
		Mass flow	416.67	kg/s	Bund dimensions	--	--
		Pipeline diameter	16	inch	Roughness legh description	Concrete	--
		Pipeline length		m	Roughness	10.00	cm
		Operation pressure	8	bar	Soil temperature	19.00	°C
		Operation temperature	45	°C	Meteo station	Malta airport	--
		Hole diameter	1,6	inch	Ambient relative humidity	75.00	%
					Ambient temperature	19.00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
		RELEASE DATA					
					Release duration	120	s
					Mass flow rate [3]	416.67	kg/s
					Total mass released	50000	kg
					Total volume released [1]	50	m ³
		EVAPORATION & DISPERSION DATA					
					Pool area [2]	5045	m ²
					Evaporation rate 4D	0,000059931	kg/s
					Evaporation rate 5D	0,000030032	kg/s
					Evaporation duration 5D	1643,4	s
					Evaporation duration 2F	1640,9	s
		POOL FIRE DAMAGE ZONES					
					LC99% - 37,5 kW/m ²	22	m
					LC50% - 15 kW/m ²	24	m
					LC40% - 13,4 kW/m ²	26	m
					LC5% - 9,3 kW/m ²	36	m
					LC3% - 7,3 kW/m ²	42	m
					LC01% - 5 kW/m ²	48	m
		FLASH FIRE & EXPLOSION ZONES					
					Length of cloud (between LEL) 5D	0	m
					Length of cloud (between LEL) 2F	0	m
		ENVIRONMENTAL SPILLAGE DATA					
					Oil interceptor		--
					Oil interceptor capacity	24	m ³
					Oil interceptor efficiency	NA	--
					Total volume released to water	27	m ³
NOTES							
[1] HFO density = 991 kg/m ³							
[2] Pool thickness (on land) = 10 mm. Limited to 1500 m ²							
[3] Equivalent to 1,5 x flow rate							

Case description: Scenario 2A - evap d

Model: Pool evaporation

version: 5.16 (04/04/2016)

Reference: Yellow Book CPR14E 2nd Edition - Chapter 5: Evaporation

compared to: Scenario 2A - evap f

Parameters	Scenario 2A - evap d	Scenario 2A - evap f
Inputs		
Chemical name (DIPPR)	n-EICOSANE (DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	First 20% average (flammable)	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	416,67	416,67
Duration of the release (s)	1800	1800
Total mass released (kg)		
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	Spreading in bunds	Spreading in bunds
Type of pool growth on Water		
Temperature of the pool (°C)	45	45
Maximum pool surface area (m2)	1500	1500
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	flat sandy soil, concrete, tiles, plant-yard	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800
Results	Scenario 2A - evap d	Scenario 2A - evap f
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	41	41
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	5,99E-05	3,00E-05
Purple book representative evaporation duration (s)	1643,4	1640,9
Representative temperature (°C)	45,188	45,396
Representative pool diameter (m)	43,702	43,702
Density after mixing with air (kg/m3)	1,2072	1,2072
Total evaporated mass (kg)	0,09494	0,049276
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	1500	1500
Other information		
Main program	Effects 8.1 8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1Fiandrea_silvasantos at 04/04/2016 16:03:55

Case description: scenario 2A - PFIRE LC01, LC03, LC05

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 2A - PFIRE LC40, LC50, LC99

Parameters	scenario 2A - PFIRE LC01, LC03, LC05	scenario 2A - PFIRE LC40, LC50, LC99
Inputs		
Chemical name (DIPPR)	n-EICOSANE (DIPPR)	n-EICOSANE (DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	7.50E+05	7.50E+05
Mass flow rate of the source (kg/s)		
Duration of the release (s)		
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	45	45
Pool burning rate	Calculate/Default	Calculate/Default
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	Calculate/Default	Calculate/Default
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	scenario 2A - PFIRE LC01, LC03, LC05	scenario 2A - PFIRE LC40, LC50, LC99
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0019392	0,0027756
Heat radiation first contour at (m)	48,436	25,916
Heat radiation second contour at (m)	42,179	24,456
Heat radiation third contour at (m)	37,558	21,852
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	14524	14524
Heat emission from fire surface (kW/m2)	20,633	20,127
Flame tilt (deg)	49,28	35,336
View factor (%)	0,02345	0,034407
Atmospheric transmissivity (%)	40,08	40,08
Flame temperature (°C)	507,38	502,64
Height of the Flame (m)	24,676	29,044
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	Effects 8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/02/2010	

Effects report created by ESLR2RH1FAndrea_silvasantos at 08/04/2016 12:58:17



Case description: scenario 2A - explosive mass D (linked to Pool evaporation - Scenario 2A - evap d)

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (04/04/2016)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 2A - explosive mass F (linked to Pool evaporation - Scenario 2A - evap f)

Parameters

Inputs

Chemical name (DIPPR)	scenario 2A - explosive mass D (linked to Pool evaporation - Scenario 2A - evap d)	scenario 2A - explosive mass F (linked to Pool evaporation - Scenario 2A - evap f)
Type of release	n-EICOSANE (DIPPR)	n-EICOSANE (DIPPR)
Total mass released (kg)	Evaporating pool release	Evaporating pool release
Mass flow rate of the source (kg/s)	5.99E-05	5.99E-05
Duration of the release (s)	1643.4	1643.4
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	1500	1500
Diameter of expanded jet (m)		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	D (Neutral)
Wind speed at 10 m height (m/s)	5	5
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	Mud flats, snow, no vegetation, no obstacles.	Mud flats, snow, no vegetation, no obstacles.
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

Explosive mass at time t (kg)	scenario 2A - explosive mass D (linked to Pool evaporation - Scenario 2A - evap d)	scenario 2A - explosive mass F (linked to Pool evaporation - Scenario 2A - evap f)
Height to LEL at time t (m)	0	0
Length of cloud (between LEL) at time t (m)	0	0
Width of cloud (between LEL) at time t (m)	0	0
Offset between release location and LEL at time t (m)	0	0
Maximum explosive mass (kg)	0	0
...at time tmem (s)	0	0
Start time where 95% of maximum of explosive mass is reached (s)	0	0
Time where explosive mass starts decreasing below 95% of max (s)	0	0
Length of cloud (between LEL) at time tmem (m)	0	0
Width of cloud (between LEL) at time tmem (m)	0	0
Offset between release location and LEL at time tmem (m)	0	0
Maximum area of explosive cloud (m2)	0	0
...at time tmac (s)	0	0
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0	0
Width of cloud (between LEL) at time tmac (m)	0	0
Offset between release location and LEL at time tmac (m)	0	0
Offset between release centre and cloud centre at time tmac (m)	0	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0

Other information

Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fandrea_silvasantos at 04/04/2016 16:07:11

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units	
		STORAGE TANK	HFO	Units				
HFO-003	Continuous release from a hole with an effective diameter of 10 mm of the HFO storage tank nr 1, nr 2	Substance	HFO		Confined release	No	--	
		Nominal volume	25535	m3	Bund dimensions	--	m3	
		Filling degree	95	%	Roughness legth description	Concrete	--	
		Diameter	40	m	Roughness	10,00	cm	
		Heigth	20	m	Soil temperature	19,00	°C	
		Design pressure	atm	bar	Meteo station	Malta airport	--	
		Operation Pressure	atm	bar	Ambient relative humidity	75,00	%	
		Rupture pressure	atm	bar	Ambient temperature	19,00	°C	
		Operation Temperature	65	°C	Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	until device is empty	s	
					Mass flow rate	0,70852	kg/s	
					Total mass released	1,83E+07	kg	
					Total volume released [1]	18450	m3	
					Maximum volume released [4]	31	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	3089	m²	
					Evaporation rate 4D	6,34E-05	kg/s	
					Evaporation rate 2F	6,20E-05	kg/s	
					Evaporation duration 5D	635,34	s	
					Evaporation duration 2F	563,91	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	52	m	
					LC50% - 15 kW/m2	22	m	
					LC40% - 13,4 kW/m2	24	m	
					LC5% - 9,3 kW/m2	52	m	
					LC3% - 7,3 kW/m2	38	m	
					LC01% - 5 kW/m2	42	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	0	m	
					Length of cloud (between LEL) 2F	0	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	D	--	
					Oil interceptor capacity	21	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	10	m3	

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm. Limited to 1500 m2

[3] Maximum release time equivalent to a shift = 12 h. Maximum volume directed to interceptors = 31m3

Case description: scenario 3 release

Model: Liquid release

version: 5.08 (05/11/2015)

Reference: Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4 Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	(DIPPR)
Use which representative step	average
Type of release	hole in vessel
Pipeline length (m)	
Pipeline diameter (mm)	
Pipeline roughness (mm)	
Hole diameter (mm)	10
Hole rounding	Sharp edges
Discharge coefficient (-)	0,62
Vessel type	Vertical cylinder
Vessel volume (m3)	25535
Height cylinder (m)	20
Filling degree (%)	95
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	65
Type of calculation	device is empty
Time <i>t</i> after start release (s)	

Results

Initial mass in vessel (kg)	1,83E+07
Mass flow rate at time <i>t</i> (kg/s)	
Total mass released (kg)	1,83E+07
Time needed to empty vessel (s)	5,10E+07
Filling degree at time <i>t</i> (%)	
Height of liquid at time <i>t</i> (m)	
Maximum mass flow rate (kg/s)	0,70852
Representative release rate (kg/s)	0,70852
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fandrea_silvasantos at 05/11/2015 10:55:08

Case description: Scenario 3 - evap d (linked to Liquid release - scenario 3 release)

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 3 - evap f (linked to Liquid release - scenario 3 release)

Parameters

Inputs	(linked to Liquid n-EICOSANE (DIPPR) (flammable) Land Continuous 0,70852 1800 1,83E+07	(linked to Liquid n-EICOSANE (DIPPR) (flammable) Land Continuous 0,70852 1800 1,83E+07
Chemical name (DIPPR)		
Use which representative step		
Evaporation from land or water		
Type of release		
Mass flow rate of the source (kg/s)		
Duration of the release (s)		
Total mass released (kg)		
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	Spreading in bunds	Spreading in bunds
Type of pool growth on Water		
Temperature of the pool (°C)	65	65
Maximum pool surface area (m2)	1500	1500
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles, plant-	concrete, tiles, plant-
Maximum evaluation time for evaporation (s)	1800	1800

Results

	(linked to Liquid 1,4459	(linked to Liquid 1,4459
Heat flux from solar radiation (kW/m2)		
Time pool spreading ends (s)		
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	6,34E-05	6,20E-05
Purple book representative evaporation duration (s)	635,34	563,91
Representative temperature (°C)	59,092	65,973
Representative pool diameter (m)	20,336	20,435
Density after mixing with air (kg/m3)	1,2072	1,2073
Total evaporated mass (kg)	0,040256	0,034976
... duration evaporation time (s)	1799,5	1799,5

Corresponding representative pool surface area (m2)	324,8	327,98
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Other information

Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 05/11/2015 11:00:39

Case description: scenario 3- PFIRE LC01, LC03, LC05

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 3 - PFIRE LC40, LC50, LC99

Parameters

Inputs	LC01, LC03, LC05	LC40, LC50, LC99
Chemical name (DIPPR)	n-EICOSANE (DIPPR)	n-EICOSANE (DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	1,78E+07	1,78E+07
Mass flow rate of the source (kg/s)		
Duration of the release (s)		
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	65	65
Pool burning rate	Calculate/Default	Calculate/Default
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	Calculate/Default	Calculate/Default
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		

Results

	LC01, LC03, LC05	LC40, LC50, LC99
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0019392	0,0027756
Heat radiation first contour at (m)	48,436	25,916
Heat radiation second contour at (m)	42,179	24,456
Heat radiation third contour at (m)	37,558	21,852

Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	3,44E+05	3,44E+05
Heat emission from fire surface (kW/m2)	20,633	20,127
Flame tilt (deg)	49,28	35,336
View factor (%)	0,02345	0,034407
Atmospheric transmissivity (%)	40,08	40,08
Flame temperature (°C)	507,38	502,64
Height of the Flame (m)	24,676	29,044
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97

Other information	
Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 08/04/2016 12:50:46
Effects report created by ESLR2RH1Flandrea_silvasantos at 05/11/2015 10:54:27

Case description: scenario 3 - explosive mass D (linked to Pool evaporation - Scenario 3 - evap d (linked to Liquid release - scenario 3 re

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 19

compared to: scenario 3 - explosive mass F (linked to Pool evaporation - Scenario 3 - evap f (linked to Liquid release - scenario 3 release))

Parameters

Inputs	mass D (linked to Pool	mass F (linked to Pool
Chemical name (DIPPR)	n-EICOSANE (DIPPR)	n-EICOSANE (DIPPR)
Type of release	release	release
Total mass released (kg)	1,83E+07	1,83E+07
Mass flow rate of the source (kg/s)	6,34E-05	6,20E-05
Duration of the release (s)	635,34	563,91
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	324,8	327,98
Diameter of expanded jet (m)		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	2
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	vegetation, no	vegetation, no
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	mass D (linked to Pool	mass F (linked to Pool
Explosive mass at time t (kg)	0	0
Height to LEL at time t (m)	0	0
Length of cloud (between LEL) at time t (m)	0	0
Width of cloud (between LEL) at time t (m)	0	0
Offset between release location and LEL at time t (m)	0	0
Maximum explosive mass (kg)	0	0
...at time tmem (s)	0	0
Start time where 95% of maximum of explosive mass is reached (s)	0	0
Time where explosive mass starts decreasing below 95% of max (s)	0	0
Length of cloud (between LEL) at time tmem (m)	0	0
Width of cloud (between LEL) at time tmem (m)	0	0
Offset between release location and LEL at time tmem (m)	0	0
Maximum area of explosive cloud (m2)	0	0
...at time tmac (s)	0	0
Explosive mass at time tmac (kg)	0	0

Length of cloud (between LEL) at time tmac (m)	0	0
Width of cloud (between LEL) at time tmac (m)	0	0
Offset between release location and LEL at time tmac (m)	0	0
Offset between release centre and cloud centre at time tmac (m)	0	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0,096426

Other information

Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 05/11/2015 11:01:19

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units	
		STORAGE TANK	HFO	Units				
HFO-003 CF	Instantaneous release of the entire contents of the HFO storage tank nr 1, nr 2	Substance	HFO		Confined release	Yes	--	
		Nominal volume	25535	m3	Bund dimensions		m3	
		Filling degree	95	%	Roughness length description	Concrete	--	
		Diameter	40	m	Roughness	10,00	cm	
		Height	20	m	Soil temperature	19,00	°C	
		Design pressure	atm	bar	Meteo station	Malta airport	--	
		Operation Pressure	atm	bar	Ambient relative humidity	75,00	%	
		Rupture pressure	atm	bar	Ambient temperature	19,00	°C	
		Operation Temperature	65	°C	Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
						RELEASE DATA		
					Release duration	Instantaneous	s	
					Mass flow rate	na	kg/s	
					Total mass released	25305185,00	kg	
					Total volume released [1]	25535	m3	
					Maximum volume released	25535	m3	
						EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	4700	m²	
					Evaporation rate 4D	1,42E-03	kg/s	
					Evaporation rate 2F	6,94E-04	kg/s	
					Evaporation duration 5D	1790,9	s	
					Evaporation duration 2F	1793,2	s	
						POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	39	m	
					LC50% - 15 kW/m2	42	m	
					LC40% - 13,4 kW/m2	44	m	
					LC5% - 9,3 kW/m2	62	m	
					LC3% - 7,3 kW/m2	69	m	
					LC01% - 5 kW/m2	79	m	
						FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	0	m	
					Length of cloud (between LEL) 2F	0	m	
						BUND DRAINAGE TO INTERCEPTORS		
					Bund pipeline dimensions	6	inch	
					Bund height	5	m	
					Mass flow rate	82,28	kg/s	
					Release duration [3]	1800	s	
					Total volume released [1]	149	m3	
						ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	D	--	
					Oil interceptor capacity	21	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	128	m3	

NOTES

[1] HFO density = 991 kg/m3

[2] Bund area

[3] Maximum release time equivalent to = 0,5 h. Maximum volume directed to interceptors = 149m3

Case description: scenario 3A release from bund

Model: Liquid release

version: 5.08 (05/04/2016)

Reference: Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4 Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	(DIPPR)
Use which representative step	average
Type of release	hole in vessel
Pipeline length (m)	
Pipeline diameter (mm)	
Pipeline roughness (mm)	
Hole diameter (inch)	6
Hole rounding	Sharp edges
Discharge coefficient (-)	0,62
Vessel type	Vertical cylinder
Vessel volume (m3)	25535
Height cylinder (m)	5
Filling degree (%)	95
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	65
Type of calculation	specified time
Time t after start release (s)	1800

Results

Initial mass in vessel (kg)	1,83E+07
Mass flow rate at time t (kg/s)	81,945
Total mass released at time t (kg)	1,49E+05
Time needed to empty vessel (s)	
Filling degree at time t (%)	94,228
Height of liquid at time t (m)	4,7114
Maximum mass flow rate (kg/s)	82,28
Representative release rate (kg/s)	82,247
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fl andrea_silvasantos at 05/04/2016 14:28:03

Case description: Scenario 3A - evap d

Model: Pool evaporation

version: 5.16 (04/04/2016)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 3A - evap f

Parameters

Inputs	Scenario 3A - evap d	Scenario 3A - evap f
Chemical name (DIPPR)	n-EICOSANE (DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	(flammable)	(flammable)
Evaporation from land or water	Land	Land
Type of release	Instantaneous	Instantaneous
Mass flow rate of the source (kg/s)		
Duration of the release (s)		
Total mass released (kg)	2,53E+07	2,53E+07
Height pool at t=0	Calculate/Default	Calculate/Default
Value pool height at t=0 (m)		
Type of pool growth on Land	Spreading in bunds	Spreading in bunds
Type of pool growth on Water		
Temperature of the pool (°C)	65	65
Maximum pool surface area (m2)	4700	4700
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles, plant-	concrete, tiles, plant-
Maximum evaluation time for evaporation (s)	1800	1800

Results

	Scenario 3A - evap d	Scenario 3A - evap f
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)		
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	0,0014183	0,00069423
Purple book representative evaporation duration (s)	1790,9	1793,2
Representative temperature (°C)	64,929	64,932
Representative pool diameter (m)	77,358	77,358
Density after mixing with air (kg/m3)	1,2075	1,2076
Total evaporated mass (kg)	2,54	1,2449
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	4700	4700

Other information

Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 04/04/2016 16:35:14

Case description: scenario 3A- PFIRE LC01, LC03, LC05

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 3A - PFIRE LC40, LC50, LC99

Parameters

Inputs	LC01, LC03, LC05	LC40, LC50, LC99
Chemical name (DIPPR)	n-EICOSANE (DIPPR)	n-EICOSANE (DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	2,53E+07	2,53E+07
Mass flow rate of the source (kg/s)		
Duration of the release (s)		
Pool surface poolfire (m2)	4700	4700
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	65	65
Pool burning rate	Calculate/Default	Calculate/Default
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	Calculate/Default	Calculate/Default
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		

Results

	LC01, LC03, LC05	LC40, LC50, LC99
Max Diameter of the Pool Fire (m)	77,358	77,358
Heat radiation at X (kW/m2)	0,0057696	0,0078277
Heat radiation first contour at (m)	78,967	43,727
Heat radiation second contour at (m)	69,12	41,946
Heat radiation third contour at (m)	61,812	38,68

Combustion rate (kg/s)	161,8	161,8
Duration of the pool fire (s)	1,56E+05	1,56E+05
Heat emission from fire surface (kW/m2)	21,133	20,724
Flame tilt (deg)	47,022	32,84
View factor (%)	0,067865	0,093887
Atmospheric transmissivity (%)	40,23	40,23
Flame temperature (°C)	511,97	508,22
Height of the Flame (m)	37,545	42,46
Calculated pool surface area (m2)	4700	4700
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97

Other information	
Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 08/04/2016 13:04:18
Effects report created by ESLR2RH1Flandrea_silvasantos at 05/11/2015 10:54:27

Case description: scenario 3 - explosive mass D (linked to Pool evaporation - Scenario 3 - evap d (linked to Liquid release - scenario 3 re

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 19

compared to: scenario 3 - explosive mass F (linked to Pool evaporation - Scenario 3 - evap f (linked to Liquid release - scenario 3 release))

Parameters

Inputs	mass D (linked to Pool	mass F (linked to Pool
Chemical name (DIPPR)	n-EICOSANE (DIPPR)	n-EICOSANE (DIPPR)
Type of release	release	release
Total mass released (kg)	1,83E+07	1,83E+07
Mass flow rate of the source (kg/s)	6,34E-05	6,20E-05
Duration of the release (s)	635,34	563,91
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	324,8	327,98
Diameter of expanded jet (m)		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	2
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	vegetation, no	vegetation, no
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	mass D (linked to Pool	mass F (linked to Pool
Explosive mass at time t (kg)	0	0
Height to LEL at time t (m)	0	0
Length of cloud (between LEL) at time t (m)	0	0
Width of cloud (between LEL) at time t (m)	0	0
Offset between release location and LEL at time t (m)	0	0
Maximum explosive mass (kg)	0	0
...at time tmem (s)	0	0
Start time where 95% of maximum of explosive mass is reached (s)	0	0
Time where explosive mass starts decreasing below 95% of max (s)	0	0
Length of cloud (between LEL) at time tmem (m)	0	0
Width of cloud (between LEL) at time tmem (m)	0	0
Offset between release location and LEL at time tmem (m)	0	0
Maximum area of explosive cloud (m2)	0	0
...at time tmac (s)	0	0
Explosive mass at time tmac (kg)	0	0

Length of cloud (between LEL) at time tmac (m)	0	0
Width of cloud (between LEL) at time tmac (m)	0	0
Offset between release location and LEL at time tmac (m)	0	0
Offset between release centre and cloud centre at time tmac (m)	0	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0,096426

Other information

Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 05/11/2015 11:01:19

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units	
		STORAGE TANK	HFO	Units					
HFO-004	Continuous release from a hole with an effective diameter of 10 mm of the HFO storage tank nr 3	Substance	HFO		Confined release		No	--	
		Nominal volume	5633	m3	Bund dimensions		--	m3	
		Filling degree	95	%	Roughness length description		Concrete	--	
		Diameter	22	m	Roughness		10,00	cm	
		Height	15	m	Soil temperature		19,00	°C	
		Design pressure	atm	bar	Meteo station		Malta airport	--	
		Operation Pressure	atm	bar	Ambient relative humidity		75,00	%	
		Rupture pressure	1,21	bar	Ambient temperature		19,00	°C	
		Design temperature	65	°C	Meteorological condition 1		D / 4	-- / m/s	
		Operation Temperature	65	°C	Meteorological condition 2		F / 2	-- / m/s	
		RELEASE DATA							
		Release duration		until device is empty				s	
		Mass flow rate		0,6136				kg/s	
		Total mass released		4,03E+06				kg	
		Total volume released [1]		4070				m3	
		Maximum volume released [4]		27				m3	
		EVAPORATION & DISPERSION DATA							
		Maximum pool area [2]		2675				m²	
		Evaporation rate 4D		5,44E-05				kg/s	
		Evaporation rate 2F		5,36E-05				kg/s	
		Evaporation duration 5D		637,19				s	
		Evaporation duration 2F		564,93				s	
		POOL FIRE DAMAGE ZONES							
		LC99% - 37,5 kW/m2		52				m	
		LC50% - 15 kW/m2		22				m	
		LC40% - 13,4 kW/m2		26				m	
		LC5% - 9,3 kW/m2		52				m	
		LC3% - 7,3 kW/m2		38				m	
		LC01% - 5 kW/m2		42				m	
		FLASH FIRE & EXPLOSION ZONES							
		Length of cloud (between LEL) 5D		0				m	
		Length of cloud (between LEL) 2F		0				m	
		ENVIRONMENTAL SPILLAGE DATA							
		Oil interceptor		D				--	
		Oil interceptor capacity		21				m3	
		Oil interceptor efficiency		NA				--	
		Total volume released to water		6				m3	

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm. Limited to 1500 m2

[3] Maximum release time equivalent to a shift = 12 h. Maximum volume directed to interceptors = 27m3

Case description: scenario 4 release

Model: Liquid release

version: 5.08 (05/11/2015)

Reference: Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4 Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	(DIPPR)
Use which representative step	average
Type of release	hole in vessel
Pipeline length (m)	
Pipeline diameter (mm)	
Pipeline roughness (mm)	
Hole diameter (mm)	10
Hole rounding	Sharp edges
Discharge coefficient (-)	0,62
Vessel type	Vertical cylinder
Vessel volume (m3)	5633
Height cylinder (m)	15
Filling degree (%)	95
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	65
Type of calculation	device is empty
Time t after start release (s)	

Results

Initial mass in vessel (kg)	4,03E+06
Mass flow rate at time t (kg/s)	
Total mass released (kg)	4,03E+06
Time needed to empty vessel (s)	1,30E+07
Filling degree at time t (%)	
Height of liquid at time t (m)	
Maximum mass flow rate (kg/s)	0,6136
Representative release rate (kg/s)	0,61359
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 05/11/2015 10:55:40

Case description: Scenario 4 - evap d (linked to Liquid release - scenario 4 release)

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2nd Edition - Chapter 5: Evaporation

compared to: Scenario 4 - evap f (linked to Liquid release - scenario 4 release)

Parameters		
Inputs	evap d (linked to	evap f (linked to
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Use which representative step	average	average
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	0,61359	0,61359
Duration of the release (s)	1800	1800
Total mass released (kg)	4,03E+06	4,03E+06
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	bunds	bunds
Type of pool growth on Water		
Temperature of the pool (°C)	65	65
Maximum pool surface area (m2)	1500	1500
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	concrete, tiles,
Maximum evaluation time for evaporation (s)	1800	1800
Results	evap d (linked to	evap f (linked to
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)		
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	5,44E-05	5,36E-05
Purple book representative evaporation duration (s)	637,19	564,93
Representative temperature (°C)	58,928	65,866
Representative pool diameter (m)	18,922	19,016
Density after mixing with air (kg/m3)	1,2072	1,2073
Total evaporated mass (kg)	0,034646	0,030267
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	281,22	284
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 11:02:07

Case description: scenario 4- PFIRE LC01, LC03, LC05 (linked to Liquid release - scenario 4 release)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 4 - PFIRE LC40, LC50, LC99 (linked to Liquid release - scenario 4 release)

Parameters	PFIRE LC01,	PFIRE LC40,
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	4,03E+06	4,03E+06
Mass flow rate of the source (kg/s)	0,61359	0,61359
Duration of the release (s)	1800	1800
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)	10	10
Discharge coefficient (-)	0,62	0,62
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	65	65
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	Scenario 1 PFIRE LC01,	Scenario 2 PFIRE LC40,
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0019392	0,0019392
Heat radiation first contour at (m)	48,436	28,799
Heat radiation second contour at (m)	42,179	26,179
Heat radiation third contour at (m)	37,558	21,852
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	78111	78111
Heat emission from fire surface (kW/m2)	20,633	20,633
Flame tilt (deg)	49,28	49,28
View factor (%)	0,02345	0,02345
Atmospheric transmissivity (%)	40,08	40,08
Flame temperature (°C)	507,38	507,38
Height of the Flame (m)	24,676	24,676
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information	Effects	
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	



Effects report created by ESLR2RH1FlAndrea_silvasantos at 08/04/2016 12:51:27
Effects report created by ESLR2RH1FlAndrea_silvasantos at 05/11/2015 11:02:24

Case description: scenario 4 - explosive mass D (linked to Pool evaporation - Scenario 4 - evap d (linked to Liquid release - scenario 4 release))

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 4 - explosive mass F (linked to Pool evaporation - Scenario 4 - evap f (linked to Liquid release - scenario 4 release))

Parameters

Inputs

	explosive mass
Chemical name (DIPPR)	(DIPPR)
Type of release	release
Total mass released (kg)	4,03E+06
Mass flow rate of the source (kg/s)	5,44E-05
Duration of the release (s)	637,19
Initial liquid mass fraction (%)	
Fixed pool surface (m2)	281,22
Diameter of expanded jet (m)	
Temperature after release (°C)	19
X-coordinate of release (m)	0
Y-coordinate of release (m)	0
Z-coordinate (height) of release (m)	
Ambient temperature (°C)	19
Meteorological data	Pasquill
Pasquill stability class	D (Neutral)
Wind speed at 10 m height (m/s)	5
Inverse Monin-Obukhov length (1/L) (1/m)	
Predefined wind direction	User defined
Wind comes from (North = 0 degrees) (deg)	270
Ambient relative humidity (%)	75
Roughness length description	no vegetation,
Time t after start release (s)	120
Concentration averaging time (s)	20
Resolution of the time consuming graphs	Low

Results

	explosive mass
Explosive mass at time t (kg)	0
Height to LEL at time t (m)	0
Length of cloud (between LEL) at time t (m)	0
Width of cloud (between LEL) at time t (m)	0
Offset between release location and LEL at time t (m)	0
Maximum explosive mass (kg)	0
...at time tmem (s)	0
Start time where 95% of maximum of explosive mass is reached (s)	0
Time where explosive mass starts decreasing below 95% of max (s)	0
Length of cloud (between LEL) at time tmem (m)	0
Width of cloud (between LEL) at time tmem (m)	0
Offset between release location and LEL at time tmem (m)	0
Maximum area of explosive cloud (m2)	0
...at time tmac (s)	0
Explosive mass at time tmac (kg)	0
Length of cloud (between LEL) at time tmac (m)	0
Width of cloud (between LEL) at time tmac (m)	0
Offset between release location and LEL at time tmac (m)	0
Offset between release centre and cloud centre at time tmac (m)	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1FlAndrea_silvasantos at 05/11/2015 11:02:42

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		STORAGE TANK	HFO	Units				
HFO-004 CF	Instantaneous release of the entire contents of the HFO storage tank nr 3	Substance	HFO		Confined release	No	--	
		Nominal volume	5633	m3	Bund dimensions	--	m3	
		Filling degree	95	%	Roughness length description	Concrete	--	
		Diameter	22	m	Roughness	10,00	cm	
		Height	15	m	Soil temperature	19,00	°C	
		Design pressure	atm	bar	Meteo station	Malta airport	--	
		Operation Pressure	atm	bar	Ambient relative humidity	75,00	%	
		Rupture pressure	1,21	bar	Ambient temperature	19,00	°C	
		Design temperature	65	°C	Meteorological condition 1	D / 4	-- / m/s	
		Operation Temperature	65	°C	Meteorological condition 2	F / 2	-- / m/s	
		RELEASE DATA						
		Release duration		Instantaneous	s			
		Mass flow rate		na	kg/s			
		Total mass released		5582303,00	kg			
		Total volume released [1]		5633	m3			
		Maximum volume released		5633	m3			
		EVAPORATION & DISPERSION DATA						
		Maximum pool area [2]		4700	m²			
		Evaporation rate 4D		0,000054373	kg/s			
		Evaporation rate 2F		0,000053577	kg/s			
		Evaporation duration 5D		637,19	s			
		Evaporation duration 2F		564,93	s			
		POOL FIRE DAMAGE ZONES						
		LC99% - 37,5 kW/m2		39	m			
		LC50% - 15 kW/m2		42	m			
		LC40% - 13,4 kW/m2		13	m			
		LC5% - 9,3 kW/m2		62	m			
		LC3% - 7,3 kW/m2		69	m			
		LC01% - 5 kW/m2		79	m			
		FLASH FIRE & EXPLOSION ZONES						
		Length of cloud (between LEL) 5D		0	m			
		Length of cloud (between LEL) 2F		0	m			
		BUND DRAINAGE TO INTERCEPTORS						
		Bund pipeline dimensions		6	inch			
		Bund height		5	m			
		Mass flow rate		82,28	kg/s			
		Release duration [3]		1800	s			
		Total volume released [1]		149	m3			
		ENVIRONMENTAL SPILLAGE DATA						
		Oil interceptor		D	--			
		Oil interceptor capacity		21	m3			
		Oil interceptor efficiency		NA	--			
		Total volume released to water		128	m3			

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm. Limited to 1500 m2

[3] Maximum release time equivalent to = 0,5 h. Maximum volume directed to interceptors = 149m3

Case description: scenario 4A release from bund

Model: Liquid release

version: 5.08 (05/04/2016)

Reference: Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	(DIPPR)
Use which representative step	average
Type of release	hole in vessel
Pipeline length (m)	
Pipeline diameter (mm)	
Pipeline roughness (mm)	
Hole diameter (inch)	6
Hole rounding	Sharp edges
Discharge coefficient (-)	0.62
Vessel type	Vertical cylinder
Vessel volume (m3)	5633
Height cylinder (m)	5
Filling degree (%)	95
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	65
Type of calculation	specified time
Time t after start release (s)	1800

Results

Initial mass in vessel (kg)	4,03E+06
Mass flow rate at time t (kg/s)	80,762
Total mass released at time t (kg)	1,47E+05
Time needed to empty vessel (s)	
Filling degree at time t (%)	91,527
Height of liquid at time t (m)	4,5763
Maximum mass flow rate (kg/s)	82,28
Representative release rate (kg/s)	82,13
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fl andrea_silvasantos at 05/04/2016 14:57:53

Case description: Scenario 4 - evap d (linked to Liquid release - scenario 4 release)

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2nd Edition - Chapter 5: Evaporation

compared to: Scenario 4 - evap f (linked to Liquid release - scenario 4 release)

Parameters

Inputs	evap d (linked to	evap f (linked to
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Use which representative step	average	average
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	0,61359	0,61359
Duration of the release (s)	1800	1800
Total mass released (kg)	4,03E+06	4,03E+06
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	bunds	bunds
Type of pool growth on Water		
Temperature of the pool (°C)	65	65
Maximum pool surface area (m2)	1500	1500
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	concrete, tiles,
Maximum evaluation time for evaporation (s)	1800	1800

Results

	evap d (linked to	evap f (linked to
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)		
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	5,44E-05	5,36E-05
Purple book representative evaporation duration (s)	637,19	564,93
Representative temperature (°C)	58,928	65,866
Representative pool diameter (m)	18,922	19,016
Density after mixing with air (kg/m3)	1,2072	1,2073
Total evaporated mass (kg)	0,034646	0,030267
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	281,22	284

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 11:02:07

Case description: scenario 4A- PFIRE LC01, LC03, LC05

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 4A - PFIRE LC40, LC50, LC99

Parameters	PFIRE LC01,	PFIRE LC40,
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	5,58E+06	5,58E+06
Mass flow rate of the source (kg/s)		
Duration of the release (s)		
Pool surface poolfire (m2)	4700	4700
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	65	65
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	Scenario 4A PFIRE LC01,	Scenario 4A PFIRE LC40,
Max Diameter of the Pool Fire (m)	77,358	77,358
Heat radiation at X (kW/m2)	0,0057696	0,0078277
Heat radiation first contour at (m)	78,967	43,727
Heat radiation second contour at (m)	69,12	41,946
Heat radiation third contour at (m)	61,812	38,68
Combustion rate (kg/s)	161,8	161,8
Duration of the pool fire (s)	34487	34487
Heat emission from fire surface (kW/m2)	21,133	20,724
Flame tilt (deg)	47,022	32,84
View factor (%)	0,067865	0,093887
Atmospheric transmissivity (%)	40,23	40,23
Flame temperature (°C)	511,97	508,22
Height of the Flame (m)	37,545	42,46
Calculated pool surface area (m2)	4700	4700
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information	Effects	
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	



Effects report created by ESLR2RH1FlAndrea_silvasantos at 08/04/2016 13:04:48
Effects report created by ESLR2RH1FlAndrea_silvasantos at 05/11/2015 11:02:24

Case description: scenario 4 - explosive mass D (linked to Pool evaporation - Scenario 4 - evap d (linked to Liquid release - scenario 4 release))

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 4 - explosive mass F (linked to Pool evaporation - Scenario 4 - evap f (linked to Liquid release - scenario 4 release))

Parameters

Inputs

	explosive mass
Chemical name (DIPPR)	(DIPPR)
Type of release	release
Total mass released (kg)	4,03E+06
Mass flow rate of the source (kg/s)	5,44E-05
Duration of the release (s)	637,19
Initial liquid mass fraction (%)	
Fixed pool surface (m2)	281,22
Diameter of expanded jet (m)	
Temperature after release (°C)	19
X-coordinate of release (m)	0
Y-coordinate of release (m)	0
Z-coordinate (height) of release (m)	
Ambient temperature (°C)	19
Meteorological data	Pasquill
Pasquill stability class	D (Neutral)
Wind speed at 10 m height (m/s)	5
Inverse Monin-Obukhov length (1/L) (1/m)	
Predefined wind direction	User defined
Wind comes from (North = 0 degrees) (deg)	270
Ambient relative humidity (%)	75
Roughness length description	no vegetation,
Time t after start release (s)	120
Concentration averaging time (s)	20
Resolution of the time consuming graphs	Low

Results

	explosive mass
Explosive mass at time t (kg)	0
Height to LEL at time t (m)	0
Length of cloud (between LEL) at time t (m)	0
Width of cloud (between LEL) at time t (m)	0
Offset between release location and LEL at time t (m)	0
Maximum explosive mass (kg)	0
...at time tmem (s)	0
Start time where 95% of maximum of explosive mass is reached (s)	0
Time where explosive mass starts decreasing below 95% of max (s)	0
Length of cloud (between LEL) at time tmem (m)	0
Width of cloud (between LEL) at time tmem (m)	0
Offset between release location and LEL at time tmem (m)	0
Maximum area of explosive cloud (m2)	0
...at time tmac (s)	0
Explosive mass at time tmac (kg)	0
Length of cloud (between LEL) at time tmac (m)	0
Width of cloud (between LEL) at time tmac (m)	0
Offset between release location and LEL at time tmac (m)	0
Offset between release centre and cloud centre at time tmac (m)	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1FlAndrea_silvasantos at 05/11/2015 11:02:42

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	HFO	Units			
HFO-005	HFO pipelines from storage tank to D3 transfer pump. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm	Substance	HFO		Confined release	No	--
		Volume	na	m3	Bund dimensions	--	--
		Pipeline diameter	8	inch	Roughness length description	Concrete	--
		Pipeline length	200	m	Roughness	10,00	cm
		Operation pressure	4	bar	Soil temperature	19,00	°C
		Operation temperature	45	°C	Meteo station	Malta airport	--
		Hole diameter	0,8	inch	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	2,9236	kg/s
					Total mass released	5262,48	kg
					Total volume released [1]	5	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	531	m²
					Evaporation rate 4D	9,61E-05	kg/s
					Evaporation rate 2F	7,83E-05	kg/s
					Evaporation duration 5D	937,88	s
					Evaporation duration 2F	862,71	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	13	m
					LC50% - 15 kW/m2	15	m
					LC40% - 13,4 kW/m2	16	m
					LC5% - 9,3 kW/m2	23	m
					LC3% - 7,3 kW/m2	26	m
					LC01% - 5 kW/m2	31	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	0	m
					Length of cloud (between LEL) 2F	0	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	E	--
					Oil interceptor capacity	27	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 cm.

Case description: scenario 5 release

Model: Liquid release

version: 5.08 (05/11/2015)

Reference: Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	(DIPPR)
Use which representative step	average
Type of release	vessel through
Pipeline length (m)	200
Pipeline diameter (inch)	8
Pipeline roughness (mm)	0,045
Hole diameter (inch)	0,8
Hole rounding	Sharp edges
Discharge coefficient (-)	0,62
Vessel type	Vertical cylinder
Vessel volume (m3)	25535
Height cylinder (m)	20
Filling degree (%)	95
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	65
Type of calculation	specified time
Time t after start release (s)	1800

Results

Initial mass in vessel (kg)	1,83E+07
Mass flow rate at time t (kg/s)	2,9232
Total mass released at time t (kg)	5288,5
Time needed to empty vessel (s)	
Filling degree at time t (%)	94,973
Height of liquid at time t (m)	18,995
Maximum mass flow rate (kg/s)	2,9236
Representative release rate (kg/s)	2,9236
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fl andrea_silvasantos at 05/11/2015 10:55:59

Case description: Scenario 5 - evap d (linked to Liquid release - scenario 5 release)

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2nd Edition - Chapter 5: Evaporation

compared to: Scenario 5 - evap f (linked to Liquid release - scenario 5 release)

Parameters

Inputs	evap d (linked to	evap f (linked to
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Use which representative step	average	average
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	2,9236	2,9236
Duration of the release (s)	1800	1800
Total mass released (kg)	5288,5	5288,5
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	bunds	bunds
Type of pool growth on Water		
Temperature of the pool (°C)	65	65
Maximum pool surface area (m2)	506	506
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	concrete, tiles,
Maximum evaluation time for evaporation (s)	1800	1800

Results

	evap d (linked to	evap f (linked to
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	660,5	659
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	9,61E-05	7,83E-05
Purple book representative evaporation duration (s)	937,88	862,71
Representative temperature (°C)	59,066	64,155
Representative pool diameter (m)	25,382	25,382
Density after mixing with air (kg/m3)	1,2073	1,2073
Total evaporated mass (kg)	0,090111	0,067525
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	506	506

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fandrea_silvasantos at 05/11/2015 11:03:17

Case description: scenario 5- PFIRE LC01, LC03, LC05 (linked to Liquid release - scenario 4 release)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 5 - PFIRE LC40, LC50, LC99 (linked to Liquid release - scenario 4 release)

Parameters		
Inputs	PFIRE LC01,	PFIRE LC40,
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	4,03E+06	4,03E+06
Mass flow rate of the source (kg/s)	0,61359	0,61359
Duration of the release (s)	1800	1800
Pool surface poolfire (m2)	506	506
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)	10	10
Discharge coefficient (-)	0,62	0,62
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	65	65
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	PFIRE LC01,	PFIRE LC40,
Max Diameter of the Pool Fire (m)	25,382	25,382
Heat radiation at X (kW/m2)	0,00069456	0,001036
Heat radiation first contour at (m)	30,599	15,964
Heat radiation second contour at (m)	26,466	14,714
Heat radiation third contour at (m)	23,483	12,692
Combustion rate (kg/s)	17,419	17,419
Duration of the pool fire (s)	2,32E+05	2,32E+05
Heat emission from fire surface (kW/m2)	20,184	19,628
Flame tilt (deg)	51,355	37,71
View factor (%)	0,008603	0,013197
Atmospheric transmissivity (%)	39,999	39,999
Flame temperature (°C)	503,18	497,88
Height of the Flame (m)	16,551	20,063
Calculated pool surface area (m2)	506	506
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	



Effects report created by ESLR2RH1Fiandrea_silvasantos at 08/04/2016 12:51:57

Case description: scenario 5 - explosive mass D (linked to Pool evaporation - Scenario 5 - evap d (linked to Liquid release - scenario 5 release))

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 5 - explosive mass F (linked to Pool evaporation - Scenario 5 - evap f (linked to Liquid release - scenario 5 release))

Parameters

Inputs

	explosive mass	explosive mass
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
Total mass released (kg)	5288,5	5288,5
Mass flow rate of the source (kg/s)	9,61E-05	7,83E-05
Duration of the release (s)	937,88	862,71
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	506	506
Diameter of expanded jet (m)		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	2
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation,
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	explosive mass	explosive mass
Explosive mass at time t (kg)	0	0
Height to LEL at time t (m)	0	0
Length of cloud (between LEL) at time t (m)	0	0
Width of cloud (between LEL) at time t (m)	0	0
Offset between release location and LEL at time t (m)	0	0
Maximum explosive mass (kg)	0	0
...at time tmem (s)	0	0
Start time where 95% of maximum of explosive mass is reached (s)	0	0
Time where explosive mass starts decreasing below 95% of max (s)	0	0
Length of cloud (between LEL) at time tmem (m)	0	0
Width of cloud (between LEL) at time tmem (m)	0	0
Offset between release location and LEL at time tmem (m)	0	0
Maximum area of explosive cloud (m2)	0	0
...at time tmac (s)	0	0
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0	0
Width of cloud (between LEL) at time tmac (m)	0	0
Offset between release location and LEL at time tmac (m)	0	0
Offset between release centre and cloud centre at time tmac (m)	0	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0,096426

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 11:04:16

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		Pipeline	HFO	Units				
HFO-005 FBR	HFO pipelines from storage tank to D3 transfer pump. Rupture in the pipeline	Substance	HFO		Confined release	No	--	
		Volume	na	m3	Bund dimensions	--	--	
		Pipeline diameter	8	inch	Roughness length description	Concrete	--	
		Pipeline length	200	m	Roughness	10,00	cm	
		Operation pressure	4	bar	Soil temperature	19,00	°C	
		Operation temperature	45	°C	Meteo station	Malta airport	--	
		Hole diameter	8	inch	Ambient relative humidity	75,00	%	
					Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate	109,07	kg/s	
					Total mass released	196326	kg	
					Total volume released [1]	198	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	19811	m²	
					Evaporation rate 4D	3,52E-04	kg/s	
					Evaporation rate 2F	1,92E-04	kg/s	
					Evaporation duration 5D	1361,3	s	
					Evaporation duration 2F	1347,5	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	22	m	
					LC50% - 15 kW/m2	24	m	
					LC40% - 13,4 kW/m2	26	m	
					LC5% - 9,3 kW/m2	38	m	
					LC3% - 7,3 kW/m2	42	m	
					LC01% - 5 kW/m2	48	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	0	m	
					Length of cloud (between LEL) 2F	0	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	E	--	
					Oil interceptor capacity	27	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	171	m3	

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm.

Case description: scenario 5A release

Model: Liquid release

version: 5.08 (31/03/2016)

Reference: Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	(DIPPR)
Use which representative step	average
Type of release	vessel through
Pipeline length (m)	200
Pipeline diameter (inch)	8
Pipeline roughness (mm)	0,045
Hole diameter (inch)	8
Hole rounding	Sharp edges
Discharge coefficient (-)	0,62
Vessel type	Vertical cylinder
Vessel volume (m3)	25535
Height cylinder (m)	20
Filling degree (%)	95
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	65
Type of calculation	specified time
Time t after start release (s)	1800

Results

Initial mass in vessel (kg)	1,83E+07
Mass flow rate at time t (kg/s)	108,46
Total mass released at time t (kg)	1,97E+05
Time needed to empty vessel (s)	
Filling degree at time t (%)	93,978
Height of liquid at time t (m)	18,796
Maximum mass flow rate (kg/s)	109,07
Representative release rate (kg/s)	109,01
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fl andrea_silvasantos at 05/04/2016 15:05:38

Case description: Scenario 5A - evap d (linked to Liquid release - scenario 5A release)

Model: Pool evaporation

version: 5.16 (31/03/2016)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 5A- evap f (linked to Liquid release - scenario 5A release)

Parameters

Inputs	evap d (linked to	evap f (linked to
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Use which representative step	average	average
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	109,01	109,01
Duration of the release (s)	1800	1800
Total mass released (kg)	1,97E+05	1,97E+05
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	bunds	bunds
Type of pool growth on Water		
Temperature of the pool (°C)	65	65
Maximum pool surface area (m2)	1500	1500
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	concrete, tiles,
Maximum evaluation time for evaporation (s)	1800	1800

Results

	evap d (linked to	evap f (linked to
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	63,5	63,5
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	0,00035248	0,00019178
Purple book representative evaporation duration (s)	1361,3	1347,5
Representative temperature (°C)	61,763	62,828
Representative pool diameter (m)	43,702	43,702
Density after mixing with air (kg/m3)	1,2073	1,2074
Total evaporated mass (kg)	0,47983	0,25843
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	1500	1500

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 05/04/2016 15:06:14

Case description: scenario 5A- PFIRE LC01, LC03, LC05 (linked to Liquid release - scenario 5A release)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 5A - PFIRE LC40, LC50, LC99 copy (linked to Liquid release - scenario 5A release)

Parameters		
Inputs	PFIRE LC01,	PFIRE LC40,
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	1,97E+05	1,97E+05
Mass flow rate of the source (kg/s)	109,01	109,01
Duration of the release (s)	1800	1800
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)	203,2	203,2
Discharge coefficient (-)	0,62	0,62
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	65	65
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	Scenario 5A PFIRE LC01,	Scenario 5A PFIRE LC40,
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0019392	0,0027756
Heat radiation first contour at (m)	48,436	25,916
Heat radiation second contour at (m)	42,179	24,456
Heat radiation third contour at (m)	37,558	21,852
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	3810,3	3810,3
Heat emission from fire surface (kW/m2)	20,633	20,127
Flame tilt (deg)	49,28	35,336
View factor (%)	0,02345	0,034407
Atmospheric transmissivity (%)	40,08	40,08
Flame temperature (°C)	507,38	502,64
Height of the Flame (m)	24,676	29,044
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	



Effects report created by ESLR2RH1Fiandrea_silvasantos at 08/04/2016 12:58:40

Case description: scenario 5 - explosive mass D (linked to Pool evaporation - Scenario 5 - evap d (linked to Liquid release - scenario 5 release))

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 5 - explosive mass F (linked to Pool evaporation - Scenario 5 - evap f (linked to Liquid release - scenario 5 release))

Parameters		
Inputs		
	explosive mass	explosive mass
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
Total mass released (kg)	5288,5	5288,5
Mass flow rate of the source (kg/s)	9,61E-05	7,83E-05
Duration of the release (s)	937,88	862,71
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	506	506
Diameter of expanded jet (m)		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data		
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	2
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction		
Wind comes from (North = 0 degrees) (deg)	User defined	User defined
	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation,
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low
Results		
	explosive mass	explosive mass
Explosive mass at time t (kg)	0	0
Height to LEL at time t (m)	0	0
Length of cloud (between LEL) at time t (m)	0	0
Width of cloud (between LEL) at time t (m)	0	0
Offset between release location and LEL at time t (m)	0	0
Maximum explosive mass (kg)	0	0
...at time tmem (s)	0	0
Start time where 95% of maximum of explosive mass is reached (s)	0	0
Time where explosive mass starts decreasing below 95% of max (s)	0	0
Length of cloud (between LEL) at time tmem (m)	0	0
Width of cloud (between LEL) at time tmem (m)	0	0
Offset between release location and LEL at time tmem (m)	0	0
Maximum area of explosive cloud (m2)	0	0
...at time tmac (s)	0	0
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0	0
Width of cloud (between LEL) at time tmac (m)	0	0
Offset between release location and LEL at time tmac (m)	0	0
Offset between release centre and cloud centre at time tmac (m)	0	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0,096426
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 11:04:16

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		D3 Transfer pump	HFO	Units				
HFO-006	Leak (10 % diameter). Discharge line	Substance	HFO		Confined release	Yes	--	
		Maximum mass flow	40	m3/h	Bund dimensions		m3	
		Pipeline diameter	8	inch	Roughness length description	Concrete	--	
		Operation pressure	4	bar	Roughness	10,00	cm	
		Operation temperature	45	°C	Soil temperature	19,00	°C	
		Hole diameter	0,8	inch	Meteo station	Malta airport	--	
		Release mass flow [3]	1,10	kg/s	Ambient relative humidity	75,00	%	
					Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	600	s	
					Mass flow rate	1,10	kg/s	
					Total mass released	660,67	kg	
					Total volume released [1]	0,67	m3	
					EVAPORATION & DISPERSION DATA			
					Pool area [2]	67	m²	
					Evaporation rate 5D	0,000007514	kg/s	
					Evaporation rate 2F	6,9351E-06	kg/s	
					Evaporation duration 5D	909,92	s	
					Evaporation duration 2F	758,59	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	5	m	
					LC50% - 15 kW/m2	6	m	
					LC40% - 13,4 kW/m2	7	m	
					LC5% - 9,3 kW/m2	10	m	
					LC3% - 7,3 kW/m2	11	m	
					LC01% - 5 kW/m2	13	m	
					FLASH FIRE & EXPLOSION DAMAGE ZONES			
					Length of cloud (between LEL) 5D	0	m	
					Length of cloud (between LEL) 2F	0	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	E	--	
					Oil interceptor capacity	27	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	0	m3	

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm

[3] Equivalent to the 10% of the flow rate

Case description: Scenario 6 - evap D

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 6 - evap F

Parameters	Scenario 6 - evap D	Scenario 6 - evap F
Inputs		
Chemical name (DIPPR)	n-EICOSANE (DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	First 20% average (flammable)	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	1,1	1,1
Duration of the release (s)	600	600
Total mass released (kg)		
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	Spreading in bunds	Spreading in bunds
Type of pool growth on Water		
Temperature of the pool (°C)	45	45
Maximum pool surface area (m2)	67	67
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	flat sandy soil, concrete, tiles, plant-yard	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800
Results	Scenario 6 - evap D	Scenario 6 - evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	235	235
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	7,51E-06	6,94E-06
Purple book representative evaporation duration (s)	909,92	758,59
Representative temperature (°C)	52,974	59,037
Representative pool diameter (m)	9,2362	9,2362
Density after mixing with air (kg/m3)	1,2072	1,2072
Total evaporated mass (kg)	0,0068371	0,0052609
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	67	67
Other information		
Main program	Effects 8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1FlAndrea_silvasantos at 05/11/2015 11:04:55

Case description: scenario 6/17- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 6/17 - evap D)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 6/17 - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 6/17 - evap F)

Parameters		
Inputs		
	PFIRE LC01,	PFIRE LC40,
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	1036,3	1036,3
Mass flow rate of the source (kg/s)	7,51E-06	6,94E-06
Duration of the release (s)	909,92	758,59
Pool surface poolfire (m2)	67	67
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	45	45
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results		
	PFIRE LC01,	PFIRE LC40,
Max Diameter of the Pool Fire (m)	9,2362	9,2362
Heat radiation at X (kW/m2)	0,00010433	0,00015963
Heat radiation first contour at (m)	13,291	6,6743
Heat radiation second contour at (m)	11,479	5,8241
Heat radiation third contour at (m)	9,9027	4,6191
Combustion rate (kg/s)	2,3065	2,3065
Duration of the pool fire (s)	449,29	449,29
Heat emission from fire surface (kW/m2)	19,424	18,941
Flame tilt (deg)	55,01	42,068
View factor (%)	0,0013452	0,0021107
Atmospheric transmissivity (%)	39,929	39,929
Flame temperature (°C)	495,91	491,19
Height of the Flame (m)	7,873	9,5435
Calculated pool surface area (m2)	67	67
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
	Effects	
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1Fiandrea_silvasantos at 08/04/2016 12:52:32

Case description: scenario 6 - explosive mass D (linked to Pool evaporation - Scenario 6 - evap D)

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 6 - explosive mass F (linked to Pool evaporation - Scenario 6 - evap F)

Parameters

Inputs	explosive mass	explosive mass
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
Total mass released (kg)		
Mass flow rate of the source (kg/s)	7,51E-06	6,94E-06
Duration of the release (s)	909,92	758,59
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	67	67
Diameter of expanded jet (m)		
Temperature after release (°C)	45	45
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	D (Neutral)
Wind speed at 10 m height (m/s)	5	2
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation,
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	explosive mass	explosive mass
Explosive mass at time t (kg)	0,00E+00	0,00E+00
Height to LEL at time t (m)	0,00E+00	0,00E+00
Length of cloud (between LEL) at time t (m)	0,00E+00	0,00E+00
Width of cloud (between LEL) at time t (m)	0,00E+00	0,00E+00
Offset between release location and LEL at time t (m)	-1,00E+100	-1,00E+100
Maximum explosive mass (kg)	0,00E+00	0,00E+00
...at time tmem (s)	0,00E+00	0,00E+00
Start time where 95% of maximum of explosive mass is reached (s)	0,00E+00	0,00E+00
Time where explosive mass starts decreasing below 95% of max (s)	0,00E+00	0,00E+00
Length of cloud (between LEL) at time tmem (m)	0,00E+00	0,00E+00
Width of cloud (between LEL) at time tmem (m)	0,00E+00	0,00E+00
Offset between release location and LEL at time tmem (m)	-1,00E+100	-1,00E+100
Maximum area of explosive cloud (m2)	0,00E+00	0,00E+00
...at time tmac (s)	0,00E+00	0,00E+00
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Width of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Offset between release location and LEL at time tmac (m)	-1,00E+100	-1,00E+100
Offset between release centre and cloud centre at time tmac (m)	-1,50E+100	-1,50E+100
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0

Other information

Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1FlAndrea_silvasantos at 05/11/2015 11:05:49

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		D3 Transfer pump	HFO	Units				
HFO-006 of	Catastrophic failure. Discharge line	Substance	HFO		Confined release	Yes	--	
		Maximum mass flow	40	m3/h	Bund dimensions		m3	
		Pipeline diameter	8	inch	Roughness length description	Concrete	--	
		Operation pressure	4	bar	Roughness	10,00	cm	
		Operation temperature	45	°C	Soil temperature	19,00	°C	
		Hole diameter	8	inch	Meteo station	Malta airport	--	
		Release mass flow [3]	16,52	kg/s	Ambient relative humidity	75,00	%	
					Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	600	s	
					Mass flow rate	16,52	kg/s	
					Total mass released	9910,00	kg	
					Total volume released [1]	10,00	m3	
					EVAPORATION & DISPERSION DATA			
					Pool area [2]	1000	m²	
					Evaporation rate 5D	1,26E-04	kg/s	
					Evaporation rate 2F	1,04E-04	kg/s	
					Evaporation duration 5D	842,44	s	
					Evaporation duration 2F	726,17	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	18	m	
					LC50% - 15 kW/m2	22	m	
					LC40% - 13,4 kW/m2	24	m	
					LC5% - 9,3 kW/m2	31	m	
					LC3% - 7,3 kW/m2	35	m	
					LC01% - 5 kW/m2	41	m	
					FLASH FIRE & EXPLOSION DAMAGE ZONES			
					Length of cloud (between LEL) 5D	0	m	
					Length of cloud (between LEL) 2F	0	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	E	--	
					Oil interceptor capacity	27	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	0	m3	

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm

[3] Equivalent to 1,5 x flow rate

Case description: Scenario 6A/17A - evap D

Model: Pool evaporation

version: 5.16 (05/04/2016)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 6A/17A - evap F

Parameters	Scenario 6A/17A - evap D	Scenario 6A/17A - evap F
Inputs		
Chemical name (DIPPR)	n-EICOSANE (DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	First 20% average (flammable)	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	16,52	16,52
Duration of the release (s)	600	600
Total mass released (kg)		
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	Spreading in bunds	Spreading in bunds
Type of pool growth on Water		
Temperature of the pool (°C)	45	45
Maximum pool surface area (m2)	1000	1000
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	flat sandy soil, concrete, tiles, plant-yard	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800
Results	Scenario 6A/17A - evap D	Scenario 6A/17A - evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	233,5	233,5
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	0,00012634	0,00010414
Purple book representative evaporation duration (s)	842,44	726,17
Representative temperature (°C)	55,498	60,561
Representative pool diameter (m)	35,682	35,682
Density after mixing with air (kg/m3)	1,2073	1,2073
Total evaporated mass (kg)	0,10643	0,075626
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	1000	1000
Other information		
Main program	Effects 8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1FlAndrea_silvasantos at 05/04/2016 15:15:48

Case description: scenario 6A/17A- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 6A/17A - evap D)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 6A/17A - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 6A/17A - evap D)

Parameters	PFIRE LC01,	PFIRE LC40,
Inputs	(DIPPR)	(DIPPR)
Chemical name (DIPPR)	Confined	Confined
Pool size determination	9910	9910
Total mass released (kg)	0,00012634	0,00012634
Mass flow rate of the source (kg/s)	842,44	842,44
Duration of the release (s)	1000	1000
Pool surface poolfire (m2)	0	0
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)		
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	45	45
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		

Results	PFIRE LC01,	PFIRE LC40,
Max Diameter of the Pool Fire (m)	35,682	35,682
Heat radiation at X (kW/m2)	0,0013208	0,0013208
Heat radiation first contour at (m)	40,758	23,949
Heat radiation second contour at (m)	35,46	21,867
Heat radiation third contour at (m)	31,492	17,842
Combustion rate (kg/s)	34,426	34,426
Duration of the pool fire (s)	287,87	287,87
Heat emission from fire surface (kW/m2)	20,462	20,462
Flame tilt (deg)	50,063	50,063
View factor (%)	0,016119	0,016119
Atmospheric transmissivity (%)	40,045	40,045
Flame temperature (°C)	505,79	505,79
Height of the Flame (m)	21,26	21,26
Calculated pool surface area (m2)	1000	1000
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97

Other information	Effects
Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 08/04/2016 12:59:25

Case description: scenario 6 - explosive mass D (linked to Pool evaporation - Scenario 6 - evap D)

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 6 - explosive mass F (linked to Pool evaporation - Scenario 6 - evap F)

Parameters

Inputs	explosive mass	explosive mass
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
Total mass released (kg)		
Mass flow rate of the source (kg/s)	7,51E-06	6,94E-06
Duration of the release (s)	909,92	758,59
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	67	67
Diameter of expanded jet (m)		
Temperature after release (°C)	45	45
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	D (Neutral)
Wind speed at 10 m height (m/s)	5	2
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation,
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	explosive mass	explosive mass
Explosive mass at time t (kg)	0,00E+00	0,00E+00
Height to LEL at time t (m)	0,00E+00	0,00E+00
Length of cloud (between LEL) at time t (m)	0,00E+00	0,00E+00
Width of cloud (between LEL) at time t (m)	0,00E+00	0,00E+00
Offset between release location and LEL at time t (m)	-1,00E+100	-1,00E+100
Maximum explosive mass (kg)	0,00E+00	0,00E+00
...at time tmem (s)	0,00E+00	0,00E+00
Start time where 95% of maximum of explosive mass is reached (s)	0,00E+00	0,00E+00
Time where explosive mass starts decreasing below 95% of max (s)	0,00E+00	0,00E+00
Length of cloud (between LEL) at time tmem (m)	0,00E+00	0,00E+00
Width of cloud (between LEL) at time tmem (m)	0,00E+00	0,00E+00
Offset between release location and LEL at time tmem (m)	-1,00E+100	-1,00E+100
Maximum area of explosive cloud (m2)	0,00E+00	0,00E+00
...at time tmac (s)	0,00E+00	0,00E+00
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Width of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Offset between release location and LEL at time tmac (m)	-1,00E+100	-1,00E+100
Offset between release centre and cloud centre at time tmac (m)	-1,50E+100	-1,50E+100
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0

Other information

Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1FlAndrea_silvasantos at 05/11/2015 11:05:49

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	HFO	Units			
HFO-007	HFO pipelines from D3 transfer pump to D3 buffer tank. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm	Substance	HFO		Confined release	No	--
		Flow rate	40	m3/h	Bund dimensions	--	--
		Pipeline diameter	6	inch	Roughness length description	Concrete	--
		Pipeline length	110	m	Roughness	10,00	cm
		Operation pressure	4	bar	Soil temperature	19,00	°C
		Operation temperature	100	°C	Meteo station	Malta airport	--
		Hole diameter	0,6	inch	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate [3]	1,10	kg/s
					Total mass released	1982	kg
					Total volume released [1]	2	m3
					EVAPORATION & DISPERSION DATA		
					Pool area [2]	200	m²
					Evaporation rate 4D	0,000022108	kg/s
					Evaporation rate 5D	0,00001792	kg/s
					Evaporation duration 5D	941,19	s
					Evaporation duration 2F	864,69	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	8	m
					LC50% - 15 kW/m2	10	m
					LC40% - 13,4 kW/m2	11	m
					LC5% - 9,3 kW/m2	16	m
					LC3% - 7,3 kW/m2	18	m
					LC01% - 5 kW/m2	21	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	0	m
					Length of cloud (between LEL) 2F	0	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	D	--
					Oil interceptor capacity	21	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 cm

[3] Equivalent to the 10% of the flow rate

Case description: Scenario 7 - evap D

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 7 - evap F

Parameters

Inputs	evap D	Scenario 7 - evap F
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	1,1	1,1
Duration of the release (s)	1800	1800
<i>Total mass released (kg)</i>		
<i>Height pool at t=0</i>		
<i>Value pool height at t=0 (m)</i>		
Type of pool growth on Land	bunds	Spreading in bunds
<i>Type of pool growth on Water</i>		
Temperature of the pool (°C)	45	45
Maximum pool surface area (m2)	200	200
Temperature of the subsoil (°C)	19	19
<i>Temperature of the water (°C)</i>		
<i>Max temperature difference between pool and water (K)</i>		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
<i>Solar heat radiation flux (W/m2)</i>		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800

Results

	evap D	Scenario 7 - evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	696,5	695
<i>Time until pool has totally evaporated (s)</i>		
Purple book representative evaporation rate (kg/s)	2,21E-05	1,79E-05
Purple book representative evaporation duration (s)	941,19	864,69
Representative temperature (°C)	53,4	58,214
Representative pool diameter (m)	15,958	15,958
Density after mixing with air (kg/m3)	1,2072	1,2072
Total evaporated mass (kg)	0,020808	0,015495
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	200	200

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fandrea_silvasantos at 05/11/2015 11:07:09

Case description: scenario 7/18/19- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 7/18/19 - evap D)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 7/1819 - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 7/18/19 - evap F)

Parameters	PFIRE LC01,	PFIRE LC40,
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	1982	1982
Mass flow rate of the source (kg/s)	2,21E-05	1,79E-05
Duration of the release (s)	941,19	864,69
Pool surface poolfire (m2)	200	200
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	45	45
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	Scenario 7/18/19 PFIRE LC01,	Scenario 7/18/19 PFIRE LC40,
Max Diameter of the Pool Fire (m)	15,958	15,958
Heat radiation at X (kW/m2)	0,00029039	0,00043847
Heat radiation first contour at (m)	20,844	10,65
Heat radiation second contour at (m)	17,788	9,5919
Heat radiation third contour at (m)	15,739	7,9798
Combustion rate (kg/s)	6,8851	6,8851
Duration of the pool fire (s)	287,87	287,87
Heat emission from fire surface (kW/m2)	19,822	19,299
Flame tilt (deg)	53,067	39,724
View factor (%)	0,0036662	0,0056858
Atmospheric transmissivity (%)	39,958	39,958
Flame temperature (°C)	499,75	494,71
Height of the Flame (m)	11,768	14,264
Calculated pool surface area (m2)	200	200
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	Effects 8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1Fiandrea_silvasantos at 08/04/2016 12:53:01

Case description: scenario 7 - explosive mass D (linked to Pool evaporation - Scenario 7 - evap D)

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 7 - explosive mass f (linked to Pool evaporation - Scenario 7 - evap F)

Parameters

Inputs	explosive mass	explosive mass f
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
Total mass released (kg)		
Mass flow rate of the source (kg/s)	2,21E-05	1,79E-05
Duration of the release (s)	941,19	864,69
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	200	200
Diameter of expanded jet (m)		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	2
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation,
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	explosive mass	explosive mass f
Explosive mass at time t (kg)	-1,00E+100	-1,00E+100
Height to LEL at time t (m)	-1,00E+100	-1,00E+100
Length of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100
Width of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100
Offset between release location and LEL at time t (m)	-1,00E+100	-1,00E+100
Maximum explosive mass (kg)	-1,00E+100	-1,00E+100
...at time tmem (s)	-1,00E+100	-1,00E+100
Start time where 95% of maximum of explosive mass is reached (s)	-1,00E+100	-1,00E+100
Time where explosive mass starts decreasing below 95% of max (s)	-1,00E+100	-1,00E+100
Length of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100
Width of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100
Offset between release location and LEL at time tmem (m)	-1,00E+100	-1,00E+100
Maximum area of explosive cloud (m2)	-1,00E+100	-1,00E+100
...at time tmac (s)	-1,00E+100	-1,00E+100
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Width of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Offset between release location and LEL at time tmac (m)	-1,00E+100	-1,00E+100
Offset between release centre and cloud centre at time tmac (m)	-1,50E+100	-1,50E+100
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 11:08:03

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	HFO	Units			
HFO-007 FBR	HFO pipelines from D3 transfer pump to D3 buffer tank. Rupture in the pipeline	Substance	HFO		Confined release	No	--
		Flow rate	40	m3/h	Bund dimensions	--	--
		Pipeline diameter	6	inch	Roughness length description	Concrete	--
		Pipeline length	110	m	Roughness	10,00	cm
		Operation pressure	4	bar	Soil temperature	19,00	°C
		Operation temperature	100	°C	Meteo station	Malta airport	--
		Hole diameter	6	inch	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate [3]	16,52	kg/s
					Total mass released	29730	kg
					Total volume released [1]	30	m3
					EVAPORATION & DISPERSION DATA		
					Pool area [2]	3000	m²
					Evaporation rate 4D	1,26E-04	kg/s
					Evaporation rate 5D	8,36E-05	kg/s
					Evaporation duration 5D	1065,5	s
					Evaporation duration 2F	1013,3	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	22	m
					LC50% - 15 kW/m2	24	m
					LC40% - 13,4 kW/m2	26	m
					LC5% - 9,3 kW/m2	38	m
					LC3% - 7,3 kW/m2	42	m
					LC01% - 5 kW/m2	48	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	0	m
					Length of cloud (between LEL) 2F	0	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	D	--
					Oil interceptor capacity	21	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	9	m3

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm

[3] Equivalent to 1,5 x flow rate

Case description: Scenario 7A/18A/19A - evap D

Model: Pool evaporation

version: 5.16 (05/04/2016)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 7A/18A/19A - evap F

Parameters

Inputs	7A/18A/19A -	Scenario 7A/18A/19A - evap F
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	16,52	16,52
Duration of the release (s)	1800	1800
<i>Total mass released (kg)</i>		
<i>Height pool at t=0</i>		
<i>Value pool height at t=0 (m)</i>		
Type of pool growth on Land	bunds	Spreading in bunds
<i>Type of pool growth on Water</i>		
Temperature of the pool (°C)	45	45
Maximum pool surface area (m2)	1500	1500
Temperature of the subsoil (°C)	19	19
<i>Temperature of the water (°C)</i>		
<i>Max temperature difference between pool and water (K)</i>		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
<i>Solar heat radiation flux (W/m2)</i>		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800

Results

	7A/18A/19A -	Scenario 7A/18A/19A - evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	349,5	349
<i>Time until pool has totally evaporated (s)</i>		
Purple book representative evaporation rate (kg/s)	0,00012609	8,36E-05
Purple book representative evaporation duration (s)	1065,5	1013,3
Representative temperature (°C)	51,883	54,726
Representative pool diameter (m)	43,702	43,702
Density after mixing with air (kg/m3)	1,2072	1,2073
Total evaporated mass (kg)	0,13436	0,084737
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	1500	1500

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fandrea_silvasantos at 05/04/2016 15:25:40

Case description: scenario 7A/18A/19A- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 7A/18A/19A - evap D)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 7A/18A/19A - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 7A/18A/19A - evap F)

Parameters	7A/18A/19A-	7A/18A/19A -
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	29730	29730
Mass flow rate of the source (kg/s)	0,00012609	8,36E-05
Duration of the release (s)	1065,5	1013,3
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	45	45
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		

Results	7A/18A/19A-	7A/18A/19A -
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0019392	0,0027756
Heat radiation first contour at (m)	48,436	25,916
Heat radiation second contour at (m)	42,179	24,456
Heat radiation third contour at (m)	37,558	21,852
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	575,73	575,73
Heat emission from fire surface (kW/m2)	20,633	20,127
Flame tilt (deg)	49,28	35,336
View factor (%)	0,02345	0,034407
Atmospheric transmissivity (%)	40,08	40,08
Flame temperature (°C)	507,38	502,64
Height of the Flame (m)	24,676	29,044
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97

Other information	Effects
Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fiandrea_silvasantos at 08/04/2016 13:00:08

Case description: scenario 7A/18A/19A - explosive mass D (linked to Pool evaporation - Scenario 7A/18A/19A - evap D)

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/04/2016)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 7A/18A/19A - explosive mass f (linked to Pool evaporation - Scenario 7A/18A/19A - evap F)

Parameters		
Inputs	7A/18A/19A -	7A/18A/19A -
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
Total mass released (kg)		
Mass flow rate of the source (kg/s)	0,00012609	8,36E-05
Duration of the release (s)	1065,5	1013,3
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	1500	1500
Diameter of expanded jet (m)		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	2
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation,
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low
Results	7A/18A/19A -	7A/18A/19A -
Explosive mass at time t (kg)	0	0
Height to LEL at time t (m)	0	0
Length of cloud (between LEL) at time t (m)	0	0
Width of cloud (between LEL) at time t (m)	0	0
Offset between release location and LEL at time t (m)	0	0
Maximum explosive mass (kg)	0	0
...at time tmem (s)	0	0
Start time where 95% of maximum of explosive mass is reached (s)	0	0
Time where explosive mass starts decreasing below 95% of max (s)	0	0
Length of cloud (between LEL) at time tmem (m)	0	0
Width of cloud (between LEL) at time tmem (m)	0	0
Offset between release location and LEL at time tmem (m)	0	0
Maximum area of explosive cloud (m2)	0	0
...at time tmac (s)	0	0
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0	0
Width of cloud (between LEL) at time tmac (m)	0	0
Offset between release location and LEL at time tmac (m)	0	0
Offset between release centre and cloud centre at time tmac (m)	0	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0,096426
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/04/2016 15:27:17

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units	
		D3 BUFFER TANK	HFO	Units					
HFO-008	Continuous release from a hole with an effective diameter of 10 mm of the HFO service tank	Substance	HFO		Confined release		No	--	
		Nominal volume	125	m3	Bund dimensions		--	m3	
		Filling degree	95	%	Roughness length description		Concrete	--	
		Diameter	22	m	Roughness		10,00	cm	
		Height	15	m	Soil temperature		19,00	°C	
		Operation Pressure	4	bar	Meteo station		Malta airport	--	
		Operation Temperature	100	°C	Ambient relative humidity		75,00	%	
					Ambient temperature		19,00	°C	
					Meteorological condition 1		D / 4	-- / m/s	
					Meteorological condition 2		F / 2	-- / m/s	
					RELEASE DATA				
					Release duration		until device is empty	s	
					Mass flow rate		0,6136	kg/s	
					Total mass released		8,95E+04	kg	
					Total volume released [1]		90	m3	
					EVAPORATION & DISPERSION DATA				
					Maximum pool area [2]		9032	m²	
					Evaporation rate 4D		0,000054338	kg/s	
					Evaporation rate 2F		0,000053544	kg/s	
					Evaporation duration 5D		637,19	s	
					Evaporation duration 2F		564,94	s	
					POOL FIRE DAMAGE ZONES				
					LC99% - 37,5 kW/m2		22	m	
					LC50% - 15 kW/m2		24	m	
					LC40% - 13,4 kW/m2		26	m	
					LC5% - 9,3 kW/m2		38	m	
					LC3% - 7,3 kW/m2		42	m	
					LC01% - 5 kW/m2		48	m	
					FLASH FIRE & EXPLOSION ZONES				
					Length of cloud (between LEL) 5D		0	m	
					Length of cloud (between LEL) 2F		0	m	
					ENVIRONMENTAL SPILLAGE DATA				
					Oil interceptor		D	--	
					Oil interceptor capacity		21	m3	
					Oil interceptor efficiency		NA	--	
					Total volume released to water		69	m3	

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm. Limited to 1500 m2

Case description: scenario 8 release

Model: Liquid release

version: 5.08 (05/11/2015)

Reference: Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	(DIPPR)
Use which representative step	average
Type of release	hole in vessel
Pipeline length (m)	
Pipeline diameter (mm)	
Pipeline roughness (mm)	
Hole diameter (mm)	10
Hole rounding	Sharp edges
Discharge coefficient (-)	0,62
Vessel type	Vertical cylinder
Vessel volume (m3)	125
Height cylinder (m)	15
Filling degree (%)	95
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	65
Type of calculation	device is empty
Time t after start release (s)	

Results

Initial mass in vessel (kg)	89506
Mass flow rate at time t (kg/s)	
Total mass released (kg)	89506
Time needed to empty vessel (s)	2,87E+05
Filling degree at time t (%)	
Height of liquid at time t (m)	
Maximum mass flow rate (kg/s)	0,6136
Representative release rate (kg/s)	0,61322
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1FlAndrea_silvasantos at 05/11/2015 11:10:12

Case description: Scenario 8 - evap d (linked to Liquid release - scenario 8 release)

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2nd Edition - Chapter 5: Evaporation

compared to: Scenario 8 - evap F (linked to Liquid release - scenario 8 release)

Parameters

Inputs	evap d (linked to	evap F (linked to
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Use which representative step	average	average
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	0,61322	0,61322
Duration of the release (s)	1800	1800
Total mass released (kg)	89506	89506
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	bunds	bunds
Type of pool growth on Water		
Temperature of the pool (°C)	65	65
Maximum pool surface area (m2)	1500	1500
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	concrete, tiles,
Maximum evaluation time for evaporation (s)	1800	1800

Results

	evap d (linked to	evap F (linked to
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)		
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	5,43E-05	5,35E-05
Purple book representative evaporation duration (s)	637,19	564,94
Representative temperature (°C)	58,927	65,866
Representative pool diameter (m)	18,917	19,01
Density after mixing with air (kg/m3)	1,2072	1,2073
Total evaporated mass (kg)	0,034624	0,030249
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	281,05	283,82

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fandrea_silvasantos at 05/11/2015 11:12:32

Case description: scenario 8- PFIRE LC01, LC03, LC05 (linked to Liquid release - scenario 8 release)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 8 - PFIRE LC40, LC50, LC99 (linked to Liquid release - scenario 8 release)

Parameters

Inputs	PFIRE LC01,	PFIRE LC40,
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	89506	89506
Mass flow rate of the source (kg/s)	0,61322	0,61322
Duration of the release (s)	1800	1800
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)	10	10
Discharge coefficient (-)	0,62	0,62
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	65	65
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		

Results

	Scenario 8 PFIRE LC01,	Scenario 8 PFIRE LC40,
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0019392	0,0027756
Heat radiation first contour at (m)	48,436	25,916
Heat radiation second contour at (m)	42,179	24,456
Heat radiation third contour at (m)	37,558	21,852
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	1733,3	1733,3
Heat emission from fire surface (kW/m2)	20,633	20,127
Flame tilt (deg)	49,28	35,336
View factor (%)	0,02345	0,034407
Atmospheric transmissivity (%)	40,08	40,08
Flame temperature (°C)	507,38	502,64
Height of the Flame (m)	24,676	29,044
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010



Effects report created by ESLR2RH1Fiandrea_silvasantos at 08/04/2016 12:53:30

Case description: scenario 8 - explosive mass D (linked to Pool evaporation - Scenario 8 - evap d (linked to Liquid release - scenario 8 release))

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 8 - explosive mass F (linked to Pool evaporation - Scenario 8 - evap F (linked to Liquid release - scenario 8 release))

Parameters

Inputs

	explosive mass	explosive mass
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
Total mass released (kg)	89506	89506
Mass flow rate of the source (kg/s)	5,43E-05	5,35E-05
Duration of the release (s)	637,19	564,94
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	281,05	283,82
Diameter of expanded jet (m)		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	2
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation,
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	explosive mass	explosive mass
Explosive mass at time t (kg)	0	0
Height to LEL at time t (m)	0	0
Length of cloud (between LEL) at time t (m)	0	0
Width of cloud (between LEL) at time t (m)	0	0
Offset between release location and LEL at time t (m)	0	0
Maximum explosive mass (kg)	0	0
...at time tmem (s)	0	0
Start time where 95% of maximum of explosive mass is reached (s)	0	0
Time where explosive mass starts decreasing below 95% of max (s)	0	0
Length of cloud (between LEL) at time tmem (m)	0	0
Width of cloud (between LEL) at time tmem (m)	0	0
Offset between release location and LEL at time tmem (m)	0	0
Maximum area of explosive cloud (m2)	0	0
...at time tmac (s)	0	0
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0	0
Width of cloud (between LEL) at time tmac (m)	0	0
Offset between release location and LEL at time tmac (m)	0	0
Offset between release centre and cloud centre at time tmac (m)	0	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0,096426

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

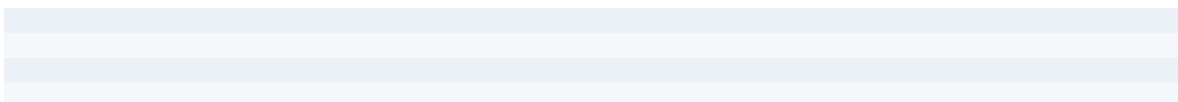
Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 11:16:49

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units	
		D3 BUFFER TANK	HFO	Units					
HFO-008 CF	Instantaneous release of the entire contents. HFO service tank	Substance	HFO		Confined release		No	--	
		Nominal volume	125	m3	Bund dimensions		--	m3	
		Filling degree	95	%	Roughness length description		Concrete	--	
		Diameter	22	m	Roughness		10,00	cm	
		Height	15	m	Soil temperature		19,00	°C	
		Operation Pressure	4	bar	Meteo station		Malta airport	--	
		Operation Temperature	100	°C	Ambient relative humidity		75,00	%	
					Ambient temperature		19,00	°C	
					Meteorological condition 1		D / 4	-- / m/s	
					Meteorological condition 2		F / 2	-- / m/s	
					RELEASE DATA				
					Release duration		Instantaneous	s	
					Mass flow rate		na	kg/s	
					Total mass released		1,24E+05	kg	
					Total volume released [1]		125	m3	
					EVAPORATION & DISPERSION DATA				
					Maximum pool area [2]		12500	m²	
					Evaporation rate 4D		0,00034452	kg/s	
					Evaporation rate 2F		0,00016931	kg/s	
					Evaporation duration 5D		1367,9	s	
					Evaporation duration 2F		1490,5	s	
					POOL FIRE DAMAGE ZONES				
					LC99% - 37,5 kW/m2		22	m	
					LC50% - 15 kW/m2		24	m	
					LC40% - 13,4 kW/m2		26	m	
					LC5% - 9,3 kW/m2		38	m	
					LC3% - 7,3 kW/m2		42	m	
					LC01% - 5 kW/m2		48	m	
					FLASH FIRE & EXPLOSION ZONES				
					Length of cloud (between LEL) 5D		0	m	
					Length of cloud (between LEL) 2F		0	m	
					ENVIRONMENTAL SPILLAGE DATA				
					Oil interceptor		D	--	
					Oil interceptor capacity		21	m3	
					Oil interceptor efficiency		NA	--	
					Total volume released to water		104	m3	

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm. Limited to 1500 m2



Case description: Scenario 8A - evap d

Model: Pool evaporation

version: 5.16 (05/04/2016)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 8A - evap F

Parameters

Inputs	evap d	evap F
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Use which representative step	average	average
Evaporation from land or water	Land	Land
Type of release	Instantaneous	Instantaneous
Mass flow rate of the source (kg/s)		
Duration of the release (s)		
Total mass released (kg)	1,24E+05	1,24E+05
Height pool at t=0	t	t
Value pool height at t=0 (m)		
Type of pool growth on Land	bunds	bunds
Type of pool growth on Water		
Temperature of the pool (°C)	65	65
Maximum pool surface area (m2)	1500	1500
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	concrete, tiles,
Maximum evaluation time for evaporation (s)	1800	1800

Results

	evap d	evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	7,5	7,5
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	0,00034452	0,00016931
Purple book representative evaporation duration (s)	1367,9	1490,5
Representative temperature (°C)	64,728	64,73
Representative pool diameter (m)	36,91	36,989
Density after mixing with air (kg/m3)	1,2074	1,2074
Total evaporated mass (kg)	0,47127	0,25235
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	1070	1074,6

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fandrea_silvasantos at 05/04/2016 15:35:39

Case description: scenario 8A- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 8A - evap d)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 8A - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 8A - evap F)

Parameters		
Inputs	PFIRE LC01,	PFIRE LC40,
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	1,24E+05	1,24E+05
Mass flow rate of the source (kg/s)	0,00034452	0,00016931
Duration of the release (s)	1367,9	1490,5
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	65	65
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	Scenario 8A PFIRE LC01,	Scenario 8A PFIRE LC40,
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0019392	0,0027756
Heat radiation first contour at (m)	48,436	25,916
Heat radiation second contour at (m)	42,179	24,456
Heat radiation third contour at (m)	37,558	21,852
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	2401,3	2401,3
Heat emission from fire surface (kW/m2)	20,633	20,127
Flame tilt (deg)	49,28	35,336
View factor (%)	0,02345	0,034407
Atmospheric transmissivity (%)	40,08	40,08
Flame temperature (°C)	507,38	502,64
Height of the Flame (m)	24,676	29,044
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	



Effects report created by ESLR2RH1Fiandrea_silvasantos at 08/04/2016 13:01:11

Case description: scenario 8 - explosive mass D (linked to Pool evaporation - Scenario 8 - evap d (linked to Liquid release - scenario 8 release))

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 8 - explosive mass F (linked to Pool evaporation - Scenario 8 - evap F (linked to Liquid release - scenario 8 release))

Parameters		
Inputs		
	explosive mass	explosive mass
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
Total mass released (kg)	89506	89506
Mass flow rate of the source (kg/s)	5,43E-05	5,35E-05
Duration of the release (s)	637,19	564,94
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	281,05	283,82
Diameter of expanded jet (m)		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data		
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	2
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction		
Wind comes from (North = 0 degrees) (deg)	User defined	User defined
	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation,
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low
Results		
	explosive mass	explosive mass
Explosive mass at time t (kg)	0	0
Height to LEL at time t (m)	0	0
Length of cloud (between LEL) at time t (m)	0	0
Width of cloud (between LEL) at time t (m)	0	0
Offset between release location and LEL at time t (m)	0	0
Maximum explosive mass (kg)	0	0
...at time tmem (s)	0	0
Start time where 95% of maximum of explosive mass is reached (s)	0	0
Time where explosive mass starts decreasing below 95% of max (s)	0	0
Length of cloud (between LEL) at time tmem (m)	0	0
Width of cloud (between LEL) at time tmem (m)	0	0
Offset between release location and LEL at time tmem (m)	0	0
Maximum area of explosive cloud (m2)	0	0
...at time tmac (s)	0	0
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0	0
Width of cloud (between LEL) at time tmac (m)	0	0
Offset between release location and LEL at time tmac (m)	0	0
Offset between release centre and cloud centre at time tmac (m)	0	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0,096426
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 11:16:49

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		Pipeline	HFO	Units				
HFO-009	HFO pipelines from D3 buffer tanks to D3 centrifuges supply pump. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	HFO		Confined release	No	--	
		Flow rate	40	m3/h	Bund dimensions	--	--	
		Pipeline diameter	4	inch	Roughness length description	Concrete	--	
		Pipeline length	30	m	Roughness	10,00	cm	
		Operation pressure	4	bar	Soil temperature	19,00	°C	
		Operation temperature	100	°C	Meteo station	Malta airport	--	
		Hole diameter	0,4	inch	Ambient relative humidity	75,00	%	
					Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate	1,10	kg/s	
					Total mass released	1982	kg	
					Total volume released [1]	2	m3	
					EVAPORATION & DISPERSION DATA			
					Pool area [2]	200	m²	
					Evaporation rate 4D	0,000022108	kg/s	
					Evaporation rate 5D	0,00001792	kg/s	
					Evaporation duration 5D	941,19	s	
					Evaporation duration 2F	864,69	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	8	m	
					LC50% - 15 kW/m2	10	m	
					LC40% - 13,4 kW/m2	11	m	
					LC5% - 9,3 kW/m2	16	m	
					LC3% - 7,3 kW/m2	18	m	
					LC01% - 5 kW/m2	21	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	0	m	
					Length of cloud (between LEL) 2F	0	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	D	--	
					Oil interceptor capacity	21	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	0	m3	

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm

[3] Equivalent to the 10% of the flow rate

Case description: Scenario 7 - evap D

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 7 - evap F

Parameters	evap D	Scenario 7 - evap F
Inputs		
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	1,1	1,1
Duration of the release (s)	1800	1800
Total mass released (kg)		
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	bunds	Spreading in bunds
Type of pool growth on Water		
Temperature of the pool (°C)	45	45
Maximum pool surface area (m2)	200	200
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800
Results		
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	696,5	695
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	2,21E-05	1,79E-05
Purple book representative evaporation duration (s)	941,19	864,69
Representative temperature (°C)	53,4	58,214
Representative pool diameter (m)	15,958	15,958
Density after mixing with air (kg/m3)	1,2072	1,2072
Total evaporated mass (kg)	0,020808	0,015495
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	200	200
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1Flandrea_silvasantos at 05/11/2015 11:07:09

Case description: scenario 7/18/19- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 7/18/19 - evap D)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 7/1819 - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 7/18/19 - evap F)

Parameters	PFIRE LC01,	PFIRE LC40,
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	1982	1982
Mass flow rate of the source (kg/s)	2,21E-05	1,79E-05
Duration of the release (s)	941,19	864,69
Pool surface poolfire (m2)	200	200
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	45	45
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	Scenario 7/18/19 PFIRE LC01,	Scenario 7/18/19 PFIRE LC40,
Max Diameter of the Pool Fire (m)	15,958	15,958
Heat radiation at X (kW/m2)	0,00029039	0,00043847
Heat radiation first contour at (m)	20,844	10,65
Heat radiation second contour at (m)	17,788	9,5919
Heat radiation third contour at (m)	15,739	7,9798
Combustion rate (kg/s)	6,8851	6,8851
Duration of the pool fire (s)	287,87	287,87
Heat emission from fire surface (kW/m2)	19,822	19,299
Flame tilt (deg)	53,067	39,724
View factor (%)	0,0036662	0,0056858
Atmospheric transmissivity (%)	39,958	39,958
Flame temperature (°C)	499,75	494,71
Height of the Flame (m)	11,768	14,264
Calculated pool surface area (m2)	200	200
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	



Effects report created by ESLR2RH1Fiandrea_silvasantos at 08/04/2016 12:54:41

Case description: scenario 7 - explosive mass D (linked to Pool evaporation - Scenario 7 - evap D)

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 7 - explosive mass f (linked to Pool evaporation - Scenario 7 - evap F)

Parameters

Inputs	explosive mass	explosive mass f
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
Total mass released (kg)		
Mass flow rate of the source (kg/s)	2,21E-05	1,79E-05
Duration of the release (s)	941,19	864,69
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	200	200
Diameter of expanded jet (m)		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	2
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation,
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	explosive mass	explosive mass f
Explosive mass at time t (kg)	-1,00E+100	-1,00E+100
Height to LEL at time t (m)	-1,00E+100	-1,00E+100
Length of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100
Width of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100
Offset between release location and LEL at time t (m)	-1,00E+100	-1,00E+100
Maximum explosive mass (kg)	-1,00E+100	-1,00E+100
...at time tmem (s)	-1,00E+100	-1,00E+100
Start time where 95% of maximum of explosive mass is reached (s)	-1,00E+100	-1,00E+100
Time where explosive mass starts decreasing below 95% of max (s)	-1,00E+100	-1,00E+100
Length of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100
Width of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100
Offset between release location and LEL at time tmem (m)	-1,00E+100	-1,00E+100
Maximum area of explosive cloud (m2)	-1,00E+100	-1,00E+100
...at time tmac (s)	-1,00E+100	-1,00E+100
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Width of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Offset between release location and LEL at time tmac (m)	-1,00E+100	-1,00E+100
Offset between release centre and cloud centre at time tmac (m)	-1,50E+100	-1,50E+100
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 11:08:03

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	HFO	Units			
HFO-009 FBR	HFO pipelines from D3 buffer tanks to D3 centrifuges supply pump. Rupture in the pipeline	Substance	HFO		Confined release	No	--
		Flow rate	40	m3/h	Bund dimensions	--	--
		Pipeline diameter	4	inch	Roughness length description	Concrete	--
		Pipeline length	30	m	Roughness	10,00	cm
		Operation pressure	4	bar	Soil temperature	19,00	°C
		Operation temperature	100	°C	Meteo station	Malta airport	--
		Hole diameter	4	inch	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	16,52	kg/s
					Total mass released	29730	kg
					Total volume released [1]	30	m3
					EVAPORATION & DISPERSION DATA		
					Pool area [2]	3000	m²
					Evaporation rate 4D	0,00012609	kg/s
					Evaporation rate 5D	0,000083621	kg/s
					Evaporation duration 5D	1065,5	s
					Evaporation duration 2F	1013,3	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	23	m
					LC50% - 15 kW/m2	41	m
					LC40% - 13,4 kW/m2	44	m
					LC5% - 9,3 kW/m2	53	m
					LC3% - 7,3 kW/m2	57	m
					LC01% - 5 kW/m2	63	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	0	m
					Length of cloud (between LEL) 2F	0	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	D	--
					Oil interceptor capacity	21	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	9	m3

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm. Limited to 1500m2

[3] Equivalent to 1,5 x flow rate

Case description: Scenario 7A/18A/19A - evap D

Model: Pool evaporation

version: 5.16 (05/04/2016)

Reference: Yellow Book CPR14E 2nd Edition - Chapter 5: Evaporation

compared to: Scenario 7A/18A/19A - evap F

Parameters	7A/18A/19A -	Scenario 7A/18A/19A - evap F
Inputs		
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	16,52	16,52
Duration of the release (s)	1800	1800
Total mass released (kg)		
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	bunds	Spreading in bunds
Type of pool growth on Water		
Temperature of the pool (°C)	45	45
Maximum pool surface area (m2)	1500	1500
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800
Results	7A/18A/19A -	Scenario 7A/18A/19A - evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	349,5	349
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	0,00012609	8,36E-05
Purple book representative evaporation duration (s)	1065,5	1013,3
Representative temperature (°C)	51,883	54,726
Representative pool diameter (m)	43,702	43,702
Density after mixing with air (kg/m3)	1,2072	1,2073
Total evaporated mass (kg)	0,13436	0,084737
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	1500	1500
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1Fandrea_silvasantos at 05/04/2016 15:25:40

Case description: scenario 7A/18A/19A- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 7A/18A/19A - evap D)

Model: Pool fire

version: 5.11 (05/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 7A/18A/19A - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 7A/18A/19A - evap F)

Parameters	7A/18A/19A-	7A/18A/19A -
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	29730	29730
Mass flow rate of the source (kg/s)	0,00012609	8,36E-05
Duration of the release (s)	1065,5	1013,3
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	45	45
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	35	35
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results		
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0049294	0,0066469
Heat radiation first contour at (m)	63,407	43,733
Heat radiation second contour at (m)	56,551	41,214
Heat radiation third contour at (m)	52,701	22,837
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	575,73	575,73
Heat emission from fire surface (kW/m2)	48,431	44,887
Flame tilt (deg)	49,28	35,336
View factor (%)	0,02345	0,034407
Atmospheric transmissivity (%)	43,404	43,038
Flame temperature (°C)	690,23	672,26
Height of the Flame (m)	24,676	29,044
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	



Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/04/2016 15:26:43

Case description: scenario 7A/18A/19A - explosive mass D (linked to Pool evaporation - Scenario 7A/18A/19A - evap D)

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/04/2016)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 7A/18A/19A - explosive mass f (linked to Pool evaporation - Scenario 7A/18A/19A - evap F)

Parameters		
Inputs	7A/18A/19A -	7A/18A/19A -
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
Total mass released (kg)		
Mass flow rate of the source (kg/s)	0,00012609	8,36E-05
Duration of the release (s)	1065,5	1013,3
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	1500	1500
Diameter of expanded jet (m)		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	2
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation,
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low
Results	7A/18A/19A -	7A/18A/19A -
Explosive mass at time t (kg)	0	0
Height to LEL at time t (m)	0	0
Length of cloud (between LEL) at time t (m)	0	0
Width of cloud (between LEL) at time t (m)	0	0
Offset between release location and LEL at time t (m)	0	0
Maximum explosive mass (kg)	0	0
...at time tmem (s)	0	0
Start time where 95% of maximum of explosive mass is reached (s)	0	0
Time where explosive mass starts decreasing below 95% of max (s)	0	0
Length of cloud (between LEL) at time tmem (m)	0	0
Width of cloud (between LEL) at time tmem (m)	0	0
Offset between release location and LEL at time tmem (m)	0	0
Maximum area of explosive cloud (m2)	0	0
...at time tmac (s)	0	0
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0	0
Width of cloud (between LEL) at time tmac (m)	0	0
Offset between release location and LEL at time tmac (m)	0	0
Offset between release centre and cloud centre at time tmac (m)	0	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0,096426
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/04/2016 15:27:17

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		D3 centrifuges supply	HFO	Units				
HFO-010	Leak (10 % diameter). Discharge line	Substance	HFO		Confined release	Yes	--	
		Maximum mass flow	40	m3/h	Bund dimensions		m3	
		Pipeline diameter	4	inch	Roughness length description	Concrete	--	
		Operation pressure	4	bar	Roughness	10,00	cm	
		Operation temperature	100	°C	Soil temperature	19,00	°C	
		Hole diameter	0,4	inch	Meteo station	Malta airport	--	
					Ambient relative humidity	75,00	%	
					Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate	1,10	kg/s	
					Total mass released	1982	kg	
					Total volume released [1]	2	m3	
					EVAPORATION & DISPERSION DATA			
					Pool area [2]	200	m²	
					Evaporation rate 4D	0,000085061	kg/s	
					Evaporation rate 5D	0,000078865	kg/s	
					Evaporation duration 5D	960,71	s	
					Evaporation duration 2F	863,47	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	8	m	
					LC50% - 15 kW/m2	10	m	
					LC40% - 13,4 kW/m2	11	m	
					LC5% - 9,3 kW/m2	16	m	
					LC3% - 7,3 kW/m2	18	m	
					LC01% - 5 kW/m2	21	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	0	m	
					Length of cloud (between LEL) 2F	0	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	D	--	
					Oil interceptor capacity	21	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	0	m3	

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

Case description: scenario 10 release

Model: Liquid release

version: 5.08 (05/11/2015)

Reference: Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	(DIPPR)
Use which representative step	average
Type of release	vessel through
Pipeline length (m)	30
Pipeline diameter (inch)	4
Pipeline roughness (mm)	0,045
Hole diameter (inch)	0,4
Hole rounding	Sharp edges
Discharge coefficient (-)	0,62
Vessel type	cylinder
Vessel volume (m3)	45000
Length cylinder (m)	30
Filling degree (%)	100
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	100
Type of calculation	specified time
Time t after start release (s)	1800

Results

Initial mass in vessel (kg)	3,29E+07
Mass flow rate at time t (kg/s)	1,0762
Total mass released at time t (kg)	1947,2
Time needed to empty vessel (s)	
Filling degree at time t (%)	99,994
Height of liquid at time t (m)	43,655
Maximum mass flow rate (kg/s)	1,0767
Representative release rate (kg/s)	1,0766
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1FlAndrea_silvasantos at 05/11/2015 11:24:39

Case description: Scenario 10 - evap D (linked to Liquid release - scenario 10 release)

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2nd Edition - Chapter 5: Evaporation

compared to: Scenario 10 - evap F (linked to Liquid release - scenario 10 release)

Parameters

Inputs	evap D (linked to DIPPR)	evap F (linked to DIPPR)
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Use which representative step	average	average
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	1,0766	1,0766
Duration of the release (s)	1800	1800
Total mass released (kg)	1947,2	1947,2
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	bunds	bunds
Type of pool growth on Water		
Temperature of the pool (°C)	100	100
Maximum pool surface area (m2)	200	200
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	concrete, tiles,
Maximum evaluation time for evaporation (s)	1800	1800

Results

	evap D (linked to DIPPR)	evap F (linked to DIPPR)
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	704,5	702
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	8,51E-05	7,89E-05
Purple book representative evaporation duration (s)	960,71	863,47
Representative temperature (°C)	66,681	73,494
Representative pool diameter (m)	15,958	15,958
Density after mixing with air (kg/m3)	1,2073	1,2074
Total evaporated mass (kg)	0,081719	0,068098
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	200	200

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fandrea_silvasantos at 05/11/2015 11:26:31

Case description: scenario 10/11- PFIRE LC01, LC03, LC05 (linked to Liquid release - scenario 10/11 release)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 10/11 - PFIRE LC40, LC50, LC99 (linked to Liquid release - scenario 10/11 release)

Parameters	PFIRE LC01,	PFIRE LC40,
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	1947,2	1947,2
Mass flow rate of the source (kg/s)	1,0766	1,0766
Duration of the release (s)	1800	1800
Pool surface poolfire (m2)	200	200
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)	10,16	10,16
Discharge coefficient (-)	0,62	0,62
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	100	100
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	PFIRE LC01,	PFIRE LC40,
Max Diameter of the Pool Fire (m)	15,958	15,958
Heat radiation at X (kW/m2)	0,00029039	0,00043847
Heat radiation first contour at (m)	20,844	10,65
Heat radiation second contour at (m)	17,788	9,5919
Heat radiation third contour at (m)	15,739	7,9798
Combustion rate (kg/s)	6,8851	6,8851
Duration of the pool fire (s)	282,81	282,81
Heat emission from fire surface (kW/m2)	19,822	19,299
Flame tilt (deg)	53,067	39,724
View factor (%)	0,0036662	0,0056858
Atmospheric transmissivity (%)	39,958	39,958
Flame temperature (°C)	499,75	494,71
Height of the Flame (m)	11,768	14,264
Calculated pool surface area (m2)	200	200
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Case description: scenario 8 - explosive mass D (linked to Pool evaporation - Scenario 10 - evap D (linked to Liquid release - scenario 10 release))

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 8 - explosive mass F (linked to Pool evaporation - Scenario 10 - evap F (linked to Liquid release - scenario 10 release))

Parameters

Inputs

	explosive mass	explosive mass
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
Total mass released (kg)	1947,2	1947,2
Mass flow rate of the source (kg/s)	8,51E-05	7,89E-05
Duration of the release (s)	960,71	863,47
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	200	200
Diameter of expanded jet (m)		
Temperature after release (°C)	100	100
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	2
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation,
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	explosive mass	explosive mass
Explosive mass at time t (kg)	0	0
Height to LEL at time t (m)	0	0
Length of cloud (between LEL) at time t (m)	0	0
Width of cloud (between LEL) at time t (m)	0	0
Offset between release location and LEL at time t (m)	0	0
Maximum explosive mass (kg)	0	0
...at time tmem (s)	0	0
Start time where 95% of maximum of explosive mass is reached (s)	0	0
Time where explosive mass starts decreasing below 95% of max (s)	0	0
Length of cloud (between LEL) at time tmem (m)	0	0
Width of cloud (between LEL) at time tmem (m)	0	0
Offset between release location and LEL at time tmem (m)	0	0
Maximum area of explosive cloud (m2)	0	0
...at time tmac (s)	0	0
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0	0
Width of cloud (between LEL) at time tmac (m)	0	0
Offset between release location and LEL at time tmac (m)	0	0
Offset between release centre and cloud centre at time tmac (m)	0	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0,096426

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 11:29:44

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		D3 centrifuges supply	HFO	Units			
HFO-010 CF	Catastrophic failure. Discharge line	Substance	HFO		Confined release	Yes	--
		Maximum mass flow	40	m3/h	Bund dimensions		m3
		Pipeline diameter	4	inch	Roughness length description	Concrete	--
		Operation pressure	4	bar	Roughness	10,00	cm
		Operation temperature	100	°C	Soil temperature	19,00	°C
		Hole diameter	4	inch	Meteo station	Malta airport	--
					Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	16,52	kg/s
					Total mass released	29730	kg
					Total volume released [1]	30	m3
					EVAPORATION & DISPERSION DATA		
					Pool area [2]	3000	m²
					Evaporation rate 4D	8,51E-05	kg/s
					Evaporation rate 5D	7,89E-05	kg/s
					Evaporation duration 5D	960,71	s
					Evaporation duration 2F	863,47	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	22	m
					LC50% - 15 kW/m2	24	m
					LC40% - 13,4 kW/m2	26	m
					LC5% - 9,3 kW/m2	38	m
					LC3% - 7,3 kW/m2	42	m
					LC01% - 5 kW/m2	48	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	0	m
					Length of cloud (between LEL) 2F	0	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	D	--
					Oil interceptor capacity	21	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	9	m3

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 cm. Limited to 1500m2

[3] Equivalent to 1,5 x flow rate

Case description: scenario 10A/11A release

Model: Liquid release

version: 5.08 (05/04/2016)

Reference: Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	(DIPPR)
Use which representative step	average
Type of release	vessel through
Pipeline length (m)	30
Pipeline diameter (inch)	4
Pipeline roughness (mm)	0,045
Hole diameter (inch)	4
Hole rounding	Sharp edges
Discharge coefficient (-)	0,62
Vessel type	cylinder
Vessel volume (m3)	45000
Length cylinder (m)	30
Filling degree (%)	100
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	100
Type of calculation	specified time
Time t after start release (s)	1800

Results

Initial mass in vessel (kg)	3,29E+07
Mass flow rate at time t (kg/s)	62,246
Total mass released at time t (kg)	1,13E+05
Time needed to empty vessel (s)	
Filling degree at time t (%)	99,657
Height of liquid at time t (m)	43,001
Maximum mass flow rate (kg/s)	62,759
Representative release rate (kg/s)	62,655
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1FlAndrea_silvasantos at 05/04/2016 15:44:25

Case description: Scenario 10 - evap D (linked to Liquid release - scenario 10 release)

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2nd Edition - Chapter 5: Evaporation

compared to: Scenario 10 - evap F (linked to Liquid release - scenario 10 release)

Parameters

Inputs

	evap D (linked to	evap F (linked to
	DIPPR)	DIPPR)
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Use which representative step	average	average
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	1,0766	1,0766
Duration of the release (s)	1800	1800
Total mass released (kg)	1947,2	1947,2
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	bunds	bunds
Type of pool growth on Water		
Temperature of the pool (°C)	100	100
Maximum pool surface area (m2)	200	200
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	concrete, tiles,
Maximum evaluation time for evaporation (s)	1800	1800

Results

	evap D (linked to	evap F (linked to
	DIPPR)	DIPPR)
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	704,5	702
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	8,51E-05	7,89E-05
Purple book representative evaporation duration (s)	960,71	863,47
Representative temperature (°C)	66,681	73,494
Representative pool diameter (m)	15,958	15,958
Density after mixing with air (kg/m3)	1,2073	1,2074
Total evaporated mass (kg)	0,081719	0,068098
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	200	200

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fandrea_silvasantos at 05/11/2015 11:26:31

Case description: scenario 10A/11A- PFIRE LC01, LC03, LC05

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 10A/11A - PFIRE LC40, LC50, LC99

Parameters	10A/11A- PFIRE	10A/11A -
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	29730	29730
Mass flow rate of the source (kg/s)		
Duration of the release (s)		
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	100	100
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	10A/11A- PFIRE	10A/11A -
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0019392	0,0027756
Heat radiation first contour at (m)	48,436	25,916
Heat radiation second contour at (m)	42,179	24,456
Heat radiation third contour at (m)	37,558	21,852
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	575,73	575,73
Heat emission from fire surface (kW/m2)	20,633	20,127
Flame tilt (deg)	49,28	35,336
View factor (%)	0,02345	0,034407
Atmospheric transmissivity (%)	40,08	40,08
Flame temperature (°C)	507,38	502,64
Height of the Flame (m)	24,676	29,044
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Case description: scenario 8 - explosive mass D (linked to Pool evaporation - Scenario 10 - evap D (linked to Liquid release - scenario 10 release))

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 8 - explosive mass F (linked to Pool evaporation - Scenario 10 - evap F (linked to Liquid release - scenario 10 release))

Parameters

Inputs

	explosive mass	explosive mass
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
Total mass released (kg)	1947,2	1947,2
Mass flow rate of the source (kg/s)	8,51E-05	7,89E-05
Duration of the release (s)	960,71	863,47
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	200	200
Diameter of expanded jet (m)		
Temperature after release (°C)	100	100
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	2
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation,
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	explosive mass	explosive mass
Explosive mass at time t (kg)	0	0
Height to LEL at time t (m)	0	0
Length of cloud (between LEL) at time t (m)	0	0
Width of cloud (between LEL) at time t (m)	0	0
Offset between release location and LEL at time t (m)	0	0
Maximum explosive mass (kg)	0	0
...at time tmem (s)	0	0
Start time where 95% of maximum of explosive mass is reached (s)	0	0
Time where explosive mass starts decreasing below 95% of max (s)	0	0
Length of cloud (between LEL) at time tmem (m)	0	0
Width of cloud (between LEL) at time tmem (m)	0	0
Offset between release location and LEL at time tmem (m)	0	0
Maximum area of explosive cloud (m2)	0	0
...at time tmac (s)	0	0
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0	0
Width of cloud (between LEL) at time tmac (m)	0	0
Offset between release location and LEL at time tmac (m)	0	0
Offset between release centre and cloud centre at time tmac (m)	0	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0,096426

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 11:29:44

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	HFO	Units			
HFO-011	HFO pipelines from D3 centrifuges supply pump to D3 centrifuges. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	HFO		Confined release	No	--
		Flow rate	40	m3	Bund dimensions	--	--
		Pipeline diameter	4	inch	Roughness length description	Concrete	--
		Pipeline length	10	m	Roughness	10,00	cm
		Operation pressure	4	bar	Soil temperature	19,00	°C
		Operation temperature	100	°C	Meteo station	Malta airport	--
		Hole diameter	0,4	inch	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate [3]	1,10	kg/s
					Total mass released	1982	kg
					Total volume released [1]	2	m3
					EVAPORATION & DISPERSION DATA		
					Pool area [2]	200	m²
					Evaporation rate 4D	0,000085061	kg/s
					Evaporation rate 5D	0,000078865	kg/s
					Evaporation duration 5D	960,71	s
					Evaporation duration 2F	863,47	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	8	m
					LC50% - 15 kW/m2	10	m
					LC40% - 13,4 kW/m2	11	m
					LC5% - 9,3 kW/m2	16	m
					LC3% - 7,3 kW/m2	18	m
					LC01% - 5 kW/m2	21	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	0	m
					Length of cloud (between LEL) 2F	0	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	D	--
					Oil interceptor capacity	21	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm

[3] Equivalent to the 10% of the flow rate

Case description: scenario 10 release

Model: Liquid release

version: 5.08 (05/11/2015)

Reference: Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	(DIPPR)
Use which representative step	average
Type of release	vessel through
Pipeline length (m)	30
Pipeline diameter (inch)	4
Pipeline roughness (mm)	0,045
Hole diameter (inch)	0,4
Hole rounding	Sharp edges
Discharge coefficient (-)	0,62
Vessel type	cylinder
Vessel volume (m3)	45000
Length cylinder (m)	30
Filling degree (%)	100
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	100
Type of calculation	specified time
Time t after start release (s)	1800

Results

Initial mass in vessel (kg)	3,29E+07
Mass flow rate at time t (kg/s)	1,0762
Total mass released at time t (kg)	1947,2
Time needed to empty vessel (s)	
Filling degree at time t (%)	99,994
Height of liquid at time t (m)	43,655
Maximum mass flow rate (kg/s)	1,0767
Representative release rate (kg/s)	1,0766
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1FlAndrea_silvasantos at 05/11/2015 11:24:39

Case description: Scenario 10 - evap D (linked to Liquid release - scenario 10 release)

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2nd Edition - Chapter 5: Evaporation

compared to: Scenario 10 - evap F (linked to Liquid release - scenario 10 release)

Parameters

Inputs	evap D (linked to DIPPR)	evap F (linked to DIPPR)
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Use which representative step	average	average
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	1,0766	1,0766
Duration of the release (s)	1800	1800
Total mass released (kg)	1947,2	1947,2
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	bunds	bunds
Type of pool growth on Water		
Temperature of the pool (°C)	100	100
Maximum pool surface area (m2)	200	200
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	concrete, tiles,
Maximum evaluation time for evaporation (s)	1800	1800

Results

	evap D (linked to DIPPR)	evap F (linked to DIPPR)
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	704,5	702
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	8,51E-05	7,89E-05
Purple book representative evaporation duration (s)	960,71	863,47
Representative temperature (°C)	66,681	73,494
Representative pool diameter (m)	15,958	15,958
Density after mixing with air (kg/m3)	1,2073	1,2074
Total evaporated mass (kg)	0,081719	0,068098
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	200	200

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fandrea_silvasantos at 05/11/2015 11:26:31

Case description: scenario 10/11- PFIRE LC01, LC03, LC05 (linked to Liquid release - scenario 10/11 release)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 10/11 - PFIRE LC40, LC50, LC99 (linked to Liquid release - scenario 10/11 release)

Parameters	PFIRE LC01,	PFIRE LC40,
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	1947,2	1947,2
Mass flow rate of the source (kg/s)	1,0766	1,0766
Duration of the release (s)	1800	1800
Pool surface poolfire (m2)	200	200
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)	10,16	10,16
Discharge coefficient (-)	0,62	0,62
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	100	100
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	PFIRE LC01,	PFIRE LC40,
Max Diameter of the Pool Fire (m)	15,958	15,958
Heat radiation at X (kW/m2)	0,00029039	0,00043847
Heat radiation first contour at (m)	20,844	10,65
Heat radiation second contour at (m)	17,788	9,5919
Heat radiation third contour at (m)	15,739	7,9798
Combustion rate (kg/s)	6,8851	6,8851
Duration of the pool fire (s)	282,81	282,81
Heat emission from fire surface (kW/m2)	19,822	19,299
Flame tilt (deg)	53,067	39,724
View factor (%)	0,0036662	0,0056858
Atmospheric transmissivity (%)	39,958	39,958
Flame temperature (°C)	499,75	494,71
Height of the Flame (m)	11,768	14,264
Calculated pool surface area (m2)	200	200
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Case description: scenario 8 - explosive mass D (linked to Pool evaporation - Scenario 10 - evap D (linked to Liquid release - scenario 10 release))

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 8 - explosive mass F (linked to Pool evaporation - Scenario 10 - evap F (linked to Liquid release - scenario 10 release))

Parameters

Inputs	scenario 8 - explosive mass D (linked to Pool evaporation - Scenario 10 - evap D (linked to Liquid release - scenario 10 release))		explosive mass
(DIPPR)	n-EICOSANE (DIPPR)	(DIPPR)	
Type of release	Evaporating pool release	release	
released (kg)	1947,2	1947,2	
the source (kg/s)	8,51E-05	7,89E-05	
release (s)	960,71	863,47	
mass fraction			
surface (m2)	200	200	
expanded jet			
after release	100	100	
release (m)	0	0	
release (m)	0	0	
(height) of			
temperature (°C)	19	19	
data	Pasquill	Pasquill	
class	D (Neutral)	F (Very Stable)	
10 m height	5	2	
Obukhov length			
direction	User defined	User defined	
from (North = 0	270	270	
humidity (%)	75	75	
length	Mud flats, snow, no vegetation, no obstacles.	no vegetation,	
release (s)	120	120	
averaging time	20	20	
time consuming	Low	Low	

Results

	scenario 8 - explosive mass D (linked to Pool evaporation - Scenario 10 - evap D (linked to Liquid release - scenario 10 release))		explosive mass
at time t (kg)	0	0	
time t (m)	0	0	
(between LEL) at	0	0	
(between LEL) at	0	0	
release location	0	0	
explosive mass	0	0	
(s)	0	0	
95% of	0	0	
explosive mass	0	0	
(between LEL) at	0	0	
(between LEL) at	0	0	
release location	0	0	
of explosive	0	0	
(s)	0	0	
at time tmac (kg)	0	0	
(between LEL) at	0	0	
(between LEL) at	0	0	
release location	0	0	
release centre	0	0	
Obukhov length	0	0,096426	

Other information

Main program	Effects 8.1.8.6673
database	DIPPR database
Chemical source	DIPPR Jan2010
date	14/09/2010

Effects report created by ESLR2RH1FlAndrea_silvasantos at 05/11/2015 11:29:44

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		Pipeline	HFO	Units				
HFO-011 FBR	HFO pipelines from D3 centrifuges supply pump to D3 centrifuges. Leak with FBR	Substance	HFO		Confined release	No	--	
		Flow rate	40	m3	Bund dimensions	--	--	
		Pipeline diameter	4	inch	Roughness length description	Concrete	--	
		Pipeline length	10	m	Roughness	10,00	cm	
		Operation pressure	4	bar	Soil temperature	19,00	°C	
		Operation temperature	100	°C	Meteo station	Malta airport	--	
		Hole diameter	4	inch	Ambient relative humidity	75,00	%	
					Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate [3]	16.52	kg/s	
					Total mass released	29730	kg	
					Total volume released [1]	30	m3	
					EVAPORATION & DISPERSION DATA			
					Pool area [2]	3000	m²	
					Evaporation rate 4D	0	kg/s	
					Evaporation rate 5D	0	kg/s	
					Evaporation duration 5D	0	s	
					Evaporation duration 2F	0	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	23	m	
					LC50% - 15 kW/m2	41	m	
					LC40% - 13,4 kW/m2	44	m	
					LC5% - 9,3 kW/m2	53	m	
					LC3% - 7,3 kW/m2	57	m	
					LC01% - 5 kW/m2	63	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	0	m	
					Length of cloud (between LEL) 2F	0	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	D	--	
					Oil interceptor capacity	21	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	9	m3	

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm. Limited to 1500 m2

[3] Equivalent to 1,5 x flow rate

Case description: scenario 11A release

Model: Liquid release

version: 5.08 (05/11/2015)

Reference: Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	(DIPPR)
Use which representative step	average
Type of release	vessel through
Pipeline length (m)	30
Pipeline diameter (inch)	4
Pipeline roughness (mm)	0,045
Hole diameter (inch)	0,4
Hole rounding	Sharp edges
Discharge coefficient (-)	0,62
Vessel type	cylinder
Vessel volume (m3)	45000
Length cylinder (m)	30
Filling degree (%)	100
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	100
Type of calculation	specified time
Time t after start release (s)	1800

Results

Initial mass in vessel (kg)	3,29E+07
Mass flow rate at time t (kg/s)	1,0762
Total mass released at time t (kg)	1947,2
Time needed to empty vessel (s)	
Filling degree at time t (%)	99,994
Height of liquid at time t (m)	43,655
Maximum mass flow rate (kg/s)	1,0767
Representative release rate (kg/s)	1,0766
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1FlAndrea_silvasantos at 05/11/2015 11:24:39

Case description: scenario 10A/11A- PFIRE LC01, LC03, LC05

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 10A/11A - PFIRE LC40, LC50, LC99

Parameters	10A/11A- PFIRE	10A/11A -
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	29730	29730
Mass flow rate of the source (kg/s)		
Duration of the release (s)		
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	100	100
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	10A/11A- PFIRE	10A/11A -
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0019392	0,0027756
Heat radiation first contour at (m)	48,436	25,916
Heat radiation second contour at (m)	42,179	24,456
Heat radiation third contour at (m)	37,558	21,852
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	575,73	575,73
Heat emission from fire surface (kW/m2)	20,633	20,127
Flame tilt (deg)	49,28	35,336
View factor (%)	0,02345	0,034407
Atmospheric transmissivity (%)	40,08	40,08
Flame temperature (°C)	507,38	502,64
Height of the Flame (m)	24,676	29,044
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Case description: scenario 10A/11A- PFIRE LC01, LC03, LC05

Model: Pool fire

version: 5.11 (05/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 10A/11A - PFIRE LC40, LC50, LC99

Parameters	10A/11A- PFIRE	10A/11A -
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	29730	29730
Mass flow rate of the source (kg/s)		
Duration of the release (s)		
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	100	100
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	35	35
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	10A/11A- PFIRE	10A/11A -
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0049294	0,0066469
Heat radiation first contour at (m)	63,407	43,733
Heat radiation second contour at (m)	56,551	41,214
Heat radiation third contour at (m)	52,701	22,837
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	575,73	575,73
Heat emission from fire surface (kW/m2)	48,431	44,887
Flame tilt (deg)	49,28	35,336
View factor (%)	0,02345	0,034407
Atmospheric transmissivity (%)	43,404	43,038
Flame temperature (°C)	690,23	672,26
Height of the Flame (m)	24,676	29,044
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		D3 Centrifuges	HFO	Units				
HFO-012	Continuous release from a hole with an effective diameter of 10 mm. D3 Centrifuges	Substance	HFO		Confined release	Yes	--	
		Maximum mass flow	12,2	m3/h	Bund dimensions		m3	
		Pipeline diameter	2	inch	Roughness length description	Concrete	--	
		Operation pressure	4	bar	Roughness	10,00	cm	
		Operation temperature	100	°C	Soil temperature	19,00	°C	
		Hole diameter	0,2	mm	Meteo station	Malta airport	--	
		Release mass flow [3]	0,34	kg/s	Ambient relative humidity	75,00	%	
					Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
		RELEASE DATA						
		Release duration			600	s		
		Mass flow rate [3]			0,34	kg/s		
		Total mass released			202	kg		
		Total volume released [1]			0,20	m3		
		EVAPORATION & DISPERSION DATA						
		Pool area [2]			41	m²		
		Evaporation rate 5D			7,28E-06	kg/s		
		Evaporation rate 2F			7,28E-06	kg/s		
		Evaporation duration 5D			1221,1	s		
		Evaporation duration 2F			1221,1	s		
		POOL FIRE DAMAGE ZONES						
		LC99% - 37,5 kW/m2			4	m		
		LC50% - 15 kW/m2			5	m		
		LC40% - 13,4 kW/m2			6	m		
		LC5% - 9,3 kW/m2			8	m		
		LC3% - 7,3 kW/m2			9	m		
		LC01% - 5 kW/m2			11	m		
		FLASH FIRE & EXPLOSION DAMAGE ZONES						
		Length of cloud (between LEL) 5D			0	m		
		Length of cloud (between LEL) 2F			0	m		
		ENVIRONMENTAL SPILLAGE DATA						
		Oil interceptor			D	--		
		Oil interceptor capacity			21	m3		
		Oil interceptor efficiency			NA	--		
		Total volume released to water			0	m3		

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

Case description: Scenario 12 - evap D

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 12 - evap F

Parameters

Inputs	evap D	Scenario 12 - evap F
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	0,34	0,34
Duration of the release (s)	600	600
<i>Total mass released (kg)</i>		
<i>Height pool at t=0</i>		
<i>Value pool height at t=0 (m)</i>		
Type of pool growth on Land	bunds	Spreading in bunds
<i>Type of pool growth on Water</i>		
Temperature of the pool (°C)	100	100
Maximum pool surface area (m2)	41	41
Temperature of the subsoil (°C)	19	19
<i>Temperature of the water (°C)</i>		
<i>Max temperature difference between pool and water (K)</i>		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
<i>Solar heat radiation flux (W/m2)</i>		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800

Results

	evap D	Scenario 12 - evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	458	458
<i>Time until pool has totally evaporated (s)</i>		
Purple book representative evaporation rate (kg/s)	7,28E-06	7,28E-06
Purple book representative evaporation duration (s)	1221,1	1221,1
Representative temperature (°C)	57,075	57,075
Representative pool diameter (m)	7,2252	7,2252
Density after mixing with air (kg/m3)	1,2072	1,2072
Total evaporated mass (kg)	0,0088921	0,0088921
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	41	41

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1F andrea_silvasantos at 05/11/2015 12:26:03

Case description: scenario 12- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 12 - evap D)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 12 - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 12 - evap F)

Parameters

Inputs	PFIRE LC01,	PFIRE LC40,
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	202	202
Mass flow rate of the source (kg/s)	7,28E-06	7,28E-06
Duration of the release (s)	1221,1	1221,1
Pool surface poolfire (m2)	41	41
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	100	100
Pool burning rate	Calculate/Default	Calculate/Default
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	Calculate/Default	Calculate/Default
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		

Results

	PFIRE LC01,	PFIRE LC40,
Max Diameter of the Pool Fire (m)	7,2252	7,2252
Heat radiation at X (kW/m2)	6,59E-05	6,59E-05
Heat radiation first contour at (m)	11,217	6,0503
Heat radiation second contour at (m)	9,3318	5,2675
Heat radiation third contour at (m)	8,0565	3,6136
Combustion rate (kg/s)	1,4115	1,4115
Duration of the pool fire (s)	143,11	143,11
Heat emission from fire surface (kW/m2)	19,254	19,254
Flame tilt (deg)	55,856	55,856
View factor (%)	0,00085788	0,00085788
Atmospheric transmissivity (%)	39,92	39,92
Flame temperature (°C)	494,27	494,27
Height of the Flame (m)	6,5729	6,5729
Calculated pool surface area (m2)	41	41
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97

Other information

Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010

Case description: scenario 12 - explosive mass D (linked to Pool evaporation - Scenario 12 - evap D)

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 12 - explosive mass F (linked to Pool evaporation - Scenario 12 - evap F)

Parameters

Inputs	explosive mass	explosive mass
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
<i>Total mass released (kg)</i>		
Mass flow rate of the source (kg/s)	7,28E-06	7,28E-06
Duration of the release (s)	1221,1	1221,1
<i>Initial liquid mass fraction (%)</i>		
Fixed pool surface (m2)	41	41
<i>Diameter of expanded jet (m)</i>		
Temperature after release (°C)	100	100
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
<i>Z-coordinate (height) of release (m)</i>		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	5
<i>Inverse Monin-Obukhov length (1/L) (1/m)</i>		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation, no	no vegetation, no
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	explosive mass	explosive mass
Explosive mass at time t (kg)	-1,00E+100	-1,00E+100
Height to LEL at time t (m)	-1,00E+100	-1,00E+100
Length of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100
Width of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100
Offset between release location and LEL at time t (m)	-1,00E+100	-1,00E+100
Maximum explosive mass (kg)	-1,00E+100	-1,00E+100
...at time tmem (s)	-1,00E+100	-1,00E+100
Start time where 95% of maximum of explosive mass is reached (s)	-1,00E+100	-1,00E+100
Time where explosive mass starts decreasing below 95% of max (s)	-1,00E+100	-1,00E+100
Length of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100
Width of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100
Offset between release location and LEL at time tmem (m)	-1,00E+100	-1,00E+100
Maximum area of explosive cloud (m2)	-1,00E+100	-1,00E+100
...at time tmac (s)	-1,00E+100	-1,00E+100
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Width of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Offset between release location and LEL at time tmac (m)	-1,00E+100	-1,00E+100
Offset between release centre and cloud centre at time tmac (m)	-1,50E+100	-1,50E+100
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1F andrea_silvasantos at 05/11/2015 12:29:51

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		D3 Centrifuges	HFO	Units				
HFO-012 CF	Catastrophic failure. D3 Centrifuges	Substance	HFO		Confined release	Yes	--	
		Maximum mass flow	12,2	m3/h	Bund dimensions		m3	
		Pipeline diameter	2	inch	Roughness length description	Concrete	--	
		Operation pressure	4	bar	Roughness	10,00	cm	
		Operation temperature	100	°C	Soil temperature	19,00	°C	
		Hole diameter	0,2	mm	Meteo station	Malta airport	--	
		Release mass flow [3]	5,04	kg/s	Ambient relative humidity	75,00	%	
					Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	600	s	
					Mass flow rate [3]	5,04	kg/s	
					Total mass released	3023	kg	
					Total volume released [1]	3,05	m3	
					EVAPORATION & DISPERSION DATA			
					Pool area [2]	610	m²	
					Evaporation rate 5D	1,09E-04	kg/s	
					Evaporation rate 2F	1,09E-04	kg/s	
					Evaporation duration 5D	1317,2	s	
					Evaporation duration 2F	1317,2	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	14	m	
					LC50% - 15 kW/m2	18	m	
					LC40% - 13,4 kW/m2	19	m	
					LC5% - 9,3 kW/m2	25	m	
					LC3% - 7,3 kW/m2	29	m	
					LC01% - 5 kW/m2	33	m	
					FLASH FIRE & EXPLOSION DAMAGE ZONES			
					Length of cloud (between LEL) 5D	0	m	
					Length of cloud (between LEL) 2F	0	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	D	--	
					Oil interceptor capacity	21	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	0	m3	
NOTES								
[1] HFO density = 991 kg/m3								
[2] Pool thickness (on land) = 10 mm.								
[3] Equivalent to 1,5 x flow rate								

Case description: Scenario 12A - evap D

Model: Pool evaporation

version: 5.16 (05/04/2016)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 12A - evap F

Parameters

Inputs	evap D	Scenario 12A - evap F
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	5,04	5,04
Duration of the release (s)	600	600
<i>Total mass released (kg)</i>		
<i>Height pool at t=0</i>		
<i>Value pool height at t=0 (m)</i>		
Type of pool growth on Land	bunds	Spreading in bunds
<i>Type of pool growth on Water</i>		
Temperature of the pool (°C)	100	100
Maximum pool surface area (m2)	610	610
Temperature of the subsoil (°C)	19	19
<i>Temperature of the water (°C)</i>		
<i>Max temperature difference between pool and water (K)</i>		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
<i>Solar heat radiation flux (W/m2)</i>		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800

Results

	evap D	Scenario 12A - evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	459,5	459,5
<i>Time until pool has totally evaporated (s)</i>		
Purple book representative evaporation rate (kg/s)	0,00010946	0,00010946
Purple book representative evaporation duration (s)	1317,2	1317,2
Representative temperature (°C)	58,638	58,638
Representative pool diameter (m)	27,829	27,829
Density after mixing with air (kg/m3)	1,2073	1,2073
Total evaporated mass (kg)	0,14418	0,14418
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	608,28	608,28

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1F andrea_silvasantos at 05/04/2016 15:53:22

Case description: scenario 12A- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 12A - evap D)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 12A - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 12 - evap F)

Parameters

Inputs	PFIRE LC01,	PFIRE LC40,
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	3023	3023
Mass flow rate of the source (kg/s)	0,00010946	7,28E-06
Duration of the release (s)	1317,2	1221,1
Pool surface poolfire (m2)	610	610
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	100	100
Pool burning rate	Calculate/Default	Calculate/Default
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	Calculate/Default	Calculate/Default
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		

Results

	PFIRE LC01,	PFIRE LC40,
Max Diameter of the Pool Fire (m)	27,869	27,869
Heat radiation at X (kW/m2)	0,0008283	0,0008283
Heat radiation first contour at (m)	32,972	19,113
Heat radiation second contour at (m)	28,62	17,58
Heat radiation third contour at (m)	25,45	13,935
Combustion rate (kg/s)	21	21
Duration of the pool fire (s)	143,95	143,95
Heat emission from fire surface (kW/m2)	20,259	20,259
Flame tilt (deg)	51,004	51,004
View factor (%)	0,010219	0,010219
Atmospheric transmissivity (%)	40,01	40,01
Flame temperature (°C)	503,89	503,89
Height of the Flame (m)	17,728	17,728
Calculated pool surface area (m2)	610	610
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97

Other information

Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010

Case description: scenario 12 - explosive mass D (linked to Pool evaporation - Scenario 12 - evap D)

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 12 - explosive mass F (linked to Pool evaporation - Scenario 12 - evap F)

Parameters

Inputs	explosive mass	explosive mass
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
<i>Total mass released (kg)</i>		
Mass flow rate of the source (kg/s)	7,28E-06	7,28E-06
Duration of the release (s)	1221,1	1221,1
<i>Initial liquid mass fraction (%)</i>		
Fixed pool surface (m2)	41	41
<i>Diameter of expanded jet (m)</i>		
Temperature after release (°C)	100	100
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
<i>Z-coordinate (height) of release (m)</i>		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	5
<i>Inverse Monin-Obukhov length (1/L) (1/m)</i>		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation, no	no vegetation, no
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	explosive mass	explosive mass
Explosive mass at time t (kg)	-1,00E+100	-1,00E+100
Height to LEL at time t (m)	-1,00E+100	-1,00E+100
Length of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100
Width of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100
Offset between release location and LEL at time t (m)	-1,00E+100	-1,00E+100
Maximum explosive mass (kg)	-1,00E+100	-1,00E+100
...at time tmem (s)	-1,00E+100	-1,00E+100
Start time where 95% of maximum of explosive mass is reached (s)	-1,00E+100	-1,00E+100
Time where explosive mass starts decreasing below 95% of max (s)	-1,00E+100	-1,00E+100
Length of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100
Width of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100
Offset between release location and LEL at time tmem (m)	-1,00E+100	-1,00E+100
Maximum area of explosive cloud (m2)	-1,00E+100	-1,00E+100
...at time tmac (s)	-1,00E+100	-1,00E+100
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Width of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Offset between release location and LEL at time tmac (m)	-1,00E+100	-1,00E+100
Offset between release centre and cloud centre at time tmac (m)	-1,50E+100	-1,50E+100
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1F andrea_silvasantos at 05/11/2015 12:29:51

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		Pipeline	HFO	Units				
HFO-013	HFO pipelines from D3 centrifuges to D3 service tank. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	HFO		Confined release	No	--	
		Flow rate	12,2	m3	Bund dimensions	--	--	
		Pipeline diameter	4	inch	Roughness length description	Concrete	--	
		Pipeline length	30	m	Roughness	10,00	cm	
		Operation pressure	4	bar	Soil temperature	19,00	°C	
		Operation temperature	100	°C	Meteo station	Malta airport	--	
		Hole diameter	0,4	inch	Ambient relative humidity	75,00	%	
		Release mass flow [3]	0,34	kg/s	Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate	0,34	kg/s	
					Total mass released	605	kg	
					Total volume released [1]	0,61	m3	
					EVAPORATION & DISPERSION DATA			
					Pool area [2]	122	m²	
					Evaporation rate 5D	3,72E-05	kg/s	
					Evaporation rate 2F	3,72E-05	kg/s	
					Evaporation duration 5D	869,58	s	
					Evaporation duration 2F	869,58	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	6	m	
					LC50% - 15 kW/m2	9	m	
					LC40% - 13,4 kW/m2	10	m	
					LC5% - 9,3 kW/m2	13	m	
					LC3% - 7,3 kW/m2	15	m	
					LC01% - 5 kW/m2	17	m	
					FLASH FIRE & EXPLOSION DAMAGE ZONES			
					Length of cloud (between LEL) 5D	0	m	
					Length of cloud (between LEL) 2F	0	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	D	--	
					Oil interceptor capacity	21	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	0	m3	

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 cm.

[3] Equivalent to the 10% of the flow rate

Case description: Scenario 13 - evap D

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 13 - evap F

Parameters

Inputs	evap D	Scenario 13 - evap F
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	0,34	0,34
Duration of the release (s)	1800	1800
<i>Total mass released (kg)</i>		
<i>Height pool at t=0</i>		
<i>Value pool height at t=0 (m)</i>		
Type of pool growth on Land	bunds	Spreading in bunds
<i>Type of pool growth on Water</i>		
Temperature of the pool (°C)	100	100
Maximum pool surface area (m2)	122	122
Temperature of the subsoil (°C)	19	19
<i>Temperature of the water (°C)</i>		
<i>Max temperature difference between pool and water (K)</i>		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
<i>Solar heat radiation flux (W/m2)</i>		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800

Results

	evap D	Scenario 13 - evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	1358	1358
<i>Time until pool has totally evaporated (s)</i>		
Purple book representative evaporation rate (kg/s)	3,72E-05	3,72E-05
Purple book representative evaporation duration (s)	869,58	869,58
Representative temperature (°C)	62,997	62,997
Representative pool diameter (m)	12,463	12,463
Density after mixing with air (kg/m3)	1,2072	1,2072
Total evaporated mass (kg)	0,032353	0,032353
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	122	122

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 05/11/2015 12:34:13

Case description: scenario 13- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 13 - evap D)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 13 - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 13 - evap F)

Parameters	PFIRE LC01,	PFIRE LC40,
Inputs	(DIPPR)	(DIPPR)
Chemical name (DIPPR)	Confined	Confined
Pool size determination	605	605
Total mass released (kg)	3,72E-05	3,72E-05
Mass flow rate of the source (kg/s)	869,58	869,58
Duration of the release (s)	122	122
Pool surface poolfire (m2)	0	0
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)		
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	100	100
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	SCENARIO 13 PFIRE LC01,	SCENARIO 13 PFIRE LC40,
Max Diameter of the Pool Fire (m)	12,463	12,463
Heat radiation at X (kW/m2)	0,00018275	0,00018275
Heat radiation first contour at (m)	16,813	9,693
Heat radiation second contour at (m)	14,522	8,6389
Heat radiation third contour at (m)	12,779	6,2327
Combustion rate (kg/s)	4,1999	4,1999
Duration of the pool fire (s)	144,05	144,05
Heat emission from fire surface (kW/m2)	19,638	19,638
Flame tilt (deg)	53,955	53,955
View factor (%)	0,0023298	0,0023298
Atmospheric transmissivity (%)	39,943	39,943
Flame temperature (°C)	497,99	497,99
Height of the Flame (m)	9,8129	9,8129
Calculated pool surface area (m2)	122	122
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Case description: scenario 13 - explosive mass D (linked to Pool evaporation - Scenario 13 - evap D)

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 13- explosive mass F (linked to Pool evaporation - Scenario 13 - evap F)

Parameters

Inputs

	explosive mass	explosive mass
	(DIPPR)	(DIPPR)
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
Total mass released (kg)		
Mass flow rate of the source (kg/s)	3,72E-05	3,72E-05
Duration of the release (s)	869,58	869,58
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	122	122
Diameter of expanded jet (m)		
Temperature after release (°C)	100	100
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	5
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation,
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	explosive mass	explosive mass
Explosive mass at time t (kg)	-1,00E+100	-1,00E+100
Height to LEL at time t (m)	-1,00E+100	-1,00E+100
Length of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100
Width of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100
Offset between release location and LEL at time t (m)	-1,00E+100	-1,00E+100
Maximum explosive mass (kg)	-1,00E+100	-1,00E+100
...at time tmem (s)	-1,00E+100	-1,00E+100
Start time where 95% of maximum of explosive mass is reached (s)	-1,00E+100	-1,00E+100
Time where explosive mass starts decreasing below 95% of max (s)	-1,00E+100	-1,00E+100
Length of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100
Width of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100
Offset between release location and LEL at time tmem (m)	-1,00E+100	-1,00E+100
Maximum area of explosive cloud (m2)	-1,00E+100	-1,00E+100
...at time tmac (s)	-1,00E+100	-1,00E+100
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Width of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Offset between release location and LEL at time tmac (m)	-1,00E+100	-1,00E+100
Offset between release centre and cloud centre at time tmac (m)	-1,50E+100	-1,50E+100
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 12:37:14

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	HFO	Units			
HFO-013 FBR	HFO pipelines from D3 centrifuges to D3 service tank. Rupture in the pipeline	Substance	HFO		Confined release	No	--
		Flow rate	12,2	m3	Bund dimensions	--	--
		Pipeline diameter	4	inch	Roughness length description	Concrete	--
		Pipeline length	30	m	Roughness	10,00	cm
		Operation pressure	4	bar	Soil temperature	19,00	°C
		Operation temperature	100	°C	Meteo station	Malta airport	--
		Hole diameter	4	inch	Ambient relative humidity	75,00	%
		Release mass flow [3]	5,04	kg/s	Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	5,04	kg/s
					Total mass released	9068	kg
					Total volume released [1]	9,15	m3
					EVAPORATION & DISPERSION DATA		
					Pool area [2]	1830	m²
					Evaporation rate 5D	5,73E-04	kg/s
					Evaporation rate 2F	5,73E-04	kg/s
					Evaporation duration 5D	871,67	s
					Evaporation duration 2F	871,67	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	22	m
					LC50% - 15 kW/m2	26	m
					LC40% - 13,4 kW/m2	29	m
					LC5% - 9,3 kW/m2	38	m
					LC3% - 7,3 kW/m2	42	m
					LC01% - 5 kW/m2	48	m
					FLASH FIRE & EXPLOSION DAMAGE ZONES		
					Length of cloud (between LEL) 5D	0	m
					Length of cloud (between LEL) 2F	0	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	D	--
					Oil interceptor capacity	21	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm. Limited to 1500 m2

[3] Equivalent to 1,5 x flow rate

Case description: Scenario 13A - evap D

Model: Pool evaporation

version: 5.16 (05/04/2016)

Reference: Yellow Book CPR14E 2nd Edition - Chapter 5: Evaporation

compared to: Scenario 13A - evap F

Parameters

Inputs	evap D	Scenario 13A - evap F
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	5,04	5,04
Duration of the release (s)	1800	1800
<i>Total mass released (kg)</i>		
<i>Height pool at t=0</i>		
<i>Value pool height at t=0 (m)</i>		
Type of pool growth on Land	bunds	Spreading in bunds
<i>Type of pool growth on Water</i>		
Temperature of the pool (°C)	100	100
Maximum pool surface area (m2)	1500	1500
Temperature of the subsoil (°C)	19	19
<i>Temperature of the water (°C)</i>		
<i>Max temperature difference between pool and water (K)</i>		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
<i>Solar heat radiation flux (W/m2)</i>		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800

Results

	evap D	Scenario 13A - evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	1125	1125
<i>Time until pool has totally evaporated (s)</i>		
Purple book representative evaporation rate (kg/s)	0,00057303	0,00057303
Purple book representative evaporation duration (s)	871,67	871,67
Representative temperature (°C)	66,718	66,718
Representative pool diameter (m)	43,702	43,702
Density after mixing with air (kg/m3)	1,2074	1,2074
Total evaporated mass (kg)	0,49949	0,49949
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	1500	1500

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fandrea_silvasantos at 05/04/2016 15:58:06

Case description: scenario 13A- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 13A - evap D)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 13A- PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 13A - evap F)

Parameters	PFIRE LC01,	PFIRE LC40,
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	9068	9068
Mass flow rate of the source (kg/s)	0,00057303	0,00057303
Duration of the release (s)	871,67	871,67
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	100	100
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	PFIRE LC01,	PFIRE LC40,
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0019392	0,0019392
Heat radiation first contour at (m)	48,436	28,799
Heat radiation second contour at (m)	42,179	26,179
Heat radiation third contour at (m)	37,558	21,852
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	175,61	175,61
Heat emission from fire surface (kW/m2)	20,633	20,633
Flame tilt (deg)	49,28	49,28
View factor (%)	0,02345	0,02345
Atmospheric transmissivity (%)	40,08	40,08
Flame temperature (°C)	507,38	507,38
Height of the Flame (m)	24,676	24,676
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Case description: scenario 13 - explosive mass D (linked to Pool evaporation - Scenario 13 - evap D)

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 13- explosive mass F (linked to Pool evaporation - Scenario 13 - evap F)

Parameters			
Inputs			
Chemical name (DIPPR)	explosive mass	explosive mass	
	(DIPPR)	(DIPPR)	
Type of release	release	release	
Total mass released (kg)			
Mass flow rate of the source (kg/s)	3,72E-05	3,72E-05	
Duration of the release (s)	869,58	869,58	
Initial liquid mass fraction (%)			
Fixed pool surface (m2)	122	122	
Diameter of expanded jet (m)			
Temperature after release (°C)	100	100	
X-coordinate of release (m)	0	0	
Y-coordinate of release (m)	0	0	
Z-coordinate (height) of release (m)			
Ambient temperature (°C)	19	19	
Meteorological data			
Pasquill stability class	Pasquill	Pasquill	
	D (Neutral)	F (Very Stable)	
Wind speed at 10 m height (m/s)	5	5	
Inverse Monin-Obukhov length (1/L) (1/m)			
Predefined wind direction	User defined	User defined	
Wind comes from (North = 0 degrees) (deg)	270	270	
Ambient relative humidity (%)	75	75	
Roughness length description	no vegetation,	no vegetation,	
Time t after start release (s)	120	120	
Concentration averaging time (s)	20	20	
Resolution of the time consuming graphs	Low	Low	
Results			
Explosive mass at time t (kg)	explosive mass	explosive mass	
	-1,00E+100	-1,00E+100	
Height to LEL at time t (m)	-1,00E+100	-1,00E+100	
Length of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100	
Width of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100	
Offset between release location and LEL at time t (m)	-1,00E+100	-1,00E+100	
Maximum explosive mass (kg)	-1,00E+100	-1,00E+100	
...at time tmem (s)	-1,00E+100	-1,00E+100	
Start time where 95% of maximum of explosive mass is reached (s)	-1,00E+100	-1,00E+100	
Time where explosive mass starts decreasing below 95% of max (s)	-1,00E+100	-1,00E+100	
Length of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100	
Width of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100	
Offset between release location and LEL at time tmem (m)	-1,00E+100	-1,00E+100	
Maximum area of explosive cloud (m2)	-1,00E+100	-1,00E+100	
...at time tmac (s)	-1,00E+100	-1,00E+100	
Explosive mass at time tmac (kg)	0	0	
Length of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00	
Width of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00	
Offset between release location and LEL at time tmac (m)	-1,00E+100	-1,00E+100	
Offset between release centre and cloud centre at time tmac (m)	-1,50E+100	-1,50E+100	
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0	
Other information			
Main program	8.1.8.6673		
Chemical database	DIPPR database		
Chemical source	DIPPR Jan2010		
Chemical source date	14/09/2010		

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 12:37:14

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		D3 SERVICE TANK	HFO	Units				
HFO-014	Continuous release from a hole with an effective diameter of 10 mm of the D3 HFO service tank	Substance	HFO		Confined release	No	--	
		Nominal volume	125	m3	Bund dimensions	--	m3	
		Filling degree	95	%	Roughness length description	Concrete	--	
		Diameter	5	m	Roughness	10,00	cm	
		Height	7,5	m	Soil temperature	19,00	°C	
		Operation Temperature	100	°C	Meteo station	Malta airport	--	
		Operation Pressure	atm	bar	Ambient relative humidity	75,00	%	
					Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
		RELEASE DATA						
		Release duration			until device is empty	s		
		Mass flow rate			0,42125	kg/s		
		Total mass released			8,69E+04	kg		
		Total volume released [1]			88	m3		
		EVAPORATION & DISPERSION DATA						
		Maximum pool area [2]			8769	m²		
		Evaporation rate 4D			0,000057473	kg/s		
		Evaporation rate 2F			0,000057473	kg/s		
		Evaporation duration 5D			751,56	s		
		Evaporation duration 2F			751,56	s		
		POOL FIRE DAMAGE ZONES						
		LC99% - 37,5 kW/m2			22	m		
		LC50% - 15 kW/m2			26	m		
		LC40% - 13,4 kW/m2			29	m		
		LC5% - 9,3 kW/m2			38	m		
		LC3% - 7,3 kW/m2			42	m		
		LC01% - 5 kW/m2			48	m		
		FLASH FIRE & EXPLOSION ZONES						
		Length of cloud (between LEL) 5D			0	m		
		Length of cloud (between LEL) 2F			0	m		
		ENVIRONMENTAL SPILLAGE DATA						
		Oil interceptor			J	--		
		Oil interceptor capacity			15	m3		
		Oil interceptor efficiency			NA	--		
		Total volume released to water			73	m3		

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm. Limited to 1500 m2

Case description: scenario 14 release

Model: Liquid release

version: 5.08 (05/11/2015)

Reference: Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	(DIPPR)
Use which representative step	average
Type of release	hole in vessel
Pipeline length (m)	
Pipeline diameter (mm)	
Pipeline roughness (mm)	
Hole diameter (mm)	10
Hole rounding	Sharp edges
Discharge coefficient (-)	0,62
Vessel type	Vertical cylinder
Vessel volume (m3)	125
Height cylinder (m)	7,5
Filling degree (%)	95
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	100
Type of calculation	device is empty
Time t after start release (s)	

Results

Initial mass in vessel (kg)	86901
Mass flow rate at time t (kg/s)	
Total mass released (kg)	86901
Time needed to empty vessel (s)	4,08E+05
Filling degree at time t (%)	
Height of liquid at time t (m)	
Maximum mass flow rate (kg/s)	0,42125
Representative release rate (kg/s)	0,42107
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fl andrea_silvasantos at 05/11/2015 12:55:45

Case description: Scenario 14 - evap D (linked to Liquid release - scenario 14 release)

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2nd Edition - Chapter 5: Evaporation

compared to: Scenario 14 - evap F (linked to Liquid release - scenario 14 release)

Parameters

Inputs	evap D (linked to	evap F (linked to
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Use which representative step	average	average
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	0,42107	0,42107
Duration of the release (s)	1800	1800
Total mass released (kg)	86901	86901
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	bunds	bunds
Type of pool growth on Water		
Temperature of the pool (°C)	100	100
Maximum pool surface area (m2)	1500	1500
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	concrete, tiles,
Maximum evaluation time for evaporation (s)	1800	1800

Results

	evap D (linked to	evap F (linked to
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)		
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	5,75E-05	5,75E-05
Purple book representative evaporation duration (s)	751,56	751,56
Representative temperature (°C)	63,043	63,043
Representative pool diameter (m)	15,65	15,65
Density after mixing with air (kg/m3)	1,2073	1,2073
Total evaporated mass (kg)	0,043194	0,043194
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	192,36	192,36

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 05/11/2015 12:56:13

Case description: scenario 14- PFIRE LC01, LC03, LC05 (linked to Liquid release - scenario 14 release)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 14 - PFIRE LC40, LC50, LC99 (linked to Liquid release - scenario 14 release)

Parameters	PFIRE LC01,	PFIRE LC40,
Inputs	(DIPPR)	(DIPPR)
Chemical name (DIPPR)	Confined	Confined
Pool size determination	86901	86901
Total mass released (kg)	0,42107	0,42107
Mass flow rate of the source (kg/s)	1800	1800
Duration of the release (s)	1500	1500
Pool surface poolfire (m2)	0	0
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	10	10
Hole diameter (mm)	0,62	0,62
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	100	100
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	PFIRE LC01,	PFIRE LC40,
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0019392	0,0019392
Heat radiation first contour at (m)	48,436	28,799
Heat radiation second contour at (m)	42,179	26,179
Heat radiation third contour at (m)	37,558	21,852
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	1682,9	1682,9
Heat emission from fire surface (kW/m2)	20,633	20,633
Flame tilt (deg)	49,28	49,28
View factor (%)	0,02345	0,02345
Atmospheric transmissivity (%)	40,08	40,08
Flame temperature (°C)	507,38	507,38
Height of the Flame (m)	24,676	24,676
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1Fiandrea_silvasantos at 08/04/2016 12:56:27

Case description: scenario 14 - explosive mass D (linked to Pool evaporation - Scenario 14 - evap D (linked to Liquid release - scenario 14 release))

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 14- explosive mass F (linked to Pool evaporation - Scenario 14 - evap F (linked to Liquid release - scenario 14 release))

Parameters

Inputs

	explosive mass	explosive mass
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
Total mass released (kg)	86901	86901
Mass flow rate of the source (kg/s)	5,75E-05	5,75E-05
Duration of the release (s)	751,56	751,56
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	192,36	192,36
Diameter of expanded jet (m)		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	5
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation,
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	explosive mass	explosive mass
Explosive mass at time t (kg)	0	0
Height to LEL at time t (m)	0	0
Length of cloud (between LEL) at time t (m)	0	0
Width of cloud (between LEL) at time t (m)	0	0
Offset between release location and LEL at time t (m)	0	0
Maximum explosive mass (kg)	0	0
...at time tmem (s)	0	0
Start time where 95% of maximum of explosive mass is reached (s)	0	0
Time where explosive mass starts decreasing below 95% of max (s)	0	0
Length of cloud (between LEL) at time tmem (m)	0	0
Width of cloud (between LEL) at time tmem (m)	0	0
Offset between release location and LEL at time tmem (m)	0	0
Maximum area of explosive cloud (m2)	0	0
...at time tmac (s)	0	0
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0	0
Width of cloud (between LEL) at time tmac (m)	0	0
Offset between release location and LEL at time tmac (m)	0	0
Offset between release centre and cloud centre at time tmac (m)	0	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0,096426

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 12:59:10

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units	
		D3 SERVICE TANK	HFO	Units					
HFO-014 CF	Instantaneous release of the entire contents of the D3 HFO service tank	Substance	HFO		Confined release		No	--	
		Nominal volume	125	m3	Bund dimensions		--	m3	
		Filling degree	95	%	Roughness length description		Concrete	--	
		Diameter	5	m	Roughness		10,00	cm	
		Height	7,5	m	Soil temperature		19,00	°C	
		Operation Temperature	100	°C	Meteo station		Malta airport	--	
		Operation Pressure	atm	bar	Ambient relative humidity		75,00	%	
					Ambient temperature		19,00	°C	
					Meteorological condition 1		D / 4	-- / m/s	
					Meteorological condition 2		F / 2	-- / m/s	
		RELEASE DATA							
		Release duration				Instantaneous	s		
		Mass flow rate				na	kg/s		
		Total mass released				1,24E+05	kg		
		Total volume released [1]				125	m3		
		EVAPORATION & DISPERSION DATA							
		Maximum pool area [2]				12500	m²		
		Evaporation rate 4D				0,00034452	kg/s		
		Evaporation rate 2F				0,00016931	kg/s		
		Evaporation duration 5D				1367,9	s		
		Evaporation duration 2F				1490,5	s		
		POOL FIRE DAMAGE ZONES							
		LC99% - 37,5 kW/m2				22	m		
		LC50% - 15 kW/m2				24	m		
		LC40% - 13,4 kW/m2				26	m		
		LC5% - 9,3 kW/m2				38	m		
		LC3% - 7,3 kW/m2				42	m		
		LC01% - 5 kW/m2				48	m		
		FLASH FIRE & EXPLOSION ZONES							
		Length of cloud (between LEL) 5D				0	m		
		Length of cloud (between LEL) 2F				0	m		
		ENVIRONMENTAL SPILLAGE DATA							
		Oil interceptor				J	--		
		Oil interceptor capacity				15	m3		
		Oil interceptor efficiency				NA	--		
		Total volume released to water				110	m3		

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm. Limited to 1500 m2

Case description: scenario 14A- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 8A - evap d)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 14A - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 8A - evap F)

Parameters	PFIRE LC01,	PFIRE LC40,
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	1,24E+05	1,24E+05
Mass flow rate of the source (kg/s)	0,00034452	0,00016931
Duration of the release (s)	1367,9	1490,5
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	100	100
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	PFIRE LC01,	PFIRE LC40,
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0019392	0,0027756
Heat radiation first contour at (m)	48,436	25,916
Heat radiation second contour at (m)	42,179	24,456
Heat radiation third contour at (m)	37,558	21,852
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	2401,3	2401,3
Heat emission from fire surface (kW/m2)	20,633	20,127
Flame tilt (deg)	49,28	35,336
View factor (%)	0,02345	0,034407
Atmospheric transmissivity (%)	40,08	40,08
Flame temperature (°C)	507,38	502,64
Height of the Flame (m)	24,676	29,044
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1Fiandrea_silvasantos at 08/04/2016 13:05:20

Case description: scenario 14 - explosive mass D (linked to Pool evaporation - Scenario 14 - evap D (linked to Liquid release - scenario 14 release))

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 14- explosive mass F (linked to Pool evaporation - Scenario 14 - evap F (linked to Liquid release - scenario 14 release))

Parameters

Inputs

	explosive mass	explosive mass
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
Total mass released (kg)	86901	86901
Mass flow rate of the source (kg/s)	5,75E-05	5,75E-05
Duration of the release (s)	751,56	751,56
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	192,36	192,36
Diameter of expanded jet (m)		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	5
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation,
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	explosive mass	explosive mass
Explosive mass at time t (kg)	0	0
Height to LEL at time t (m)	0	0
Length of cloud (between LEL) at time t (m)	0	0
Width of cloud (between LEL) at time t (m)	0	0
Offset between release location and LEL at time t (m)	0	0
Maximum explosive mass (kg)	0	0
...at time tmem (s)	0	0
Start time where 95% of maximum of explosive mass is reached (s)	0	0
Time where explosive mass starts decreasing below 95% of max (s)	0	0
Length of cloud (between LEL) at time tmem (m)	0	0
Width of cloud (between LEL) at time tmem (m)	0	0
Offset between release location and LEL at time tmem (m)	0	0
Maximum area of explosive cloud (m2)	0	0
...at time tmac (s)	0	0
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0	0
Width of cloud (between LEL) at time tmac (m)	0	0
Offset between release location and LEL at time tmac (m)	0	0
Offset between release centre and cloud centre at time tmac (m)	0	0
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0,096426

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 12:59:10

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		Pipeline	HFO	Units				
HFO-015	HFO pipelines from D3 service tank to D3 engines. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	HFO		Confined release	No	--	
		Flow rate	27	m3/h	Bund dimensions	--	--	
		Pipeline diameter	6	inch	Roughness length description	Concrete	--	
		Pipeline length	300	m	Roughness	10,00	cm	
		Operation pressure	6	bar	Soil temperature	19,00	°C	
		Operation temperature	100	°C	Meteo station	Malta airport	--	
		Hole diameter	0,6	inch	Ambient relative humidity	75,00	%	
					Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate [3]	0,74	kg/s	
					Total mass released	1337,85	kg	
					Total volume released [1]	1	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	135	m²	
					Evaporation rate 4D	5,67E-05	kg/s	
					Evaporation rate 2F	5,67E-05	kg/s	
					Evaporation duration 5D	969,1	s	
					Evaporation duration 2F	969,1	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	7	m	
					LC50% - 15 kW/m2	9	m	
					LC40% - 13,4 kW/m2	10	m	
					LC5% - 9,3 kW/m2	13	m	
					LC3% - 7,3 kW/m2	15	m	
					LC01% - 5 kW/m2	18	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	0	m	
					Length of cloud (between LEL) 2F	0	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	D	--	
					Oil interceptor capacity	21	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	0	m3	

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

Case description: Scenario 15 - evap D

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 15 - evap F

Parameters	evap D	Scenario 15 - evap F
Inputs		
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	0,74	0,74
Duration of the release (s)	1800	1800
Total mass released (kg)		
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	bunds	Spreading in bunds
Type of pool growth on Water		
Temperature of the pool (°C)	100	100
Maximum pool surface area (m2)	135	135
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800
Results		
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	692,5	692,5
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	5,67E-05	5,67E-05
Purple book representative evaporation duration (s)	969,1	969,1
Representative temperature (°C)	66,33	66,33
Representative pool diameter (m)	13,111	13,111
Density after mixing with air (kg/m3)	1,2073	1,2073
Total evaporated mass (kg)	0,054967	0,054967
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	135	135
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1Flandrea_silvasantos at 05/11/2015 13:02:29

Case description: scenario 15/16- PFIRE LC01, LC03, LC05

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 15/16 - PFIRE LC40, LC50, LC99

Parameters		
Inputs	PFIRE LC01,	PFIRE LC40,
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	1338	1338
Mass flow rate of the source (kg/s)		
Duration of the release (s)		
Pool surface poolfire (m2)	135	135
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	100	100
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		

Results	Scenario 15/16- PFIRE LC01,	Scenario 15/16- PFIRE LC40,
Max Diameter of the Pool Fire (m)	13,111	13,111
Heat radiation at X (kW/m2)	0,00020092	0,00020092
Heat radiation first contour at (m)	17,661	10,117
Heat radiation second contour at (m)	15,126	9,0377
Heat radiation third contour at (m)	13,332	6,5563
Combustion rate (kg/s)	4,6475	4,6475
Duration of the pool fire (s)	287,9	287,9
Heat emission from fire surface (kW/m2)	19,676	19,676
Flame tilt (deg)	53,775	53,775
View factor (%)	0,0025564	0,0025564
Atmospheric transmissivity (%)	39,946	39,946
Flame temperature (°C)	498,34	498,34
Height of the Flame (m)	10,185	10,185
Calculated pool surface area (m2)	135	135
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97

Other information	
Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010



Effects report created by ESLR2RH1Fiandrea_silvasantos at 08/04/2016 12:56:54

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	HFO	Units			
HFO-015 FBR	HFO pipelines from D3 service tank to D3 engines. Rupture in the pipeline	Substance	HFO		Confined release	No	--
		Flow rate	27	m3/h	Bund dimensions	--	--
		Pipeline diameter	6	inch	Roughness length description	Concrete	--
		Pipeline length	300	m	Roughness	10,00	cm
		Operation pressure	6	bar	Soil temperature	19,00	°C
		Operation temperature	100	°C	Meteo station	Malta airport	--
		Hole diameter	6	inch	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate [3]	11,15	kg/s
					Total mass released	20067,75	kg
					Total volume released [1]	20	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	2025	m²
					Evaporation rate 4D	8,45E-04	kg/s
					Evaporation rate 2F	8,45E-04	kg/s
					Evaporation duration 5D	949,67	s
					Evaporation duration 2F	949,67	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	22	m
					LC50% - 15 kW/m2	26	m
					LC40% - 13,4 kW/m2	29	m
					LC5% - 9,3 kW/m2	38	m
					LC3% - 7,3 kW/m2	42	m
					LC01% - 5 kW/m2	48	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	0	m
					Length of cloud (between LEL) 2F	0	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	D	--
					Oil interceptor capacity	21	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm. Limited to 1500 m2

[3] Equivalent to 1,5 x flow rate

Case description: Scenario 15A/16A - evap D

Model: Pool evaporation

version: 5.16 (05/04/2016)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 15A/16A - evap F

Parameters

Inputs	15A/16A - evap	Scenario 15A/16A - evap F
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	11,15	11,15
Duration of the release (s)	1800	1800
<i>Total mass released (kg)</i>		
<i>Height pool at t=0</i>		
<i>Value pool height at t=0 (m)</i>		
Type of pool growth on Land	bunds	Spreading in bunds
<i>Type of pool growth on Water</i>		
Temperature of the pool (°C)	100	100
Maximum pool surface area (m2)	1500	1500
Temperature of the subsoil (°C)	19	19
<i>Temperature of the water (°C)</i>		
<i>Max temperature difference between pool and water (K)</i>		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
<i>Solar heat radiation flux (W/m2)</i>		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800

Results

	15A/16A - evap	Scenario 15A/16A - evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	510	510
<i>Time until pool has totally evaporated (s)</i>		
Purple book representative evaporation rate (kg/s)	0,00084542	0,00084542
Purple book representative evaporation duration (s)	949,67	949,67
Representative temperature (°C)	70,821	70,821
Representative pool diameter (m)	43,702	43,702
Density after mixing with air (kg/m3)	1,2076	1,2076
Total evaporated mass (kg)	0,80286	0,80286
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	1500	1500

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 05/04/2016 16:09:12

Case description: scenario 15A/16A- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 15A/16A - evap D)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 15A/16A - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 15A/16A - evap F)

Parameters	15A/16A- PFIRE	15A/16A -
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	20068	20068
Mass flow rate of the source (kg/s)	0,00084542	0,00084542
Duration of the release (s)	949,67	949,67
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	100	100
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	15A/16A- PFIRE	15A/16A -
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0019392	0,0019392
Heat radiation first contour at (m)	48,436	28,799
Heat radiation second contour at (m)	42,179	26,179
Heat radiation third contour at (m)	37,558	21,852
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	388,62	388,62
Heat emission from fire surface (kW/m2)	20,633	20,633
Flame tilt (deg)	49,28	49,28
View factor (%)	0,02345	0,02345
Atmospheric transmissivity (%)	40,08	40,08
Flame temperature (°C)	507,38	507,38
Height of the Flame (m)	24,676	24,676
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	



Effects report created by ESLR2RH1Fiandrea_silvasantos at 08/04/2016 13:03:22

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		Pipeline	HFO	Units				
HFO-016	HFO pipelines from storage tank to D1 HFO pumphouse. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	HFO		Confined release	No	--	
		Flow rate	27	m3	Bund dimensions	--	--	
		Pipeline diameter	6	inch	Roughness length description	Concrete	--	
		Pipeline length	200	m	Roughness	10,00	cm	
		Operation pressure	6	bar	Soil temperature	19,00	°C	
		Operation temperature	100	°C	Meteo station	Malta airport	--	
		Hole diameter	0,6	inch	Ambient relative humidity	75,00	%	
					Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate [3]	0,74325	kg/s	
					Total mass released	1337,85	kg	
					Total volume released [1]	1	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	135	m²	
					Evaporation rate 4D	5,67E-05	kg/s	
					Evaporation rate 2F	5,67E-05	kg/s	
					Evaporation duration 5D	969,1	s	
					Evaporation duration 2F	969,1	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	7	m	
					LC50% - 15 kW/m2	9	m	
					LC40% - 13,4 kW/m2	10	m	
					LC5% - 9,3 kW/m2	13	m	
					LC3% - 7,3 kW/m2	15	m	
					LC01% - 5 kW/m2	18	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	0	m	
					Length of cloud (between LEL) 2F	0	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	J	--	
					Oil interceptor capacity	15	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	0	m3	
NOTES								
[1] HFO density = 991 kg/m3								
[2] Pool thickness (on land) = 10 mm.								
[3] Equivalent to the 10% of the flow rate								

Case description: Scenario 15 - evap D

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2nd Edition - Chapter 5: Evaporation

compared to: Scenario 15 - evap F

Parameters

Inputs	evap D	Scenario 15 - evap F
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	0,74	0,74
Duration of the release (s)	1800	1800
<i>Total mass released (kg)</i>		
<i>Height pool at t=0</i>		
<i>Value pool height at t=0 (m)</i>		
Type of pool growth on Land	bunds	Spreading in bunds
<i>Type of pool growth on Water</i>		
Temperature of the pool (°C)	100	100
Maximum pool surface area (m2)	135	135
Temperature of the subsoil (°C)	19	19
<i>Temperature of the water (°C)</i>		
<i>Max temperature difference between pool and water (K)</i>		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
<i>Solar heat radiation flux (W/m2)</i>		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800

Results

	evap D	Scenario 15 - evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	692,5	692,5
<i>Time until pool has totally evaporated (s)</i>		
Purple book representative evaporation rate (kg/s)	5,67E-05	5,67E-05
Purple book representative evaporation duration (s)	969,1	969,1
Representative temperature (°C)	66,33	66,33
Representative pool diameter (m)	13,111	13,111
Density after mixing with air (kg/m3)	1,2073	1,2073
Total evaporated mass (kg)	0,054967	0,054967
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	135	135

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 05/11/2015 13:02:29

Case description: scenario 15/16- PFIRE LC01, LC03, LC05

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 15/16 - PFIRE LC40, LC50, LC99

Parameters		
Inputs	PFIRE LC01,	PFIRE LC40,
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	1338	1338
Mass flow rate of the source (kg/s)		
Duration of the release (s)		
Pool surface poolfire (m2)	135	135
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	100	100
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		

Results	Scenario 15/16- PFIRE LC01,	Scenario 15/16- PFIRE LC40,
Max Diameter of the Pool Fire (m)	13,111	13,111
Heat radiation at X (kW/m2)	0,00020092	0,00020092
Heat radiation first contour at (m)	17,661	10,117
Heat radiation second contour at (m)	15,126	9,0377
Heat radiation third contour at (m)	13,332	6,5563
Combustion rate (kg/s)	4,6475	4,6475
Duration of the pool fire (s)	287,9	287,9
Heat emission from fire surface (kW/m2)	19,676	19,676
Flame tilt (deg)	53,775	53,775
View factor (%)	0,0025564	0,0025564
Atmospheric transmissivity (%)	39,946	39,946
Flame temperature (°C)	498,34	498,34
Height of the Flame (m)	10,185	10,185
Calculated pool surface area (m2)	135	135
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97

Other information	
Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	HFO	Units			
HFO-016 FBR	HFO pipelines from storage tank to D1 HFO pumphouse. Rupture in the pipeline	Substance	HFO		Confined release	No	--
		Flow rate	27	m3	Bund dimensions	--	--
		Pipeline diameter	6	inch	Roughness length description	Concrete	--
		Pipeline length	200	m	Roughness	10,00	cm
		Operation pressure	6	bar	Soil temperature	19,00	°C
		Operation temperature	100	°C	Meteo station	Malta airport	--
		Hole diameter	6	inch	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate [3]	11,15	kg/s
					Total mass released	20067,75	kg
					Total volume released [1]	20	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	2025	m²
					Evaporation rate 4D	8,45E-04	kg/s
					Evaporation rate 2F	8,45E-04	kg/s
					Evaporation duration 5D	949,67	s
					Evaporation duration 2F	949,67	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	22	m
					LC50% - 15 kW/m2	26	m
					LC40% - 13,4 kW/m2	29	m
					LC5% - 9,3 kW/m2	38	m
					LC3% - 7,3 kW/m2	42	m
					LC01% - 5 kW/m2	48	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	0	m
					Length of cloud (between LEL) 2F	0	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	J	--
					Oil interceptor capacity	15	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	5	m3

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm. Limited to 1500 m2

[3] Equivalent to the 10% of the flow rate

Case description: Scenario 15A/16A - evap D

Model: Pool evaporation

version: 5.16 (05/04/2016)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 15A/16A - evap F

Parameters

Inputs	15A/16A - evap	Scenario 15A/16A - evap F
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	11,15	11,15
Duration of the release (s)	1800	1800
<i>Total mass released (kg)</i>		
<i>Height pool at t=0</i>		
<i>Value pool height at t=0 (m)</i>		
Type of pool growth on Land	bunds	Spreading in bunds
<i>Type of pool growth on Water</i>		
Temperature of the pool (°C)	100	100
Maximum pool surface area (m2)	1500	1500
Temperature of the subsoil (°C)	19	19
<i>Temperature of the water (°C)</i>		
<i>Max temperature difference between pool and water (K)</i>		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
<i>Solar heat radiation flux (W/m2)</i>		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800

Results	15A/16A - evap	Scenario 15A/16A - evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	510	510
<i>Time until pool has totally evaporated (s)</i>		
Purple book representative evaporation rate (kg/s)	0,00084542	0,00084542
Purple book representative evaporation duration (s)	949,67	949,67
Representative temperature (°C)	70,821	70,821
Representative pool diameter (m)	43,702	43,702
Density after mixing with air (kg/m3)	1,2076	1,2076
Total evaporated mass (kg)	0,80286	0,80286
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	1500	1500

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 05/04/2016 16:09:12

Case description: scenario 15A/16A- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 15A/16A - evap D)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 15A/16A - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 15A/16A - evap F)

Parameters	15A/16A- PFIRE	15A/16A -
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	20068	20068
Mass flow rate of the source (kg/s)	0,00084542	0,00084542
Duration of the release (s)	949,67	949,67
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	100	100
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	15A/16A- PFIRE	15A/16A -
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0019392	0,0019392
Heat radiation first contour at (m)	48,436	28,799
Heat radiation second contour at (m)	42,179	26,179
Heat radiation third contour at (m)	37,558	21,852
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	388,62	388,62
Heat emission from fire surface (kW/m2)	20,633	20,633
Flame tilt (deg)	49,28	49,28
View factor (%)	0,02345	0,02345
Atmospheric transmissivity (%)	40,08	40,08
Flame temperature (°C)	507,38	507,38
Height of the Flame (m)	24,676	24,676
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		D1 HFO pumps	HFO	Units			
HFO-017	Leak (10 % diameter). Discharge line	Substance	HFO		Confined release	Yes	--
		Maximum mass flow	40	m3/h	Bund dimensions		m3
		Pipeline diameter	4	inch	Roughness length description	Concrete	--
		Operation pressure	4	bar	Roughness	10,00	cm
		Operation temperature	100	°C	Soil temperature	19,00	°C
		Hole diameter	0,4	inch	Meteo station	Malta airport	--
		Number of pumps	2	-	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
		RELEASE DATA					
		Release duration			600	s	
		Mass flow rate			1,10	kg/s	
		Total mass released			660,67	kg	
		Total volume released [1]			0,67	m3	
		EVAPORATION & DISPERSION DATA					
		Pool area [2]			67	m²	
		Evaporation rate 5D			7,51E-06	kg/s	
		Evaporation rate 2F			6,94E-06	kg/s	
		Evaporation duration 5D			909,92	s	
		Evaporation duration 2F			758,59	s	
		POOL FIRE DAMAGE ZONES					
		LC99% - 37,5 kW/m2			5	m	
		LC50% - 15 kW/m2			10	m	
		LC40% - 13,4 kW/m2			11	m	
		LC5% - 9,3 kW/m2			14	m	
		LC3% - 7,3 kW/m2			14	m	
		LC01% - 5 kW/m2			17	m	
		FLASH FIRE & EXPLOSION DAMAGE ZONES					
		Length of cloud (between LEL) 5D			0	m	
		Length of cloud (between LEL) 2F			0	m	
		ENVIRONMENTAL SPILLAGE DATA					
		Oil interceptor			NA	--	
		Oil interceptor capacity			0	m3	
		Oil interceptor efficiency			NA	--	
		Total volume released to water			1	m3	

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

Case description: Scenario 6 - evap D

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 6 - evap F

Parameters

Inputs	evap D	Scenario 6 - evap F
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	1,1	1,1
Duration of the release (s)	600	600
<i>Total mass released (kg)</i>		
<i>Height pool at t=0</i>		
<i>Value pool height at t=0 (m)</i>		
Type of pool growth on Land	bunds	Spreading in bunds
<i>Type of pool growth on Water</i>		
Temperature of the pool (°C)	45	45
Maximum pool surface area (m2)	67	67
Temperature of the subsoil (°C)	19	19
<i>Temperature of the water (°C)</i>		
<i>Max temperature difference between pool and water (K)</i>		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
<i>Solar heat radiation flux (W/m2)</i>		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800

Results	evap D	Scenario 6 - evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	235	235
<i>Time until pool has totally evaporated (s)</i>		
Purple book representative evaporation rate (kg/s)	7,51E-06	6,94E-06
Purple book representative evaporation duration (s)	909,92	758,59
Representative temperature (°C)	52,974	59,037
Representative pool diameter (m)	9,2362	9,2362
Density after mixing with air (kg/m3)	1,2072	1,2072
Total evaporated mass (kg)	0,0068371	0,0052609
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	67	67

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 11:04:55

Case description: scenario 6- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 6 - evap D)

Model: Pool fire

version: 5.11 (05/11/2015)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 6 - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 6 - evap F)

Parameters	PFIRE LC01,	PFIRE LC40,
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	1036,3	1036,3
Mass flow rate of the source (kg/s)	7,51E-06	6,94E-06
Duration of the release (s)	909,92	758,59
Pool surface poolfire (m2)	67	67
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	45	45
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	35	35
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	PFIRE LC01,	PFIRE LC40,
Max Diameter of the Pool Fire (m)	9,2362	9,2362
Heat radiation at X (kW/m2)	0,00022763	0,00032387
Heat radiation first contour at (m)	16,89	10,795
Heat radiation second contour at (m)	14,484	9,8477
Heat radiation third contour at (m)	13,726	4,6191
Combustion rate (kg/s)	2,3065	2,3065
Duration of the pool fire (s)	449,29	449,29
Heat emission from fire surface (kW/m2)	39,965	36,588
Flame tilt (deg)	55,01	42,068
View factor (%)	0,0013452	0,0021107
Atmospheric transmissivity (%)	42,342	41,938
Flame temperature (°C)	645,46	625,62
Height of the Flame (m)	7,873	9,5435
Calculated pool surface area (m2)	67	67
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0

Weight ratio of CO ₂ /chemical (%)	311,62	311,62
Weight ratio of H ₂ O/chemical (%)	133,97	133,97

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 05/11/2015 11:05:30

Case description: scenario 6 - explosive mass D (linked to Pool evaporation - Scenario 6 - evap D)

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 6 - explosive mass F (linked to Pool evaporation - Scenario 6 - evap F)

Parameters

Inputs

	explosive mass	explosive mass
Chemical name (DIPPR)	(DIPPR)	
Type of release	pool release	pool release
Total mass released (kg)		
Mass flow rate of the source (kg/s)	7,51E-06	
Duration of the release (s)	909,92	
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	67	
Diameter of expanded jet (m)		
Temperature after release (°C)	45	
X-coordinate of release (m)	0	
Y-coordinate of release (m)	0	
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	
Meteorological data	Pasquill	
Pasquill stability class	D (Neutral)	D
Wind speed at 10 m height (m/s)	5	
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	
Ambient relative humidity (%)	75	
Roughness length description	no vegetation,	no vegetation
Time t after start release (s)	120	
Concentration averaging time (s)	20	
Resolution of the time consuming graphs	Low	

Results

	explosive mass	explosive mass
Explosive mass at time t (kg)	-1,00E+100	-1,00E+100
Height to LEL at time t (m)	-1,00E+100	-1,00E+100
Length of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100
Width of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100
Offset between release location and LEL at time t (m)	-1,00E+100	-1,00E+100
Maximum explosive mass (kg)	-1,00E+100	-1,00E+100
...at time tmem (s)	-1,00E+100	-1,00E+100
Start time where 95% of maximum of explosive mass is reached (s)	-1,00E+100	-1,00E+100
Time where explosive mass starts decreasing below 95% of max (s)	-1,00E+100	-1,00E+100
Length of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100
Width of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100
Offset between release location and LEL at time tmem (m)	-1,00E+100	-1,00E+100
Maximum area of explosive cloud (m2)	-1,00E+100	-1,00E+100
...at time tmac (s)	-1,00E+100	-1,00E+100
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Width of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Offset between release location and LEL at time tmac (m)	-1,00E+100	-1,00E+100
Offset between release centre and cloud centre at time tmac (m)	-1,50E+100	-1,50E+100
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 11:05:49

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		D1 HFO pumps	HFO	Units			
HFO-017 CF	Catastrophic failure. Discharge line	Substance	HFO		Confined release	Yes	--
		Maximum mass flow	40	m3/h	Bund dimensions		m3
		Pipeline diameter	4	inch	Roughness length description	Concrete	--
		Operation pressure	4	bar	Roughness	10,00	cm
		Operation temperature	100	°C	Soil temperature	19,00	°C
		Hole diameter	4	inch	Meteo station	Malta airport	--
		Number of pumps	2	-	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
		RELEASE DATA					
		Release duration			600	s	
		Mass flow rate			16,52	kg/s	
		Total mass released			9910,00	kg	
		Total volume released [1]			10,00	m3	
		EVAPORATION & DISPERSION DATA					
		Pool area [2]			1000	m²	
		Evaporation rate 5D			1,26E-04	kg/s	
		Evaporation rate 2F			1,04E-04	kg/s	
		Evaporation duration 5D			842,44	s	
		Evaporation duration 2F			726,17	s	
		POOL FIRE DAMAGE ZONES					
		LC99% - 37,5 kW/m2			18	m	
		LC50% - 15 kW/m2			22	m	
		LC40% - 13,4 kW/m2			24	m	
		LC5% - 9,3 kW/m2			31	m	
		LC3% - 7,3 kW/m2			35	m	
		LC01% - 5 kW/m2			41	m	
		FLASH FIRE & EXPLOSION DAMAGE ZONES					
		Length of cloud (between LEL) 5D			0	m	
		Length of cloud (between LEL) 2F			0	m	
		ENVIRONMENTAL SPILLAGE DATA					
		Oil interceptor			NA	--	
		Oil interceptor capacity			0	m3	
		Oil interceptor efficiency			NA	--	
		Total volume released to water			10	m3	

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

Case description: Scenario 6A/17A - evap D

Model: Pool evaporation

version: 5.16 (05/04/2016)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 6A/17A - evap F

Parameters

Inputs	6A/17A - evap D	Scenario 6A/17A - evap F
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	16,52	16,52
Duration of the release (s)	600	600
<i>Total mass released (kg)</i>		
<i>Height pool at t=0</i>		
<i>Value pool height at t=0 (m)</i>		
Type of pool growth on Land	bunds	Spreading in bunds
<i>Type of pool growth on Water</i>		
Temperature of the pool (°C)	45	45
Maximum pool surface area (m2)	1000	1000
Temperature of the subsoil (°C)	19	19
<i>Temperature of the water (°C)</i>		
<i>Max temperature difference between pool and water (K)</i>		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
<i>Solar heat radiation flux (W/m2)</i>		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800

Results	6A/17A - evap D	Scenario 6A/17A - evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	233,5	233,5
<i>Time until pool has totally evaporated (s)</i>		
Purple book representative evaporation rate (kg/s)	0,00012634	0,00010414
Purple book representative evaporation duration (s)	842,44	726,17
Representative temperature (°C)	55,498	60,561
Representative pool diameter (m)	35,682	35,682
Density after mixing with air (kg/m3)	1,2073	1,2073
Total evaporated mass (kg)	0,10643	0,075626
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	1000	1000

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fiandrea_silvasantos at 06/04/2016 9:49:27

Case description: scenario 6A/17A- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 6A/17A - evap D)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 6A/17A - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 6A/17A - evap D)

Parameters

Inputs	PFIRE LC01,	- PFIRE LC40,
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	9910	9910
Mass flow rate of the source (kg/s)	0,00012634	0,00012634
Duration of the release (s)	842,44	842,44
Pool surface poolfire (m2)	1000	1000
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	45	45
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		

Results

	PFIRE LC01,	- PFIRE LC40,
Max Diameter of the Pool Fire (m)	35,682	35,682
Heat radiation at X (kW/m2)	0,0013208	0,0013208
Heat radiation first contour at (m)	40,758	23,949
Heat radiation second contour at (m)	35,46	21,867
Heat radiation third contour at (m)	31,492	17,842
Combustion rate (kg/s)	34,426	34,426
Duration of the pool fire (s)	287,87	287,87
Heat emission from fire surface (kW/m2)	20,462	20,462
Flame tilt (deg)	50,063	50,063
View factor (%)	0,016119	0,016119
Atmospheric transmissivity (%)	40,045	40,045
Flame temperature (°C)	505,79	505,79
Height of the Flame (m)	21,26	21,26
Calculated pool surface area (m2)	1000	1000
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0

Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 08/04/2016 12:59:25

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	HFO	Units			
HFO-018	HFO pipelines from D1 HFO pumphouse to D1 heaters. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	HFO		Confined release	No	--
		Flow rate	40	m3/h	Bund dimensions	--	--
		Pipeline diameter	150	mm	Roughness length description	Concrete	--
		Pipeline length	10	m	Roughness	10,00	cm
		Operation pressure	6	bar	Soil temperature	19,00	°C
		Operation temperature	100	°C	Meteo station	Malta airport	--
		Hole diameter	15	mm	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	1,10	kg/s
					Total mass released	1982	kg
					Total volume released [1]	2	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [1]	200	m²
					Evaporation rate 4D	2,21E-05	kg/s
					Evaporation rate 2F	1,79E-05	kg/s
					Evaporation duration 5D	941,19	s
					Evaporation duration 2F	864,69	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	8	m
					LC50% - 15 kW/m2	16	m
					LC40% - 13,4 kW/m2	17	m
					LC5% - 9,3 kW/m2	22	m
					LC3% - 7,3 kW/m2	23	m
					LC01% - 5 kW/m2	26	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	0	m
					Length of cloud (between LEL) 2F	0	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	NA	--
					Oil interceptor capacity	0	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	2	m3
NOTES							
[1] HFO density = 991 kg/m3							
[2] Pool thickness (on land) = 10 mm.							
[3] Equivalent to the 10% of the flow rate							

Case description: Scenario 7 - evap D

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2nd Edition - Chapter 5: Evaporation

compared to: Scenario 7 - evap F

Parameters

Inputs	evap D	Scenario 7 - evap F
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	1,1	1,1
Duration of the release (s)	1800	1800
<i>Total mass released (kg)</i>		
<i>Height pool at t=0</i>		
<i>Value pool height at t=0 (m)</i>		
Type of pool growth on Land	bunds	Spreading in bunds
<i>Type of pool growth on Water</i>		
Temperature of the pool (°C)	45	45
Maximum pool surface area (m2)	200	200
Temperature of the subsoil (°C)	19	19
<i>Temperature of the water (°C)</i>		
<i>Max temperature difference between pool and water (K)</i>		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
<i>Solar heat radiation flux (W/m2)</i>		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800

Results

	evap D	Scenario 7 - evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	696,5	695
<i>Time until pool has totally evaporated (s)</i>		
Purple book representative evaporation rate (kg/s)	2,21E-05	1,79E-05
Purple book representative evaporation duration (s)	941,19	864,69
Representative temperature (°C)	53,4	58,214
Representative pool diameter (m)	15,958	15,958
Density after mixing with air (kg/m3)	1,2072	1,2072
Total evaporated mass (kg)	0,020808	0,015495
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	200	200

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fandrea_silvasantos at 05/11/2015 11:07:09

Case description: scenario 7- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 7 - evap D)

Model: Pool fire

version: 5.11 (05/11/2015)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 7 - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 7 - evap F)

Parameters

Inputs	PFIRE LC01,	PFIRE LC40,
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	1982	1982
Mass flow rate of the source (kg/s)	2,21E-05	1,79E-05
Duration of the release (s)	941,19	864,69
Pool surface poolfire (m2)	200	200
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	45	45
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	35	35
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		

Results	PFIRE LC01,	PFIRE LC40,
Max Diameter of the Pool Fire (m)	15,958	15,958
Heat radiation at X (kW/m2)	0,00066912	0,00093962
Heat radiation first contour at (m)	26,488	17,482
Heat radiation second contour at (m)	23,439	16,44
Heat radiation third contour at (m)	21,901	7,9798
Combustion rate (kg/s)	6,8851	6,8851
Duration of the pool fire (s)	287,87	287,87
Heat emission from fire surface (kW/m2)	42,756	39,096
Flame tilt (deg)	53,067	39,724
View factor (%)	0,0036662	0,0056858
Atmospheric transmissivity (%)	42,686	42,27
Flame temperature (°C)	660,94	640,48
Height of the Flame (m)	11,768	14,264
Calculated pool surface area (m2)	200	200
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 05/11/2015 11:07:41

Case description: scenario 7 - explosive mass D (linked to Pool evaporation - Scenario 7 - evap D)

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 7 - explosive mass f (linked to Pool evaporation - Scenario 7 - evap F)

Parameters

Inputs

	explosive mass	explosive mass
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
Total mass released (kg)		
Mass flow rate of the source (kg/s)	2,21E-05	1,79E-05
Duration of the release (s)	941,19	864,19
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	200	200
Diameter of expanded jet (m)		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	5
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	explosive mass	explosive mass
Explosive mass at time t (kg)	-1,00E+100	-1,00E+100
Height to LEL at time t (m)	-1,00E+100	-1,00E+100
Length of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100
Width of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100
Offset between release location and LEL at time t (m)	-1,00E+100	-1,00E+100
Maximum explosive mass (kg)	-1,00E+100	-1,00E+100
...at time tmem (s)	-1,00E+100	-1,00E+100
Start time where 95% of maximum of explosive mass is reached (s)	-1,00E+100	-1,00E+100
Time where explosive mass starts decreasing below 95% of max (s)	-1,00E+100	-1,00E+100
Length of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100
Width of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100
Offset between release location and LEL at time tmem (m)	-1,00E+100	-1,00E+100
Maximum area of explosive cloud (m2)	0,00E+00	0,00E+00
...at time tmac (s)	0,00E+00	0,00E+00
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	-1,00E+100	-1,00E+100
Width of cloud (between LEL) at time tmac (m)	-1,00E+100	-1,00E+100
Offset between release location and LEL at time tmac (m)	-1,00E+100	-1,00E+100
Offset between release centre and cloud centre at time tmac (m)	-1,50E+100	-1,50E+100
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1F andrea_silvasantos at 05/11/2015 11:08:03

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	HFO	Units			
HFO-018 FBR	HFO pipelines from D1 HFO pumphouse to D1 heaters. Rupture in the pipeline	Substance	HFO		Confined release	No	--
		Flow rate	40	m3/h	Bund dimensions	--	--
		Pipeline diameter	150	mm	Roughness length description	Concrete	--
		Pipeline length	10	m	Roughness	10,00	cm
		Operation pressure	6	bar	Soil temperature	19,00	°C
		Operation temperature	100	°C	Meteo station	Malta airport	--
		Hole diameter	150	mm	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	16,52	kg/s
					Total mass released	29730	kg
					Total volume released [1]	30	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [1]	3000	m²
					Evaporation rate 4D	1,26E-04	kg/s
					Evaporation rate 2F	8,36E-05	kg/s
					Evaporation duration 5D	1065,5	s
					Evaporation duration 2F	1013,3	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	22	m
					LC50% - 15 kW/m2	24	m
					LC40% - 13,4 kW/m2	26	m
					LC5% - 9,3 kW/m2	38	m
					LC3% - 7,3 kW/m2	42	m
					LC01% - 5 kW/m2	48	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	0	m
					Length of cloud (between LEL) 2F	0	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	NA	--
					Oil interceptor capacity	0	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	30	m3

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm. Limited to 1500 m2

[3] Equivalent to the 10% of the flow rate

Case description: Scenario 7A/18A/19A - evap D

Model: Pool evaporation

version: 5.16 (05/04/2016)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 7A/18A/19A - evap F

Parameters

Inputs	7A/18A/19A -	Scenario 7A/18A/19A - evap F
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	16,52	16,52
Duration of the release (s)	1800	1800
<i>Total mass released (kg)</i>		
<i>Height pool at t=0</i>		
<i>Value pool height at t=0 (m)</i>		
Type of pool growth on Land	bunds	Spreading in bunds
<i>Type of pool growth on Water</i>		
Temperature of the pool (°C)	45	45
Maximum pool surface area (m2)	1500	1500
Temperature of the subsoil (°C)	19	19
<i>Temperature of the water (°C)</i>		
<i>Max temperature difference between pool and water (K)</i>		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
<i>Solar heat radiation flux (W/m2)</i>		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800

Results	7A/18A/19A -	Scenario 7A/18A/19A - evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	349,5	349
<i>Time until pool has totally evaporated (s)</i>		
Purple book representative evaporation rate (kg/s)	0,00012609	8,36E-05
Purple book representative evaporation duration (s)	1065,5	1013,3
Representative temperature (°C)	51,883	54,726
Representative pool diameter (m)	43,702	43,702
Density after mixing with air (kg/m3)	1,2072	1,2073
Total evaporated mass (kg)	0,13436	0,084737
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	1500	1500

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1F/andrea_silvasantos at 06/04/2016 9:54:00

Case description: scenario 7A/18A/19A- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 7A/18A/19A - evap D)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 7A/18A/19A - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 7A/18A/19A - evap F)

Parameters

Inputs	7A/18A/19A-	7A/18A/19A -
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	29730	29730
Mass flow rate of the source (kg/s)	0,00012609	8,36E-05
Duration of the release (s)	1065,5	1013,3
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	45	45
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		

Results	7A/18A/19A-	7A/18A/19A -
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0019392	0,0027756
Heat radiation first contour at (m)	48,436	25,916
Heat radiation second contour at (m)	42,179	24,456
Heat radiation third contour at (m)	37,558	21,852
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	575,73	575,73
Heat emission from fire surface (kW/m2)	20,633	20,127
Flame tilt (deg)	49,28	35,336
View factor (%)	0,02345	0,034407
Atmospheric transmissivity (%)	40,08	40,08
Flame temperature (°C)	507,38	502,64
Height of the Flame (m)	24,676	29,044
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 08/04/2016 13:00:08

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	HFO	Units			
HFO-019	HFO pipelines from D1 heaters to D1 boilers. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	HFO		Confined release	No	--
		Flow rate	40	m3/h	Bund dimensions	--	--
		Pipeline diameter	150	mm	Roughness length description	Concrete	--
		Pipeline length	410	m	Roughness	10,00	cm
		Operation pressure	6	bar	Soil temperature	19,00	°C
		Operation temperature	100	°C	Meteo station	Malta airport	--
		Hole diameter	15	mm	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	1,101111111	kg/s
					Total mass released	1982	kg
					Total volume released [1]	2	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [1]	200	m²
					Evaporation rate 4D	2,21E-05	kg/s
					Evaporation rate 2F	1,79E-05	kg/s
					Evaporation duration 5D	941,19	s
					Evaporation duration 2F	864,69	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	8	m
					LC50% - 15 kW/m2	10	m
					LC40% - 13,4 kW/m2	11	m
					LC5% - 9,3 kW/m2	16	m
					LC3% - 7,3 kW/m2	18	m
					LC01% - 5 kW/m2	21	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	0	m
					Length of cloud (between LEL) 2F	0	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	NA	--
					Oil interceptor capacity	0	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	2	m3

NOTES

[1] HFO density = 991 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

Case description: Scenario 7 - evap D

Model: Pool evaporation

version: 5.16 (05/11/2015)

Reference: Yellow Book CPR14E 2nd Edition - Chapter 5: Evaporation

compared to: Scenario 7 - evap F

Parameters	evap D	Scenario 7 - evap F
Inputs		
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	1,1	1,1
Duration of the release (s)	1800	1800
Total mass released (kg)		
Height pool at t=0		
Value pool height at t=0 (m)		
Type of pool growth on Land	bunds	Spreading in bunds
Type of pool growth on Water		
Temperature of the pool (°C)	45	45
Maximum pool surface area (m2)	200	200
Temperature of the subsoil (°C)	19	19
Temperature of the water (°C)		
Max temperature difference between pool and water (K)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
Solar heat radiation flux (W/m2)		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800
Results		
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	696,5	695
Time until pool has totally evaporated (s)		
Purple book representative evaporation rate (kg/s)	2,21E-05	1,79E-05
Purple book representative evaporation duration (s)	941,19	864,69
Representative temperature (°C)	53,4	58,214
Representative pool diameter (m)	15,958	15,958
Density after mixing with air (kg/m3)	1,2072	1,2072
Total evaporated mass (kg)	0,020808	0,015495
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	200	200
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1Flandrea_silvasantos at 05/11/2015 11:07:09

Case description: scenario 7/18/19- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 7/18/19 - evap D)

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 7/1819 - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 7/18/19 - evap F)

Parameters	PFIRE LC01,	PFIRE LC40,
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	1982	1982
Mass flow rate of the source (kg/s)	2,21E-05	1,79E-05
Duration of the release (s)	941,19	864,69
Pool surface poolfire (m2)	200	200
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	45	45
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	Scenario 7/18/19 PFIRE LC01,	Scenario 7/18/19 PFIRE LC40,
Max Diameter of the Pool Fire (m)	15,958	15,958
Heat radiation at X (kW/m2)	0,00029039	0,00043847
Heat radiation first contour at (m)	20,844	10,65
Heat radiation second contour at (m)	17,788	9,5919
Heat radiation third contour at (m)	15,739	7,9798
Combustion rate (kg/s)	6,8851	6,8851
Duration of the pool fire (s)	287,87	287,87
Heat emission from fire surface (kW/m2)	19,822	19,299
Flame tilt (deg)	53,067	39,724
View factor (%)	0,0036662	0,0056858
Atmospheric transmissivity (%)	39,958	39,958
Flame temperature (°C)	499,75	494,71
Height of the Flame (m)	11,768	14,264
Calculated pool surface area (m2)	200	200
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Case description: scenario 7 - explosive mass D (linked to Pool evaporation - Scenario 7 - evap D)

Model: Dense Gas Dispersion: Explosive mass

version: 5.13 (05/11/2015)

Reference: Yellow Book 3rd edition 1997 chapter 4; Ermak, D.L. User manual for SLAB Lawrence Livermore National Laboratory, June 1990

compared to: scenario 7 - explosive mass f (linked to Pool evaporation - Scenario 7 - evap F)

Parameters

Inputs	explosive mass	explosive mass f
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Type of release	release	release
Total mass released (kg)		
Mass flow rate of the source (kg/s)	2,21E-05	1,79E-05
Duration of the release (s)	941,19	864,69
Initial liquid mass fraction (%)		
Fixed pool surface (m2)	200	200
Diameter of expanded jet (m)		
Temperature after release (°C)	19	19
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Z-coordinate (height) of release (m)		
Ambient temperature (°C)	19	19
Meteorological data	Pasquill	Pasquill
Pasquill stability class	D (Neutral)	F (Very Stable)
Wind speed at 10 m height (m/s)	5	2
Inverse Monin-Obukhov length (1/L) (1/m)		
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Ambient relative humidity (%)	75	75
Roughness length description	no vegetation,	no vegetation,
Time t after start release (s)	120	120
Concentration averaging time (s)	20	20
Resolution of the time consuming graphs	Low	Low

Results

	explosive mass	explosive mass f
Explosive mass at time t (kg)	-1,00E+100	-1,00E+100
Height to LEL at time t (m)	-1,00E+100	-1,00E+100
Length of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100
Width of cloud (between LEL) at time t (m)	-1,00E+100	-1,00E+100
Offset between release location and LEL at time t (m)	-1,00E+100	-1,00E+100
Maximum explosive mass (kg)	-1,00E+100	-1,00E+100
...at time tmem (s)	-1,00E+100	-1,00E+100
Start time where 95% of maximum of explosive mass is reached (s)	-1,00E+100	-1,00E+100
Time where explosive mass starts decreasing below 95% of max (s)	-1,00E+100	-1,00E+100
Length of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100
Width of cloud (between LEL) at time tmem (m)	-1,00E+100	-1,00E+100
Offset between release location and LEL at time tmem (m)	-1,00E+100	-1,00E+100
Maximum area of explosive cloud (m2)	-1,00E+100	-1,00E+100
...at time tmac (s)	-1,00E+100	-1,00E+100
Explosive mass at time tmac (kg)	0	0
Length of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Width of cloud (between LEL) at time tmac (m)	0,00E+00	0,00E+00
Offset between release location and LEL at time tmac (m)	-1,00E+100	-1,00E+100
Offset between release centre and cloud centre at time tmac (m)	-1,50E+100	-1,50E+100
Inverse Monin-Obukhov length (1/L) used (1/m)	0	0

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fiandrea_silvasantos at 05/11/2015 11:08:03

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	HFO	Units			
HFO-019 FBR	HFO pipelines from D1 heaters to D1 boilers. Rupture in the pipeline	Substance	HFO		Confined release	No	--
		Flow rate	40	m3/h	Bund dimensions	--	--
		Pipeline diameter	150	mm	Roughness length description	Concrete	--
		Pipeline length	410	m	Roughness	10,00	cm
		Operation pressure	6	bar	Soil temperature	19,00	°C
		Operation temperature	100	°C	Meteo station	Malta airport	--
		Hole diameter	150	mm	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	16,52	kg/s
					Total mass released	29730	kg
					Total volume released [1]	30	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [1]	3000	m²
					Evaporation rate 4D	1,26E-04	kg/s
					Evaporation rate 2F	8,36E-05	kg/s
					Evaporation duration 5D	1065,5	s
					Evaporation duration 2F	1013,3	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	23	m
					LC50% - 15 kW/m2	41	m
					LC40% - 13,4 kW/m2	44	m
					LC5% - 9,3 kW/m2	53	m
					LC3% - 7,3 kW/m2	57	m
					LC01% - 5 kW/m2	63	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	0	m
					Length of cloud (between LEL) 2F	0	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	NA	--
					Oil interceptor capacity	0	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	30	m3
NOTES							
[1] HFO density = 991 kg/m3							
[2] Pool thickness (on land) = 10 mm. Limited to 1500 m2							
[3] Equivalent to 1,5 x flow rate							

Case description: Scenario 7A/18A/19A - evap D

Model: Pool evaporation

version: 5.16 (05/04/2016)

Reference: Yellow Book CPR14E 2rd Edition - Chapter 5: Evaporation

compared to: Scenario 7A/18A/19A - evap F

Parameters

Inputs	7A/18A/19A -	Scenario 7A/18A/19A - evap F
Chemical name (DIPPR)	(DIPPR)	n-EICOSANE (DIPPR)
Use which representative step	average	First 20% average (flammable)
Evaporation from land or water	Land	Land
Type of release	Continuous	Continuous
Mass flow rate of the source (kg/s)	16,52	16,52
Duration of the release (s)	1800	1800
<i>Total mass released (kg)</i>		
<i>Height pool at t=0</i>		
<i>Value pool height at t=0 (m)</i>		
Type of pool growth on Land	bunds	Spreading in bunds
<i>Type of pool growth on Water</i>		
Temperature of the pool (°C)	45	45
Maximum pool surface area (m2)	1500	1500
Temperature of the subsoil (°C)	19	19
<i>Temperature of the water (°C)</i>		
<i>Max temperature difference between pool and water (K)</i>		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Solar radiation flux	Calculate value	Calculate value
<i>Solar heat radiation flux (W/m2)</i>		
Cloud cover (%)	50	50
Date: day number	21	21
Date: month number	6	6
Date: year number	2015	2015
Latitude of the location (deg)	35	35
Type of subsoil	Heavy concrete	Heavy concrete
Subsoil roughness description	concrete, tiles,	flat sandy soil, concrete, tiles, plant-yard
Maximum evaluation time for evaporation (s)	1800	1800

Results	7A/18A/19A -	Scenario 7A/18A/19A - evap F
Heat flux from solar radiation (kW/m2)	1,4459	1,4459
Time pool spreading ends (s)	349,5	349
<i>Time until pool has totally evaporated (s)</i>		
Purple book representative evaporation rate (kg/s)	0,00012609	8,36E-05
Purple book representative evaporation duration (s)	1065,5	1013,3
Representative temperature (°C)	51,883	54,726
Representative pool diameter (m)	43,702	43,702
Density after mixing with air (kg/m3)	1,2072	1,2073
Total evaporated mass (kg)	0,13436	0,084737
... duration evaporation time (s)	1799,5	1799,5
Corresponding representative pool surface area (m2)	1500	1500

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 06/04/2016 9:59:36

Case description: scenario 7A/18A/19A- PFIRE LC01, LC03, LC05 (linked to Pool evaporation - Scenario 7A/18A/19A - evap D)

Model: Pool fire

version: 5.11 (05/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario 7A/18A/19A - PFIRE LC40, LC50, LC99 (linked to Pool evaporation - Scenario 7A/18A/19A - evap F)

Parameters	7A/18A/19A-	7A/18A/19A -
Inputs		
Chemical name (DIPPR)	(DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	29730	29730
Mass flow rate of the source (kg/s)	0,00012609	8,36E-05
Duration of the release (s)	1065,5	1013,3
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	45	45
Pool burning rate	t	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	35	35
Soot Fraction	t	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	2
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		
Results	7A/18A/19A-	7A/18A/19A -
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0049294	0,0066469
Heat radiation first contour at (m)	63,407	43,733
Heat radiation second contour at (m)	56,551	41,214
Heat radiation third contour at (m)	52,701	22,837
Combustion rate (kg/s)	51,639	51,639
Duration of the pool fire (s)	575,73	575,73
Heat emission from fire surface (kW/m2)	48,431	44,887
Flame tilt (deg)	49,28	35,336
View factor (%)	0,02345	0,034407
Atmospheric transmissivity (%)	43,404	43,038
Flame temperature (°C)	690,23	672,26
Height of the Flame (m)	24,676	29,044
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	311,62	311,62
Weight ratio of H2O/chemical (%)	133,97	133,97
Other information		
Main program	8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units	
		DO Unloading arm		Units				
DO-001	Leak in unloading arm with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	DO		Confined release	NO	--	
		Maximum volume	8000	m3	Bund dimensions	na	m2	
		Hose diameter	8	inch	Roughness length description	Concrete	--	
		Length	12,948	m	Roughness	10,00	cm	
		Design pressure	na	bar	Soil temperature	19,00	°C	
		Operating pressure	4	bar	Meteo station	Malta airport	--	
		Rupture pressure	na	bar	Ambient relative humidity	75,00	%	
		Design temperature	na	°C	Ambient temperature	19,00	°C	
		Operating temperature	amb	°C	Meteorological condition 1	D / 4	-- / m/s	
		Discharge mass flow	600	t/h	Meteorological condition 2	F / 2	-- / m/s	
		Release mass flow [3]	16,67	kg/s	RELEASE DATA			
					Release duration	120	s	
					Mass flow rate	16,67	kg/s	
					Total mass released	2000	kg	
					Total volume released [1]	2	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	465	m²	
					Evaporation rate 4D	NA	kg/s	
					Evaporation rate 2F	NA	kg/s	
					Evaporation duration 5D	NA	s	
					Evaporation duration 2F	NA	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	NA	m	
					LC50% - 15 kW/m2	NA	m	
					LC40% - 13,4 kW/m2	NA	m	
					LC5% - 9,3 kW/m2	NA	m	
					LC3% - 7,3 kW/m2	NA	m	
					LC01% - 5 kW/m2	NA	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	NA	m	
					Length of cloud (between LEL) 2F	NA	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	NA	--	
					Oil interceptor capacity	0	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	2	m3	

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on water) = 5 mm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units	
		DO Unloading arm		Units				
DO-001 FBR	Rupture in unloading arm.	Substance	DO		Confined release	NO	--	
		Maximum volume	8000	m3	Bund dimensions	na	m2	
		Hose diameter	8	inch	Roughness length description	Concrete	--	
		Length	12,948	m	Roughness	10,00	cm	
		Design pressure	na	bar	Soil temperature	19,00	°C	
		Operating pressure	4	bar	Meteo station	Malta airport	--	
		Rupture pressure	na	bar	Ambient relative humidity	75,00	%	
		Design temperature	na	°C	Ambient temperature	19,00	°C	
		Operating temperature	amb	°C	Meteorological condition 1	D / 4	-- / m/s	
		Discharge mass flow	600	t/h	Meteorological condition 2	F / 2	-- / m/s	
		Release mass flow [3]	250,00	kg/s	RELEASE DATA			
					Release duration	120	s	
					Mass flow rate	250,00	kg/s	
					Total mass released	30000	kg	
					Total volume released [1]	35	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	6977	m²	
					Evaporation rate 4D	NA	kg/s	
					Evaporation rate 2F	NA	kg/s	
					Evaporation duration 5D	NA	s	
					Evaporation duration 2F	NA	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	NA	m	
					LC50% - 15 kW/m2	NA	m	
					LC40% - 13,4 kW/m2	NA	m	
					LC5% - 9,3 kW/m2	NA	m	
					LC3% - 7,3 kW/m2	NA	m	
					LC01% - 5 kW/m2	NA	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	NA	m	
					Length of cloud (between LEL) 2F	NA	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	NA	--	
					Oil interceptor capacity	0	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	35	m3	

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on water) = 5 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		Unloading pipeline		Units				
DO-002	DO Unloading pipeline from vessel to raw tanks. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	DO		Confined release	No	--	
		Mass flow	600	t/h	Bund dimensions	--	--	
		Pipeline diameter	12	inch	Roughness length description	Concrete	--	
		Pipeline length	570	m	Roughness	10,00	cm	
		Operation pressure	4	bar	Soil temperature	19,00	°C	
		Operation temperature	amb	°C	Meteo station	Malta airport	--	
		Hole diameter	1,2	inch	Ambient relative humidity	75,00	%	
		Release mass flow [3]	16,67	kg/s	Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate	16,67	kg/s	
					Total mass released	30000	kg	
					Total volume released [1]	35	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	3488	m²	
					Evaporation rate 4D	NA	kg/s	
					Evaporation rate 2F	NA	kg/s	
					Evaporation duration 5D	NA	s	
					Evaporation duration 2F	NA	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	NA	m	
					LC50% - 15 kW/m2	NA	m	
					LC40% - 13,4 kW/m2	NA	m	
					LC5% - 9,3 kW/m2	NA	m	
					LC3% - 7,3 kW/m2	NA	m	
					LC01% - 5 kW/m2	NA	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	NA	m	
					Length of cloud (between LEL) 2F	NA	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	F	--	
					Oil interceptor capacity	16	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	19	m3	

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Unloading pipeline		Units			
DO-002 FBR	DO Unloading pipeline from vessel to raw tanks. Rupture in the pipeline	Substance	DO		Confined release	No	--
		Mass flow	600	t/h	Bund dimensions	--	--
		Pipeline diameter	12	inch	Roughness length description	Concrete	--
		Pipeline length	570	m	Roughness	10,00	cm
		Operation pressure	4	bar	Soil temperature	19,00	°C
		Operation temperature	amb	°C	Meteo station	Malta airport	--
		Hole diameter	12	inch	Ambient relative humidity	75,00	%
		Release mass flow [3]	250,00	kg/s	Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	250,00	kg/s
					Total mass released	450000	kg
					Total volume released [1]	523	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	52326	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	F	--
					Oil interceptor capacity	16	m3
		Oil interceptor efficiency	NA	--			
		Total volume released to water			508	m3	

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units	
		RAW TANK	DO	Units				
DO-003	Continuous release from a hole with an effective diameter of 10 mm of the DO raw tank nr 1, nr 2, nr 3	Substance	DO		Confined release	No	--	
		Nominal volume	8598	m3	Bund dimensions	--	m3	
		Filling degree	95	%	Roughness length description	Concrete	--	
		Diameter	30	m	Roughness	10,00	cm	
		Height	12	m	Soil temperature	19,00	°C	
		Design pressure	atm	bar	Meteo station	Malta airport	--	
		Operation Pressure	atm	bar	Ambient relative humidity	75,00	%	
		Rupture pressure	1,21	bar	Ambient temperature	19,00	°C	
		Design temperature	60	°C	Meteorological condition 1	D / 4	-- / m/s	
		Operation Temperature	amb	°C	Meteorological condition 2	F / 2	-- / m/s	
		RELEASE DATA						
						Release duration	1800	s
						Mass flow rate	0,56	kg/s
						Total mass released	1006,308	kg
						Total volume released [1]	1	m3
		EVAPORATION & DISPERSION DATA						
						Maximum pool area [2]	117	m²
						Evaporation rate 4D	NA	kg/s
						Evaporation rate 2F	NA	kg/s
						Evaporation duration 5D	NA	s
						Evaporation duration 2F	NA	s
		POOL FIRE DAMAGE ZONES						
						LC99% - 37,5 kW/m2	NA	m
						LC50% - 15 kW/m2	NA	m
						LC40% - 13,4 kW/m2	NA	m
						LC5% - 9,3 kW/m2	NA	m
						LC3% - 7,3 kW/m2	NA	m
						LC01% - 5 kW/m2	NA	m
		FLASH FIRE & EXPLOSION ZONES						
						Length of cloud (between LEL) 5D	NA	m
						Length of cloud (between LEL) 2F	NA	m
		ENVIRONMENTAL SPILLAGE DATA						
						Oil interceptor	F	--
						Oil interceptor capacity	16	m3
						Oil interceptor efficiency	NA	--
						Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

Case description: scenario 22 release

Model: Liquid release

version: 5.08 (05/11/2015)

Reference: Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	PENTADECANE
Use which representative step	average
Type of release	hole in vessel
Pipeline length (m)	
Pipeline diameter (mm)	
Pipeline roughness (mm)	
Hole diameter (mm)	10
Hole rounding	Sharp edges
Discharge coefficient (-)	0,62
Vessel type	Vertical cylinder
Vessel volume (m3)	8593
Height cylinder (m)	12
Filling degree (%)	95
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	19
Type of calculation	device is empty
Time t after start release (s)	

Results

Initial mass in vessel (kg)	6,27E+06
Mass flow rate at time t (kg/s)	
Total mass released (kg)	6,27E+06
Time needed to empty vessel (s)	2,22E+07
Filling degree at time t (%)	
Height of liquid at time t (m)	
Maximum mass flow rate (kg/s)	0,55906
Representative release rate (kg/s)	0,55906
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fl andrea_silvasantos at 05/11/2015 14:54:59

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		RAW TANK	DO	Units			
DO-003 CF	Instantaneous release of the entire contents of the DO raw tank nr 1, nr 2, nr 3	Substance	DO		Confined release	Yes	--
		Nominal volume	8598	m3	Bund dimensions	2600	m2
		Filling degree	95	%	Roughness length description	Concrete	--
		Diameter	30	m	Roughness	10,00	cm
		Height	12	m	Soil temperature	19,00	°C
		Design pressure	atm	bar	Meteo station	Malta airport	--
		Operation Pressure	atm	bar	Ambient relative humidity	75,00	%
		Rupture pressure	1,21	bar	Ambient temperature	19,00	°C
		Design temperature	60	°C	Meteorological condition 1	D / 4	-- / m/s
		Operation Temperature	amb	°C	Meteorological condition 2	F / 2	-- / m/s
		RELEASE DATA					
					Release duration	instantaneous	s
					Mass flow rate	na	kg/s
					Total mass released	7394280	kg
					Total volume released [1]	8598	m3
		EVAPORATION & DISPERSION DATA					
					Maximum pool area [2]	2600	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
		POOL FIRE DAMAGE ZONES					
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
		FLASH FIRE & EXPLOSION ZONES					
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
		BUND DRAINAGE TO INTERCEPTORS					
					Bund pipeline dimensions	6	inch
					Bund height	5	m
					Mass flow rate	80,483	kg/s
					Release duration [3]	1800	s
					Total volume released [1]	146	m3
		ENVIRONMENTAL SPILLAGE DATA					
					Oil interceptor	F	--
					Oil interceptor capacity	16	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	131	m3

NOTES

- [1] DO density = 860 kg/m3
 [2] Bund area of each tank
 [3] Maximum release time equivalent to = 0,5 h. Maximum volume directed to interceptors = 149m3

Case description: scenario 22A release from bund

Model: Liquid release

version: 5.08 (06/04/2016)

Reference: Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4 Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	PENTADECANE
Use which representative step	average
Type of release	hole in vessel
Pipeline length (m)	
Pipeline diameter (mm)	
Pipeline roughness (mm)	
Hole diameter (inch)	6
Hole rounding	Sharp edges
Discharge coefficient (-)	0,62
Vessel type	Vertical cylinder
Vessel volume (m3)	8598
Height cylinder (m)	5
Filling degree (%)	95
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	65
Type of calculation	specified time
Time t after start release (s)	1800

Results

Initial mass in vessel (kg)	6,02E+06
Mass flow rate at time t (kg/s)	79,51
Total mass released at time t (kg)	1,45E+05
Time needed to empty vessel (s)	
Filling degree at time t (%)	92,717
Height of liquid at time t (m)	4,6359
Maximum mass flow rate (kg/s)	80,483
Representative release rate (kg/s)	80,387
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fl andrea_silvasantos at 06/04/2016 11:33:27

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		Unloading pipeline	DO	Units				
DO-004	DO pipelines from raw tank to transfer pumps. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm	Substance	DO		Confined release	No	--	
		Flow rate	20	m3/h	Bund dimensions	--	--	
		Pipeline diameter	10	inch	Roughness length description	Concrete	--	
		Pipeline length	210	m	Roughness	10,00	cm	
		Operation pressure	2	bar	Soil temperature	19,00	°C	
		Operation temperature	amb	°C	Meteo station	Malta airport	--	
		Hole diameter	1	inch	Ambient relative humidity	75,00	%	
		Release mass flow [3]	0,48	kg/s	Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate	0,48	kg/s	
					Total mass released	860	kg	
					Total volume released [1]	1	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	100	m²	
					Evaporation rate 4D	NA	kg/s	
					Evaporation rate 2F	NA	kg/s	
					Evaporation duration 5D	NA	s	
					Evaporation duration 2F	NA	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	NA	m	
					LC50% - 15 kW/m2	NA	m	
					LC40% - 13.4 kW/m2	NA	m	
					LC5% - 9,3 kW/m2	NA	m	
		LC3% - 7,3 kW/m2	NA	m				
		LC01% - 5 kW/m2	NA	m				
		FLASH FIRE & EXPLOSION ZONES						
		Length of cloud (between LEL) 5D	NA	m				
		Length of cloud (between LEL) 2F	NA	m				
		ENVIRONMENTAL SPILLAGE DATA						
		Oil interceptor	1	--				
		Oil interceptor capacity	24	m3				
		Oil interceptor efficiency	NA	--				
		Total volume released to water	0	m3				

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units	
		Unloading pipeline	DO	Units				
DO-004 FBR	DO pipelines from raw tank to transfer pumps. Rupture in the pipeline	Substance	DO		Confined release	No	--	
		Flow rate	20	m3/h	Bund dimensions	--	--	
		Pipeline diameter	10	inch	Roughness length description	Concrete	--	
		Pipeline length	210	m	Roughness	10,00	cm	
		Operation pressure	2	bar	Soil temperature	19,00	°C	
		Operation temperature	amb	°C	Meteo station	Malta airport	--	
		Hole diameter	10	inch	Ambient relative humidity	75,00	%	
		Release mass flow [3]	7,17	kg/s	Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate	7,17	kg/s	
					Total mass released	12900	kg	
					Total volume released [1]	15	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	1500	m²	
					Evaporation rate 4D		NA	kg/s
					Evaporation rate 2F		NA	kg/s
					Evaporation duration 5D		NA	s
					Evaporation duration 2F		NA	s
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2		NA	m
					LC50% - 15 kW/m2		NA	m
					LC40% - 13,4 kW/m2		NA	m
					LC5% - 9,3 kW/m2		NA	m
					LC3% - 7,3 kW/m2		NA	m
					LC01% - 5 kW/m2		NA	m
		FLASH FIRE & EXPLOSION ZONES						
		Length of cloud (between LEL) 5D		NA	m			
		Length of cloud (between LEL) 2F		NA	m			
		ENVIRONMENTAL SPILLAGE DATA						
		Oil interceptor		I	--			
		Oil interceptor capacity		24	m3			
		Oil interceptor efficiency		NA	--			
		Total volume released to water		0	m3			

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		DO Transfer pumps	DO	Units			
DO-005	Leak (10 % diameter). Discharge line	Substance	DO		Confined release	Yes	--
		Maximum mass flow	20	m3/h	Bund dimensions		m3
		Pipeline diameter	6	inch	Roughness length description	Concrete	--
		Operation pressure	4	bar	Roughness	10,00	cm
		Operation temperature	amb	°C	Soil temperature	19,00	°C
		Hole diameter	0,6	mm	Meteo station	Malta airport	--
		Release mass flow [3]	0,48	kg/s	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	0,48	kg/s
					Total mass released	860	kg
					Total volume released [1]	1	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	100	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	J	--
					Oil interceptor capacity	15	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		DO Transfer pumps	DO	Units			
DO-005 CF	Catastrophic failure. Discharge line	Substance	DO		Confined release	Yes	--
		Maximum mass flow	20	m3/h	Bund dimensions		m3
		Pipeline diameter	6	inch	Roughness length description	Concrete	--
		Operation pressure	4	bar	Roughness	10,00	cm
		Operation temperature	amb	°C	Soil temperature	19,00	°C
		Hole diameter	6	mm	Meteo station	Malta airport	--
		Release mass flow [3]	7,17	kg/s	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	7,17	kg/s
					Total mass released	12900	kg
					Total volume released [1]	15	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	1500	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
			LC01% - 5 kW/m2	NA	m		
			FLASH FIRE & EXPLOSION ZONES				
			Length of cloud (between LEL) 5D	NA	m		
			Length of cloud (between LEL) 2F	NA	m		
			ENVIRONMENTAL SPILLAGE DATA				
			Oil interceptor	J	--		
			Oil interceptor capacity	15	m3		
			Oil interceptor efficiency	NA	--		
			Total volume released to water	0	m3		

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	HFO	Units			
DO-006	DO pipelines from transfer pumps to centrifuges. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm	Substance	HFO		Confined release	No	--
		Flow rate	20	m3/h	Bund dimensions	--	--
		Pipeline diameter	6	inch	Roughness length description	Concrete	--
		Pipeline length	100	m	Roughness	10,00	cm
		Operation pressure	2	bar	Soil temperature	19,00	°C
		Operation temperature	amb	°C	Meteo station	Malta airport	--
		Hole diameter	0,6	inch	Ambient relative humidity	75,00	%
		Release mass flow [3]	0,14	kg/s	Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	0,60	kg/s
					Total mass released	1080	kg
					Total volume released [1]	1	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	126	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13.4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	J	--
					Oil interceptor capacity	15	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		Pipeline	HFO	Units				
DO-006 FBR	DO pipelines from transfer pumps to centrifuges. Rupture in the pipeline	Substance	HFO		Confined release	No	--	
		Flow rate	20	m3/h	Bund dimensions	--	--	
		Pipeline diameter	6	inch	Roughness length description	Concrete	--	
		Pipeline length	100	m	Roughness	10,00	cm	
		Operation pressure	2	bar	Soil temperature	19,00	°C	
		Operation temperature	amb	°C	Meteo station	Malta airport	--	
		Hole diameter	6	inch	Ambient relative humidity	75,00	%	
		Release mass flow [3]	2,15	kg/s	Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate	6,00	kg/s	
					Total mass released	10800	kg	
					Total volume released [1]	13	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	1256	m²	
					Evaporation rate 4D	NA	kg/s	
					Evaporation rate 2F	NA	kg/s	
					Evaporation duration 5D	NA	s	
					Evaporation duration 2F	NA	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	NA	m	
					LC50% - 15 kW/m2	NA	m	
					LC40% - 13.4 kW/m2	NA	m	
					LC5% - 9,3 kW/m2	NA	m	
					LC3% - 7,3 kW/m2	NA	m	
					LC01% - 5 kW/m2	NA	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	NA	m	
					Length of cloud (between LEL) 2F	NA	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	J	--	
					Oil interceptor capacity	15	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	0	m3	

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		DO Centrifuges	DO	Units			
DO-007	Continuous release from a hole with an effective diameter of 10 mm. Centrifuges	Substance	DO		Confined release	Yes	--
		Maximum mass flow	15	m3/h	Bund dimensions		m3
		Pipeline diameter	6	inch	Roughness length description	Concrete	--
		Operation pressure	4	bar	Roughness	10,00	cm
		Operation temperature	amb	°C	Soil temperature	19,00	°C
		Hole diameter	0,6	mm	Meteo station	Malta airport	--
		Release mass flow [3]	0,36	kg/s	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	600	s
					Mass flow rate	0,36	kg/s
					Total mass released	215	kg
					Total volume released [1]	0	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	25	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	J	--
					Oil interceptor capacity	15	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		DO Centrifuges	DO	Units			
DO-007 CF	Catastrophic failure. Centrifuges	Substance	DO		Confined release	Yes	--
		Maximum mass flow	15	m3/h	Bund dimensions		m3
		Pipeline diameter	6	inch	Roughness length description	Concrete	--
		Operation pressure	4	bar	Roughness	10,00	cm
		Operation temperature	amb	°C	Soil temperature	19,00	°C
		Hole diameter	6	mm	Meteo station	Malta airport	--
		Release mass flow [3]	5,38	kg/s	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	600	s
					Mass flow rate	5,38	kg/s
					Total mass released	3225	kg
					Total volume released [1]	4	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	375	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	J	--
					Oil interceptor capacity	15	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		Service pipeline	DO	Units				
DO-008	DO pipelines from centrifuges to treated tank. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	DO		Confined release	No	--	
		Flow rate	15	m3/h	Bund dimensions	--	--	
		Pipeline diameter	6	inch	Roughness length description	Concrete	--	
		Pipeline length	260	m	Roughness	10,00	cm	
		Operation pressure	4	bar	Soil temperature	19,00	°C	
		Operation temperature	amb	°C	Meteo station	Malta airport	--	
		Hole diameter	0,6	inch	Ambient relative humidity	75,00	%	
		Release mass flow [3]	0,36	kg/s	Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate	0,36	kg/s	
					Total mass released	645	kg	
					Total volume released [1]	1	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	75	m²	
					Evaporation rate 4D	NA	kg/s	
					Evaporation rate 2F	NA	kg/s	
					Evaporation duration 5D	NA	s	
					Evaporation duration 2F	NA	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	NA	m	
					LC50% - 15 kW/m2	NA	m	
					LC40% - 13.4 kW/m2	NA	m	
					LC5% - 9,3 kW/m2	NA	m	
					LC3% - 7,3 kW/m2	NA	m	
					LC01% - 5 kW/m2	NA	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	NA	m	
					Length of cloud (between LEL) 2F	NA	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	F	--	
					Oil interceptor capacity	16	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	0	m3	

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units	
		Service pipeline	DO	Units				
DO-008 FBR	DO pipelines from centrifuges to treated tank. Rupture in the pipeline	Substance	DO		Confined release	No	--	
		Flow rate	15	m3/h	Bund dimensions	--	--	
		Pipeline diameter	6	inch	Roughness length description	Concrete	--	
		Pipeline length	260	m	Roughness	10,00	cm	
		Operation pressure	4	bar	Soil temperature	19,00	°C	
		Operation temperature	amb	°C	Meteo station	Malta airport	--	
		Hole diameter	6	inch	Ambient relative humidity	75,00	%	
		Release mass flow [3]	5,38	kg/s	Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate	5,38	kg/s	
					Total mass released	9675	kg	
					Total volume released [1]	11	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	1125	m²	
					Evaporation rate 4D	NA	kg/s	
					Evaporation rate 2F	NA	kg/s	
					Evaporation duration 5D	NA	s	
					Evaporation duration 2F	NA	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	NA	m	
					LC50% - 15 kW/m2	NA	m	
					LC40% - 13,4 kW/m2	NA	m	
					LC5% - 9,3 kW/m2	NA	m	
					LC3% - 7,3 kW/m2	NA	m	
					LC01% - 5 kW/m2	NA	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	NA	m	
					Length of cloud (between LEL) 2F	NA	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	F	--	
					Oil interceptor capacity	16	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	0	m3	

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		DO TREATED TANK	DO	Units				
DO-009	Continuous release from a hole with an effective diameter of 10 mm of the DO treated tank	Substance	DO		Confined release	No	--	
		Nominal volume	8482,3	m3	Bund dimensions	--	m3	
		Filling degree	95	%	Roughness length description	Concrete	--	
		Diameter	30	m	Roughness	10,00	cm	
		Height	12	m	Soil temperature	19,00	°C	
		Design pressure	atm	bar	Meteo station	Malta airport	--	
		Operation Pressure	atm	bar	Ambient relative humidity	75,00	%	
		Rupture pressure	1,21	bar	Ambient temperature	19,00	°C	
		Design temperature	60	°C	Meteorological condition 1	D / 4	-- / m/s	
		Operation Temperature	atm	°C	Meteorological condition 2	F / 2	-- / m/s	
		RELEASE DATA						
		Release duration				1800	s	
		Mass flow rate				0,56	kg/s	
		Total mass released				1006,308	kg	
		Total volume released [1]				1	m3	
		EVAPORATION & DISPERSION DATA						
		Maximum pool area [2]				117	m²	
		Evaporation rate 4D				NA	kg/s	
		Evaporation rate 2F				NA	kg/s	
		Evaporation duration 5D				NA	s	
		Evaporation duration 2F				NA	s	
		POOL FIRE DAMAGE ZONES						
		LC99% - 37,5 kW/m2				NA	m	
		LC50% - 15 kW/m2				NA	m	
		LC40% - 13,4 kW/m2				NA	m	
		LC5% - 9,3 kW/m2				NA	m	
		LC3% - 7,3 kW/m2				NA	m	
		LC01% - 5 kW/m2				NA	m	
		FLASH FIRE & EXPLOSION ZONES						
		Length of cloud (between LEL) 5D				NA	m	
		Length of cloud (between LEL) 2F				NA	m	
		ENVIRONMENTAL SPILLAGE DATA						
		Oil interceptor				F	--	
		Oil interceptor capacity				16	m3	
		Oil interceptor efficiency				NA	--	
		Total volume released to water				0	m3	

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

Case description: scenario 28 release

Model: Liquid release

version: 5.08 (05/11/2015)

Reference: Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	PENTADECANE
Use which representative step	average
Type of release	hole in vessel
Pipeline length (m)	
Pipeline diameter (mm)	
Pipeline roughness (mm)	
Hole diameter (mm)	10
Hole rounding	Sharp edges
Discharge coefficient (-)	0,62
Vessel type	Vertical cylinder
Vessel volume (m3)	8482,3
Height cylinder (m)	12
Filling degree (%)	95
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	19
Type of calculation	device is empty
Time t after start release (s)	

Results

Initial mass in vessel (kg)	6,19E+06
Mass flow rate at time t (kg/s)	
Total mass released (kg)	6,19E+06
Time needed to empty vessel (s)	2,19E+07
Filling degree at time t (%)	
Height of liquid at time t (m)	
Maximum mass flow rate (kg/s)	0,55906
Representative release rate (kg/s)	0,55906
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1FlAndrea_silvasantos at 05/11/2015 15:07:09

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units	
		DO TREATED TANK	DO	Units					
DO-009 CF	Instantaneous release of the entire contents of the DO treated tank	Substance	DO		Confined release		Yes	--	
		Nominal volume	8482,3	m3	Bund dimensions		2600	m2	
		Filling degree	95	%	Roughness length description		Concrete	--	
		Diameter	30	m	Roughness		10,00	cm	
		Height	12	m	Soil temperature		19,00	°C	
		Design pressure	atm	bar	Meteo station		Malta airport	--	
		Operation Pressure	atm	bar	Ambient relative humidity		75,00	%	
		Rupture pressure	1,21	bar	Ambient temperature		19,00	°C	
		Design temperature	60	°C	Meteorological condition 1		D / 4	-- / m/s	
		Operation Temperature	atm	°C	Meteorological condition 2		F / 2	-- / m/s	
		RELEASE DATA							
		Release duration				Instantaneous		s	
		Mass flow rate				na		kg/s	
		Total mass released				7294778,142		kg	
		Total volume released [1]				8482		m3	
		EVAPORATION & DISPERSION DATA							
		Maximum pool area [2]				2600		m²	
		Evaporation rate 4D				NA		kg/s	
		Evaporation rate 2F				NA		kg/s	
		Evaporation duration 5D				NA		s	
		Evaporation duration 2F				NA		s	
		POOL FIRE DAMAGE ZONES							
		LC99% - 37,5 kW/m2				NA		m	
		LC50% - 15 kW/m2				NA		m	
		LC40% - 13,4 kW/m2				NA		m	
		LC5% - 9,3 kW/m2				NA		m	
		LC3% - 7,3 kW/m2				NA		m	
		LC01% - 5 kW/m2				NA		m	
		FLASH FIRE & EXPLOSION ZONES							
		Length of cloud (between LEL) 5D				NA		m	
		Length of cloud (between LEL) 2F				NA		m	
		BUND DRAINAGE TO INTERCEPTORS							
		Bund pipeline dimensions				6		inch	
		Bund height				5		m	
		Mass flow rate				80,483		kg/s	
		Release duration [3]				1800		s	
		Total volume released [1]				146		m3	
		ENVIRONMENTAL SPILLAGE DATA							
		Oil interceptor				F		--	
		Oil interceptor capacity				16		m3	
		Oil interceptor efficiency				NA		--	
		Total volume released to water				131		m3	

NOTES

[1] DO density = 860 kg/m3

[2] Bund area of each tank

[3] Maximum release time equivalent to = 0,5 h. Maximum volume directed to interceptors = 149m3

Case description: scenario 28A release from bund

Model: Liquid release

version: 5.08 (06/04/2016)

Reference: Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4 Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	PENTADECANE
Use which representative step	average
Type of release	hole in vessel
Pipeline length (m)	
Pipeline diameter (mm)	
Pipeline roughness (mm)	
Hole diameter (inch)	6
Hole rounding	Sharp edges
Discharge coefficient (-)	0,62
Vessel type	Vertical cylinder
Vessel volume (m3)	8482,3
Height cylinder (m)	5
Filling degree (%)	95
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	65
Type of calculation	specified time
Time t after start release (s)	1800

Results

Initial mass in vessel (kg)	5,94E+06
Mass flow rate at time t (kg/s)	79,497
Total mass released at time t (kg)	1,45E+05
Time needed to empty vessel (s)	
Filling degree at time t (%)	92,686
Height of liquid at time t (m)	4,6343
Maximum mass flow rate (kg/s)	80,483
Representative release rate (kg/s)	80,385
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Fl andrea_silvasantos at 06/04/2016 11:44:35

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		Service pipeline	DO	Units				
DO-010	DO return pipelines from centrifuges to raw tank nr0, nr 1. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	DO		Confined release		No	--
		Volume	15	m3	Bund dimensions		--	--
		Pipeline diameter	2	inch	Roughness length description		Concrete	--
		Pipeline length	170	m	Roughness		10,00	cm
		Operation pressure	4	bar	Soil temperature		19,00	°C
		Operation temperature	amb	°C	Meteo station		Malta airport	--
		Hole diameter	0,2	inch	Ambient relative humidity		75,00	%
		Release mass flow [3]	0,36	kg/s	Ambient temperature		19,00	°C
					Meteorological condition 1		D / 4	-- / m/s
					Meteorological condition 2		F / 2	-- / m/s
					RELEASE DATA			
					Release duration		1800	s
					Mass flow rate		0,36	kg/s
					Total mass released		645	kg
					Total volume released [1]		1	m3
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]		75	m²
					Evaporation rate 4D		NA	kg/s
					Evaporation rate 2F		NA	kg/s
					Evaporation duration 5D		NA	s
					Evaporation duration 2F		NA	s
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2		NA	m
					LC50% - 15 kW/m2		NA	m
					LC40% - 13,4 kW/m2		NA	m
					LC5% - 9,3 kW/m2		NA	m
					LC3% - 7,3 kW/m2		NA	m
					LC01% - 5 kW/m2		NA	m
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D		NA	m
					Length of cloud (between LEL) 2F		NA	m
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor		F	--
					Oil interceptor capacity		16	m3
					Oil interceptor efficiency		NA	--
					Total volume released to water		0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Service pipeline	DO	Units			
DO-010 FBR	DO return pipelines from centrifuges to raw tank nr0, nr 1. Rupture in the pipeline	Substance	DO		Confined release	No	--
		Volume	15	m3	Bund dimensions	--	--
		Pipeline diameter	2	inch	Roughness length description	Concrete	--
		Pipeline length	170	m	Roughness	10,00	cm
		Operation pressure	4	bar	Soil temperature	19,00	°C
		Operation temperature	amb	°C	Meteo station	Malta airport	--
		Hole diameter	2	inch	Ambient relative humidity	75,00	%
		Release mass flow [3]	5,38	kg/s	Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	5,38	kg/s
					Total mass released	9675	kg
					Total volume released [1]	11	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	1125	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	F	--
					Oil interceptor capacity	16	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Service pipeline	DO	Units			
DO-011	DO pipelines from centrifuges to raw tank nr 2. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	DO		Confined release	No	--
		Volume	15	m3	Bund dimensions	--	--
		Pipeline diameter	4	inch	Roughness length description	Concrete	--
		Pipeline length	250	m	Roughness	10,00	cm
		Operation pressure	4	bar	Soil temperature	19,00	°C
		Operation temperature	amb	°C	Meteo station	Malta airport	--
		Hole diameter	0,4	inch	Ambient relative humidity	75,00	%
		Release mass flow [3]	0,36	kg/s	Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	0,36	kg/s
					Total mass released	645	kg
					Total volume released [1]	1	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	75	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13.4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	F	--
					Oil interceptor capacity	16	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 cm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Service pipeline	DO	Units			
DO-011 FBR	DO pipelines from centrifuges to raw tank nr 2. Rupture in the pipeline	Substance	DO		Confined release	No	--
		Volume	15	m3	Bund dimensions	--	--
		Pipeline diameter	4	inch	Roughness length description	Concrete	--
		Pipeline length	250	m	Roughness	10,00	cm
		Operation pressure	4	bar	Soil temperature	19,00	°C
		Operation temperature	amb	°C	Meteo station	Malta airport	--
		Hole diameter	4	inch	Ambient relative humidity	75,00	%
		Release mass flow [3]	5,38	kg/s	Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	5,38	kg/s
					Total mass released	9675	kg
					Total volume released [1]	11	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	1125	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	F	--
					Oil interceptor capacity	16	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		Pipeline	DO	Units				
DO-012	DO pipeline from treated tank to D2A forwarding pumps. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	DO		Confined release	No	--	
		Flow rate	15	m3/h	Bund dimensions	--	--	
		Pipeline diameter	6	inch	Roughness length description	Concrete	--	
		Pipeline length	260	m	Roughness	10,00	cm	
		Operation pressure	3	bar	Soil temperature	19,00	°C	
		Operation temperature	amb	°C	Meteo station	Malta airport	--	
		Hole diameter	0,6	inch	Ambient relative humidity	75,00	%	
		Release mass flow [3]	0,36	kg/s	Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate	0,36	kg/s	
					Total mass released	645	kg	
					Total volume released [1]	1	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	75	m²	
					Evaporation rate 4D	NA	kg/s	
					Evaporation rate 2F	NA	kg/s	
					Evaporation duration 5D	NA	s	
					Evaporation duration 2F	NA	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	NA	m	
					LC50% - 15 kW/m2	NA	m	
					LC40% - 13.4 kW/m2	NA	m	
					LC5% - 9,3 kW/m2	NA	m	
					LC3% - 7,3 kW/m2	NA	m	
					LC01% - 5 kW/m2	NA	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	NA	m	
					Length of cloud (between LEL) 2F	NA	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	H	--	
					Oil interceptor capacity	44	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	0	m3	

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	DO	Units			
DO-012 FBR	DO pipeline from treated tank to D2A forwarding pumps. Rupture in the pipeline	Substance	DO		Confined release	No	--
		Flow rate	15	m3/h	Bund dimensions	--	--
		Pipeline diameter	6	inch	Roughness length description	Concrete	--
		Pipeline length	260	m	Roughness	10,00	cm
		Operation pressure	3	bar	Soil temperature	19,00	°C
		Operation temperature	amb	°C	Meteo station	Malta airport	--
		Hole diameter	6	inch	Ambient relative humidity	75,00	%
		Release mass flow [3]	5,38	kg/s	Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	5,38	kg/s
					Total mass released	9675	kg
					Total volume released [1]	11	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	1125	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	H	--
					Oil interceptor capacity	44	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units	
		Pipeline	DO	Units				
DO-013	DO pipeline from treated tank to D2B forwarding pumps. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	DO		Confined release	No	--	
		Flow rate	15	m3/h	Bund dimensions	--	--	
		Pipeline diameter	10	inch	Roughness length description	Concrete	--	
		Pipeline length	260	m	Roughness	10,00	cm	
		Operation pressure	3	bar	Soil temperature	19,00	°C	
		Operation temperature	amb	°C	Meteo station	Malta airport	--	
		Hole diameter	1	inch	Ambient relative humidity	75,00	%	
		Release mass flow [3]	0,36	kg/s	Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate	0,36	kg/s	
					Total mass released	645	kg	
					Total volume released [1]	1	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	75	m²	
					Evaporation rate 4D	NA	kg/s	
					Evaporation rate 2F	NA	kg/s	
					Evaporation duration 5D	NA	s	
					Evaporation duration 2F	NA	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	NA	m	
					LC50% - 15 kW/m2	NA	m	
					LC40% - 13,4 kW/m2	NA	m	
					LC5% - 9,3 kW/m2	NA	m	
		LC3% - 7,3 kW/m2	NA	m				
		LC01% - 5 kW/m2	NA	m				
		FLASH FIRE & EXPLOSION ZONES						
		Length of cloud (between LEL) 5D	NA	m				
		Length of cloud (between LEL) 2F	NA	m				
		ENVIRONMENTAL SPILLAGE DATA						
		Oil interceptor	F	--				
		Oil interceptor capacity	16	m3				
		Oil interceptor efficiency	NA	--				
		Total volume released to water	0	m3				

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	DO	Units			
DO-013 FBR	DO pipeline from treated tank to D2B forwarding pumps. rupture in the pipeline	Substance	DO		Confined release	No	--
		Flow rate	15	m3/h	Bund dimensions	--	--
		Pipeline diameter	10	inch	Roughness length description	Concrete	--
		Pipeline length	260	m	Roughness	10,00	cm
		Operation pressure	3	bar	Soil temperature	19,00	°C
		Operation temperature	amb	°C	Meteo station	Malta airport	--
		Hole diameter	10	inch	Ambient relative humidity	75,00	%
		Release mass flow [3]	5,38	kg/s	Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	5,38	kg/s
					Total mass released	9675	kg
					Total volume released [1]	11	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	1125	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	F	--
					Oil interceptor capacity	16	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		D2A Forwarding pumps	DO	Units			
DO-014	Leak (10 % diameter). Discharge line	Substance	DO		Confined release	Yes	--
		Maximum mass flow	15	m3/h	Bund dimensions		m3
		Pipeline diameter	6	inch	Roughness length description	Concrete	--
		Operation pressure	3	bar	Roughness	10,00	cm
		Operation temperature	amb	°C	Soil temperature	19,00	°C
		Hole diameter	0,6	mm	Meteo station	Malta airport	--
		Release mass flow [3]	0,36	kg/s	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	0,36	kg/s
					Total mass released	645	kg
					Total volume released [1]	1	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	75	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	F	--
					Oil interceptor capacity	16	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		D2A Forwarding pumps	DO	Units			
DO-014 CF	Catastrophic failure. Discharge line	Substance	DO		Confined release	Yes	--
		Maximum mass flow	15	m3/h	Bund dimensions		m3
		Pipeline diameter	6	inch	Roughness length description	Concrete	--
		Operation pressure	3	bar	Roughness	10,00	cm
		Operation temperature	amb	°C	Soil temperature	19,00	°C
		Hole diameter	6	mm	Meteo station	Malta airport	--
		Release mass flow [3]	5,38	kg/s	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	5,38	kg/s
					Total mass released	9675	kg
					Total volume released [1]	11	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	1125	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	F	--
					Oil interceptor capacity	16	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		D2B Forwarding pumps	DO	Units				
DO-015	Leak (10 % diameter). Discharge line	Substance	DO		Confined release	Yes	--	
		Maximum mass flow	15	m3/h	Bund dimensions		m3	
		Pipeline diameter	6	inch	Roughness length description	Concrete	--	
		Operation pressure	3	bar	Roughness	10,00	cm	
		Operation temperature	amb	°C	Soil temperature	19,00	°C	
		Hole diameter	0,6	mm	Meteo station	Malta airport	--	
		Release mass flow [3]	0,36	kg/s	Ambient relative humidity	75,00	%	
					Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate	0,36	kg/s	
					Total mass released	645	kg	
					Total volume released [1]	1	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	75	m²	
					Evaporation rate 4D	NA	kg/s	
					Evaporation rate 2F	NA	kg/s	
					Evaporation duration 5D	NA	s	
					Evaporation duration 2F	NA	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	NA	m	
					LC50% - 15 kW/m2	NA	m	
					LC40% - 13,4 kW/m2	NA	m	
					LC5% - 9,3 kW/m2	NA	m	
					LC3% - 7,3 kW/m2	NA	m	
					LC01% - 5 kW/m2	NA	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	NA	m	
					Length of cloud (between LEL) 2F	NA	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	F	--	
					Oil interceptor capacity	16	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	0	m3	

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		D2B Forwarding pumps	DO	Units			
DO-015 CF	Catastrophic failure. Discharge line	Substance	DO		Confined release	Yes	--
		Maximum mass flow	15	m3/h	Bund dimensions		m3
		Pipeline diameter	6	inch	Roughness length description	Concrete	--
		Operation pressure	3	bar	Roughness	10,00	cm
		Operation temperature	amb	°C	Soil temperature	19,00	°C
		Hole diameter	6	mm	Meteo station	Malta airport	--
		Release mass flow [3]	5,38	kg/s	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	5,38	kg/s
					Total mass released	9675	kg
					Total volume released [1]	11	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	1125	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	F	--
					Oil interceptor capacity	16	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		Pipeline	DO	Units				
DO-016	DO pipelines from forwarding pumps tank to D2A. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	DO		Confined release	No	--	
		Flow rate	15	m3/h	Bund dimensions	--	--	
		Pipeline diameter	4	inch	Roughness length description	Concrete	--	
		Pipeline length	272	m	Roughness	10,00	cm	
		Operation pressure	3	bar	Soil temperature	19,00	°C	
		Operation temperature	amb	°C	Meteo station	Malta airport	--	
		Hole diameter	0,4	inch	Ambient relative humidity	75,00	%	
		Release mass flow [3]	0,36	kg/s	Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
		RELEASE DATA						
					Release duration	1800	s	
					Mass flow rate	0,40	kg/s	
					Total mass released	720	kg	
					Total volume released [1]	1	m3	
		EVAPORATION & DISPERSION DATA						
					Maximum pool area [2]	84	m²	
					Evaporation rate 4D	NA	kg/s	
					Evaporation rate 2F	NA	kg/s	
					Evaporation duration 5D	NA	s	
					Evaporation duration 2F	NA	s	
		POOL FIRE DAMAGE ZONES						
					LC99% - 37,5 kW/m2	NA	m	
					LC50% - 15 kW/m2	NA	m	
					LC40% - 13.4 kW/m2	NA	m	
					LC5% - 9,3 kW/m2	NA	m	
					LC3% - 7,3 kW/m2	NA	m	
					LC01% - 5 kW/m2	NA	m	
		FLASH FIRE & EXPLOSION ZONES						
					Length of cloud (between LEL) 5D	NA	m	
					Length of cloud (between LEL) 2F	NA	m	
		ENVIRONMENTAL SPILLAGE DATA						
					Oil interceptor	F	--	
					Oil interceptor capacity	16	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	0	m3	

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	DO	Units			
DO-016 FBR	DO pipelines from forwarding pumps tank to D2A. Rupture in the pipeline	Substance	DO		Confined release	No	--
		Flow rate	15	m3/h	Bund dimensions	--	--
		Pipeline diameter	4	inch	Roughness length description	Concrete	--
		Pipeline length	272	m	Roughness	10,00	cm
		Operation pressure	3	bar	Soil temperature	19,00	°C
		Operation temperature	amb	°C	Meteo station	Malta airport	--
		Hole diameter	4	inch	Ambient relative humidity	75,00	%
		Release mass flow [3]	5,38	kg/s	Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	4,00	kg/s
					Total mass released	7200	kg
					Total volume released [1]	8	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	837	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	F	--
					Oil interceptor capacity	16	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		Pipeline	DO	Units				
DO-017	DO pipelines from forwarding pumps tank to D2B. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	DO		Confined release	No	--	
		Flow rate	15	m3/h	Bund dimensions	--	--	
		Pipeline diameter	4	inch	Roughness length description	Concrete	--	
		Pipeline length	290	m	Roughness	10,00	cm	
		Operation pressure	3	bar	Soil temperature	19,00	°C	
		Operation temperature	amb	°C	Meteo station	Malta airport	--	
		Hole diameter	0,4	inch	Ambient relative humidity	75,00	%	
		Release mass flow [3]	0,36	kg/s	Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
		RELEASE DATA						
					Release duration	1800	s	
					Mass flow rate	0,40	kg/s	
					Total mass released	720	kg	
					Total volume released [1]	1	m3	
		EVAPORATION & DISPERSION DATA						
					Maximum pool area [2]	84	m²	
					Evaporation rate 4D	NA	kg/s	
					Evaporation rate 2F	NA	kg/s	
					Evaporation duration 5D	NA	s	
					Evaporation duration 2F	NA	s	
		POOL FIRE DAMAGE ZONES						
					LC99% - 37,5 kW/m2	NA	m	
					LC50% - 15 kW/m2	NA	m	
					LC40% - 13.4 kW/m2	NA	m	
					LC5% - 9,3 kW/m2	NA	m	
					LC3% - 7,3 kW/m2	NA	m	
					LC01% - 5 kW/m2	NA	m	
		FLASH FIRE & EXPLOSION ZONES						
					Length of cloud (between LEL) 5D	NA	m	
					Length of cloud (between LEL) 2F	NA	m	
		ENVIRONMENTAL SPILLAGE DATA						
					Oil interceptor	J	--	
					Oil interceptor capacity	15	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	0	m3	

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units	
		Pipeline	DO	Units				
DO-017 FBR	DO pipelines from forwarding pumps tank to D2B. Rupture in the pipeline	Substance	DO		Confined release	No	--	
		Flow rate	15	m3/h	Bund dimensions	--	--	
		Pipeline diameter	4	inch	Roughness length description	Concrete	--	
		Pipeline length	290	m	Roughness	10,00	cm	
		Operation pressure	3	bar	Soil temperature	19,00	°C	
		Operation temperature	amb	°C	Meteo station	Malta airport	--	
		Hole diameter	4	inch	Ambient relative humidity	75,00	%	
		Release mass flow [3]	5,38	kg/s	Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate	4,00	kg/s	
					Total mass released	7200	kg	
					Total volume released [1]	8	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	837	m²	
					Evaporation rate 4D	NA	kg/s	
					Evaporation rate 2F	NA	kg/s	
					Evaporation duration 5D	NA	s	
					Evaporation duration 2F	NA	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	NA	m	
					LC50% - 15 kW/m2	NA	m	
					LC40% - 13,4 kW/m2	NA	m	
					LC5% - 9,3 kW/m2	NA	m	
					LC3% - 7,3 kW/m2	NA	m	
					LC01% - 5 kW/m2	NA	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	NA	m	
					Length of cloud (between LEL) 2F	NA	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	J	--	
					Oil interceptor capacity	15	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	0	m3	

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	DO	Units			
DO-018	DO pipelines from raw tank to D3 transfer pump. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	DO		Confined release	No	--
		Flow rate	40	m3/h	Bund dimensions	--	--
		Pipeline diameter	6	inch	Roughness length description	Concrete	--
		Pipeline length	220	m	Roughness	10,00	cm
		Operation pressure	2	bar	Soil temperature	19,00	°C
		Operation temperature	amb	°C	Meteo station	Malta airport	--
		Hole diameter	0,6	inch	Ambient relative humidity	75,00	%
		Release mass flow [3]	0,96	kg/s	Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	0,96	kg/s
					Total mass released	1720	kg
					Total volume released [1]	2	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	200	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	J	--
					Oil interceptor capacity	15	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		Pipeline	DO	Units				
DO-018 FBR	DO pipelines from raw tank to D3 transfer pump. Rupture in the pipeline	Substance	DO		Confined release	No	--	
		Flow rate	40	m3/h	Bund dimensions	--	--	
		Pipeline diameter	6	inch	Roughness length description	Concrete	--	
		Pipeline length	220	m	Roughness	10,00	cm	
		Operation pressure	2	bar	Soil temperature	19,00	°C	
		Operation temperature	amb	°C	Meteo station	Malta airport	--	
		Hole diameter	6	inch	Ambient relative humidity	75,00	%	
		Release mass flow [3]	14,33	kg/s	Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate	14,33	kg/s	
					Total mass released	25800	kg	
					Total volume released [1]	30	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	3000	m²	
					Evaporation rate 4D	NA	kg/s	
					Evaporation rate 2F	NA	kg/s	
					Evaporation duration 5D	NA	s	
					Evaporation duration 2F	NA	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	NA	m	
					LC50% - 15 kW/m2	NA	m	
					LC40% - 13.4 kW/m2	NA	m	
					LC5% - 9,3 kW/m2	NA	m	
					LC3% - 7,3 kW/m2	NA	m	
					LC01% - 5 kW/m2	NA	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	NA	m	
					Length of cloud (between LEL) 2F	NA	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	J	--	
					Oil interceptor capacity	15	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	15	m3	

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		D3 Transfer pumps	DO	Units			
DO-019	Leak (10 % diameter). Discharge line	Substance	DO		Confined release	Yes	--
		Maximum mass flow	40	m3/h	Bund dimensions		m3
		Pipeline diameter	6	inch	Roughness length description	Concrete	--
		Operation pressure	4	bar	Roughness	10,00	cm
		Operation temperature	amb	°C	Soil temperature	19,00	°C
		Hole diameter	0.6	inch	Meteo station	Malta airport	--
		Release mass flow [3]	0,96	kg/s	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
		RELEASE DATA					
		Release duration			1800	s	
		Mass flow rate			0,96	kg/s	
		Total mass released			1720	kg	
		Total volume released [1]			2	m3	
		EVAPORATION & DISPERSION DATA					
		Maximum pool area [2]			200	m²	
		Evaporation rate 4D			NA	kg/s	
		Evaporation rate 2F			NA	kg/s	
		Evaporation duration 5D			NA	s	
		Evaporation duration 2F			NA	s	
		POOL FIRE DAMAGE ZONES					
		LC99% - 37,5 kW/m2			NA	m	
		LC50% - 15 kW/m2			NA	m	
		LC40% - 13,4 kW/m2			NA	m	
		LC5% - 9,3 kW/m2			NA	m	
		LC3% - 7,3 kW/m2			NA	m	
		LC01% - 5 kW/m2			NA	m	
		FLASH FIRE & EXPLOSION ZONES					
		Length of cloud (between LEL) 5D			NA	m	
		Length of cloud (between LEL) 2F			NA	m	
		ENVIRONMENTAL SPILLAGE DATA					
		Oil interceptor			J	--	
		Oil interceptor capacity			15	m3	
		Oil interceptor efficiency			NA	--	
		Total volume released to water			0	m3	

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		D3 Transfer pumps	DO	Units			
DO-019 CF	Catastrophic failure. Discharge line	Substance	DO		Confined release	Yes	--
		Maximum mass flow	40	m3/h	Bund dimensions		m3
		Pipeline diameter	6	inch	Roughness length description	Concrete	--
		Operation pressure	4	bar	Roughness	10,00	cm
		Operation temperature	amb	°C	Soil temperature	19,00	°C
		Hole diameter	6	inch	Meteo station	Malta airport	--
		Release mass flow [3]	14,33	kg/s	Ambient relative humidity	75,00	%
					Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	14,33	kg/s
					Total mass released	25800	kg
					Total volume released [1]	30	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	3000	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	J	--
					Oil interceptor capacity	15	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	15	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	DO	Units			
DO-020	DO pipelines from D3 transfer pump to D3 service tank. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	DO		Confined release	No	--
		Flow rate	40	m3/h	Bund dimensions	--	--
		Pipeline diameter	4	inch	Roughness length description	Concrete	--
		Pipeline length	30	m	Roughness	10,00	cm
		Operation pressure	2	bar	Soil temperature	19,00	°C
		Operation temperature	amb	°C	Meteo station	Malta airport	--
		Hole diameter	0,4	inch	Ambient relative humidity	75,00	%
		Release mass flow [3]	0,96	kg/s	Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	0,40	kg/s
					Total mass released	720	kg
					Total volume released [1]	1	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	84	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	J	--
					Oil interceptor capacity	15	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	DO	Units			
DO-020 FBR	DO pipelines from D3 transfer pump to D3 service tank. Rupture in the pipeline	Substance	DO		Confined release	No	--
		Flow rate	40	m3/h	Bund dimensions	--	--
		Pipeline diameter	4	inch	Roughness length description	Concrete	--
		Pipeline length	30	m	Roughness	10,00	cm
		Operation pressure	2	bar	Soil temperature	19,00	°C
		Operation temperature	amb	°C	Meteo station	Malta airport	--
		Hole diameter	4	inch	Ambient relative humidity	75,00	%
		Release mass flow [3]	14,33	kg/s	Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	4,00	kg/s
					Total mass released	7200	kg
					Total volume released [1]	8	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	837	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	J	--
					Oil interceptor capacity	15	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units	
		D3 SERVICE TANK	DO	Units				
DO-021	Continuous release from a hole with an effective diameter of 10 mm of the DO service tank	Substance	DO		Confined release	No	--	
		Nominal volume	140	m3	Bund dimensions	--	m3	
		Filling degree	95	%	Roughness length description	Concrete	--	
		Diameter	5	m	Roughness	10,00	cm	
		Height	7,5	m	Soil temperature	19,00	°C	
		Design pressure	atm	bar	Meteo station	Malta airport	--	
		Operation Pressure	atm	bar	Ambient relative humidity	75,00	%	
		Rupture pressure	atm	bar	Ambient temperature	19,00	°C	
		Design temperature	atm	°C	Meteorological condition 1	D / 4	-- / m/s	
		Operation Temperature	atm	°C	Meteorological condition 2	F / 2	-- / m/s	
		RELEASE DATA						
		Release duration		until device is empty			s	
		Mass flow rate		0,44			kg/s	
		Total mass released		102120			kg	
		Total volume released [1]		119			m3	
		EVAPORATION & DISPERSION DATA						
		Maximum pool area [2]		11874			m²	
		Evaporation rate 4D		NA			kg/s	
		Evaporation rate 2F		NA			kg/s	
		Evaporation duration 5D		NA			s	
		Evaporation duration 2F		NA			s	
		POOL FIRE DAMAGE ZONES						
		LC99% - 37,5 kW/m2		NA			m	
		LC50% - 15 kW/m2		NA			m	
		LC40% - 13,4 kW/m2		NA			m	
		LC5% - 9,3 kW/m2		NA			m	
		LC3% - 7,3 kW/m2		NA			m	
		LC01% - 5 kW/m2		NA			m	
		FLASH FIRE & EXPLOSION ZONES						
		Length of cloud (between LEL) 5D		NA			m	
		Length of cloud (between LEL) 2F		NA			m	
		ENVIRONMENTAL SPILLAGE DATA						
		Oil interceptor		J			--	
		Oil interceptor capacity		15			m3	
		Oil interceptor efficiency		NA			--	
		Total volume released to water		104			m3	

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm. Limited to 1500 m2

Case description: scenario 40 release

Model: Liquid release

version: 5.08 (05/11/2015)

2.5.4Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	n-PENTADECANE (DIPPR)
Use which representative step	First 20% average (flammable)
Type of release	Release through hole in vessel
Pipeline length (m)	
Pipeline diameter (mm)	
Pipeline roughness (mm)	
Hole diameter (mm)	10
Hole rounding	Sharp edges
Discharge coefficient (-)	0,62
Vessel type	Vertical cylinder
Vessel volume (m3)	140
Height cylinder (m)	7,5
Filling degree (%)	95
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	19
Type of calculation	Calculate until device is empty
Time t after start release (s)	

Results

Initial mass in vessel (kg)	1,02E+05
Mass flow rate at time t (kg/s)	
Total mass released (kg)	1,02E+05
Time needed to empty vessel (s)	4,58E+05
Filling degree at time t (%)	
Height of liquid at time t (m)	
Maximum mass flow rate (kg/s)	0,44198
Representative release rate (kg/s)	0,4418
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

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SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units	
		D3 SERVICE TANK	DO	Units				
DO-021 CF	Instantaneous release of the entire contents of the DO service tank	Substance	DO		Confined release	No	--	
		Nominal volume	140	m3	Bund dimensions	--	m3	
		Filling degree	95	%	Roughness length description	Concrete	--	
		Diameter	5	m	Roughness	10,00	cm	
		Height	7,5	m	Soil temperature	19,00	°C	
		Design pressure	atm	bar	Meteo station	Malta airport	--	
		Operation Pressure	atm	bar	Ambient relative humidity	75,00	%	
		Rupture pressure	atm	bar	Ambient temperature	19,00	°C	
		Design temperature	atm	°C	Meteorological condition 1	D / 4	-- / m/s	
		Operation Temperature	atm	°C	Meteorological condition 2	F / 2	-- / m/s	
		RELEASE DATA						
		Release duration		instantaneous		s		
		Mass flow rate		na		kg/s		
		Total mass released		120400		kg		
		Total volume released [1]		140		m3		
		EVAPORATION & DISPERSION DATA						
		Maximum pool area [2]		14000		m²		
		Evaporation rate 4D		NA		kg/s		
		Evaporation rate 2F		NA		kg/s		
		Evaporation duration 5D		NA		s		
		Evaporation duration 2F		NA		s		
		POOL FIRE DAMAGE ZONES						
		LC99% - 37,5 kW/m2		NA		m		
		LC50% - 15 kW/m2		NA		m		
		LC40% - 13,4 kW/m2		NA		m		
		LC5% - 9,3 kW/m2		NA		m		
		LC3% - 7,3 kW/m2		NA		m		
		LC01% - 5 kW/m2		NA		m		
		FLASH FIRE & EXPLOSION ZONES						
		Length of cloud (between LEL) 5D		NA		m		
		Length of cloud (between LEL) 2F		NA		m		
		ENVIRONMENTAL SPILLAGE DATA						
		Oil interceptor		J		--		
		Oil interceptor capacity		15		m3		
		Oil interceptor efficiency		NA		--		
		Total volume released to water		125		m3		

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 cm. Limited to 1500 m2

Case description: scenario 40 release

Model: Liquid release

version: 5.08 (05/11/2015)

2.5.4 Yellow Book, CPR-14E, 3rd edition 1997, Paragraph 2.5.4

Parameters

Inputs

Chemical name (DIPPR)	PENTADECANE
Use which representative step	average
Type of release	hole in vessel
Pipeline length (m)	
Pipeline diameter (mm)	
Pipeline roughness (mm)	
Hole diameter (mm)	10
Hole rounding	Sharp edges
Discharge coefficient (-)	0,62
Vessel type	Vertical cylinder
Vessel volume (m3)	140
Height cylinder (m)	7,5
Filling degree (%)	95
Overpressure above liquid (assuming closed system) (bar)	0
Height leak above tank bottom (m)	0
Initial temperature in vessel (°C)	19
Type of calculation	device is empty
Time t after start release (s)	

Results

Initial mass in vessel (kg)	1,02E+05
Mass flow rate at time t (kg/s)	
Total mass released (kg)	1,02E+05
Time needed to empty vessel (s)	4,58E+05
Filling degree at time t (%)	
Height of liquid at time t (m)	
Maximum mass flow rate (kg/s)	0,44198
Representative release rate (kg/s)	0,4418
Representative outflow duration (s)	1800
Representative pressure (bar)	1,0151

Other information

Main program	8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

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SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	DO	Units			
DO-022	DO pipelines from D3 service tank to supply pumps. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	DO		Confined release	No	--
		Flow rate	29	m3/h	Bund dimensions	--	--
		Pipeline diameter	4	inch	Roughness length description	Concrete	--
		Pipeline length	30	m	Roughness	10,00	cm
		Operation pressure	6	bar	Soil temperature	19,00	°C
		Operation temperature	amb	°C	Meteo station	Malta airport	--
		Hole diameter	0,4	inch	Ambient relative humidity	75,00	%
		Release mass flow [3]	0,69	kg/s	Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	0,69	kg/s
					Total mass released	1247	kg
					Total volume released [1]	1	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	145	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13.4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	NA	--
					Oil interceptor capacity	0	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	1	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 cm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	DO	Units			
DO-022 FBR	DO pipelines from D3 service tank to supply pumps. Rupture in the pipeline	Substance	DO		Confined release	No	--
		Flow rate	29	m3/h	Bund dimensions	--	--
		Pipeline diameter	4	inch	Roughness length description	Concrete	--
		Pipeline length	30	m	Roughness	10,00	cm
		Operation pressure	6	bar	Soil temperature	19,00	°C
		Operation temperature	amb	°C	Meteo station	Malta airport	--
		Hole diameter	4	inch	Ambient relative humidity	75,00	%
		Release mass flow [3]	10,39	kg/s	Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	10,39	kg/s
					Total mass released	18705	kg
					Total volume released [1]	22	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	2175	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	NA	--
					Oil interceptor capacity	0	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	22	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA			Units
		Pipeline	DO	Units				
DO-023	DO pipelines from D3 supply pumps to engines. Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm.	Substance	DO		Confined release	No	--	
		Flow rate	29	m3/h	Bund dimensions	--	--	
		Pipeline diameter	3	inch	Roughness length description	Concrete	--	
		Pipeline length	215	m	Roughness	10,00	cm	
		Operation pressure	6	bar	Soil temperature	19,00	°C	
		Operation temperature	amb	°C	Meteo station	Malta airport	--	
		Hole diameter	0,3	inch	Ambient relative humidity	75,00	%	
		Release mass flow [3]	0,69	kg/s	Ambient temperature	19,00	°C	
					Meteorological condition 1	D / 4	-- / m/s	
					Meteorological condition 2	F / 2	-- / m/s	
					RELEASE DATA			
					Release duration	1800	s	
					Mass flow rate	0,69	kg/s	
					Total mass released	1247	kg	
					Total volume released [1]	1	m3	
					EVAPORATION & DISPERSION DATA			
					Maximum pool area [2]	145	m²	
					Evaporation rate 4D	NA	kg/s	
					Evaporation rate 2F	NA	kg/s	
					Evaporation duration 5D	NA	s	
					Evaporation duration 2F	NA	s	
					POOL FIRE DAMAGE ZONES			
					LC99% - 37,5 kW/m2	NA	m	
					LC50% - 15 kW/m2	NA	m	
					LC40% - 13.4 kW/m2	NA	m	
					LC5% - 9,3 kW/m2	NA	m	
					LC3% - 7,3 kW/m2	NA	m	
					LC01% - 5 kW/m2	NA	m	
					FLASH FIRE & EXPLOSION ZONES			
					Length of cloud (between LEL) 5D	NA	m	
					Length of cloud (between LEL) 2F	NA	m	
					ENVIRONMENTAL SPILLAGE DATA			
					Oil interceptor	NA	--	
					Oil interceptor capacity	0	m3	
					Oil interceptor efficiency	NA	--	
					Total volume released to water	1	m3	

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 cm.

[3] Equivalent to the 10% of the flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Pipeline	DO	Units			
DO-023 FBR	DO pipelines from D3 supply pumps to engines. Leak with FBR	Substance	DO		Confined release	No	--
		Flow rate	29	m3/h	Bund dimensions	--	--
		Pipeline diameter	3	inch	Roughness length description	Concrete	--
		Pipeline length	215	m	Roughness	10,00	cm
		Operation pressure	6	bar	Soil temperature	19,00	°C
		Operation temperature	amb	°C	Meteo station	Malta airport	--
		Hole diameter	3	inch	Ambient relative humidity	75,00	%
		Release mass flow [3]	10,39	kg/s	Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	10,39	kg/s
					Total mass released	18705	kg
					Total volume released [1]	22	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	2175	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	NA	m
					LC50% - 15 kW/m2	NA	m
					LC40% - 13,4 kW/m2	NA	m
					LC5% - 9,3 kW/m2	NA	m
					LC3% - 7,3 kW/m2	NA	m
					LC01% - 5 kW/m2	NA	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	NA	--
					Oil interceptor capacity	0	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	22	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		Unloading pipeline	DO	Units			
DO-004 FBR ED	DO pipelines from raw tank to transfer pumps. Rupture in the pipeline due to jet fire domino effect from EGM	Substance	DO		Confined release	No	--
		Flow rate	20	m3/h	Bund dimensions	--	--
		Pipeline diameter	10	inch	Roughness length description	Concrete	--
		Pipeline length	210	m	Roughness	10,00	cm
		Operation pressure	2	bar	Soil temperature	19,00	°C
		Operation temperature	amb	°C	Meteo station	Malta airport	--
		Hole diameter	10	inch	Ambient relative humidity	75,00	%
		Release mass flow [3]	7,17	kg/s	Ambient temperature	19,00	°C
					Meteorological condition 1	D / 4	-- / m/s
					Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	1800	s
					Mass flow rate	7,17	kg/s
					Total mass released	12900	kg
					Total volume released [1]	15	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	1500	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	22	m
					LC50% - 15 kW/m2	28	m
					LC40% - 13,4 kW/m2	31	m
					LC5% - 9,3 kW/m2	43	m
					LC3% - 7,3 kW/m2	49	m
					LC01% - 5 kW/m2	58	m
					FLASH FIRE & EXPLOSION ZONES		
					Length of cloud (between LEL) 5D	NA	m
					Length of cloud (between LEL) 2F	NA	m
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	1	--
					Oil interceptor capacity	24	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	0	m3

NOTES

[1] DO density = 860 kg/m3

[2] Pool thickness (on land) = 10 mm.

[3] Equivalent to 1,5 x flow rate

Case description: scenario DO-023A ED - PFIRE LC01, LC03, LC05

Model: Pool fire

version: 5.11 (07/09/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario DO-023A ED - PFIRE LC40, LC50, LC99

Parameters

Inputs	LC03, LC05	LC50, LC99
Chemical name (DIPPR)	n-DECANE (DIPPR)	n-DECANE (DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	12900	12900
Mass flow rate of the source (kg/s)		
Duration of the release (s)		
Pool surface poolfire (m2)	1500	1500
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	60	60
Pool burning rate	Calculate/Default	Calculate/Default
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	Calculate/Default	Calculate/Default
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		

Results	scenario DO-023A ED - PFIRE LC01, LC03, LC05	scenario DO-023A ED - PFIRE LC40, LC50, LC99
Max Diameter of the Pool Fire (m)	43,702	43,702
Heat radiation at X (kW/m2)	0,0032366	0,0032366
Heat radiation first contour at (m)	58,486	31,125
Heat radiation second contour at (m)	49,412	27,836
Heat radiation third contour at (m)	42,668	21,852
Combustion rate (kg/s)	92,171	92,171
Duration of the pool fire (s)	139,96	139,96
Heat emission from fire surface (kW/m2)	22,084	22,084
Flame tilt (deg)	49,28	49,28
View factor (%)	0,036566	0,036566
Atmospheric transmissivity (%)	40,08	40,08
Flame temperature (°C)	520,5	520,5
Height of the Flame (m)	37,885	37,885
Calculated pool surface area (m2)	1500	1500
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	309,41	309,41
Weight ratio of H2O/chemical (%)	139,35	139,35
Other information		
Main program	Effects 8.1.8.6673	
Chemical database	DIPPR database	
Chemical source	DIPPR Jan2010	
Chemical source date	14/09/2010	

Effects report created by ESLR2RH1Flandrea_silvasantos at 07/09/2016 10:55:20

SCENARIO ITEM	SCENARIO DESCRIPTION	EQUIPMENT DATA			SCENARIO DATA		Units
		DO Raw tank n. 1/2/3		Units			
DO-024 ED	Catastrophic failure of the DO Raw tank n. 1/2/3 due to a jet fire domino effect from EGM	Substance	DO		Confined release	Yes	--
		Nominal volume	8598	m3	Bund dimensions		m2
		Filling degree	95	%	Roughness legth description	Concrete	--
		Diameter	30	m	Roughness	10,00	cm
		Height	12	m	Soil temperature	19,00	°C
		Design pressure	atm	bar	Meteo station	Malta airport	--
		Operation Pressure	atm	bar	Ambient relative humidity	75,00	%
		Rupture pressure	1,21	bar	Ambient temperature	19,00	°C
		Design temperature	60	°C	Meteorological condition 1	D / 4	-- / m/s
		Operation Temperature	amb	°C	Meteorological condition 2	F / 2	-- / m/s
					RELEASE DATA		
					Release duration	instantaneous	s
					Mass flow rate	na	kg/s
					Total mass released	7394280	kg
					Total volume released [1]	8598	m3
					EVAPORATION & DISPERSION DATA		
					Maximum pool area [2]	2600	m²
					Evaporation rate 4D	NA	kg/s
					Evaporation rate 2F	NA	kg/s
					Evaporation duration 5D	NA	s
					Evaporation duration 2F	NA	s
					POOL FIRE DAMAGE ZONES		
					LC99% - 37,5 kW/m2	29	m
					LC50% - 15 kW/m2	36	m
					LC40% - 13,4 kW/m2	40	m
					LC5% - 9,3 kW/m2	54	m
					LC3% - 7,3 kW/m2	62	m
					LC01% - 5 kW/m2	74	m
					FLASH FIRE & EXPLOSION DAMAGE ZONES		
					Length of cloud (between LEL) 5D	0	m
					Length of cloud (between LEL) 2F	0	m
					BUND DRAINAGE TO INTERCEPTORS		
					Bund pipeline dimensions	6	inch
					Bund height	5	m
					Mass flow rate	80,483	kg/s
					Release duration [3]	1800	s
					Total volume released [1]	146	m3
					ENVIRONMENTAL SPILLAGE DATA		
					Oil interceptor	F	--
					Oil interceptor capacity	16	m3
					Oil interceptor efficiency	NA	--
					Total volume released to water	131	m3

NOTES

[1] DO density = 860 kg/m3

[2] Bund area of each tank

[3] Maximum release time equivalent to = 0.5 h. Maximum volume directed to interceptors = 149m3

Case description: scenario DO-024 ED - PFIRE LC01, LC03, LC05

Model: Pool fire

version: 5.11 (08/04/2016)

Reference: Yellow Book (CPR-14E), 3rd edition 1997, Paragraph 6.5.4

compared to: scenario DO-024 ED - PFIRE LC40, LC50, LC99

Parameters

Inputs

	LC01, LC03, LC05	024 ED - PFIRE
Chemical name (DIPPR)	n-DECANE (DIPPR)	(DIPPR)
Pool size determination	Confined	Confined
Total mass released (kg)	7,39E+06	7,39E+06
Mass flow rate of the source (kg/s)		
Duration of the release (s)		
Pool surface poolfire (m2)	2600	2600
Height of the observer position above ground level (m)	0	0
Height of the confined pool above ground level (m)	0	0
Hole diameter (mm)		
Discharge coefficient (-)		
Initial height of the liquid above release point (m)		
Cross-sectional area of the tank (m2)		
Pool thickness (mm)		
Temperature of the pool (°C)	60	60
Pool burning rate	Calculate/Default	t
Value of pool burning rate (kg/m2*s)		
Fraction combustion heat radiated (%)	5	5
Soot Fraction	Calculate/Default	t
Value of soot fraction (-)		
Wind speed at 10 m height (m/s)	5	5
Ambient temperature (°C)	19	19
Ambient relative humidity (%)	75	75
Amount of CO2 in atmosphere (%)	0,03	0,03
Distance from the centre of the pool (m)	1000	1000
Exposure duration to heat radiation (s)	20	20
Take protective effects of clothing into account	No	No
X-coordinate of release (m)	0	0
Y-coordinate of release (m)	0	0
Predefined wind direction	User defined	User defined
Wind comes from (North = 0 degrees) (deg)	270	270
Calculate all contours for	Physical effects	Physical effects
Heat radiation level (lowest) for first contour plot (kW/m2)	5	13,4
Heat radiation level for second contour plot (kW/m2)	7,3	15
Heat radiation level (highest) for third contour plot (kW/m2)	9,3	37,5
Percentage of mortality for contour calculations (%)		

Results

	LC01, LC03, LC05	024 ED - PFIRE
Max Diameter of the Pool Fire (m)	57,536	57,536
Heat radiation at X (kW/m2)	0,0055037	0,0055037
Heat radiation first contour at (m)	73,659	39,929
Heat radiation second contour at (m)	62,474	35,98
Heat radiation third contour at (m)	54,104	28,769
Combustion rate (kg/s)	159,76	159,76
Duration of the pool fire (s)	46283	46283
Heat emission from fire surface (kW/m2)	22,436	22,436
Flame tilt (deg)	48,202	48,202
View factor (%)	0,061112	0,061112
Atmospheric transmissivity (%)	40,141	40,141
Flame temperature (°C)	523,58	523,58
Height of the Flame (m)	46,372	46,372
Calculated pool surface area (m2)	2600	2600
Weight ratio of HCL/chemical (%)	0	0
Weight ratio of NO2/chemical (%)	0	0
Weight ratio of SO2/chemical (%)	0	0
Weight ratio of CO2/chemical (%)	309,41	309,41
Weight ratio of H2O/chemical (%)	139,35	139,35

Other information

Main program	Effects 8.1.8.6673
Chemical database	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source date	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 08/04/2016 13:33:48

Chemical source date	14/09/2010
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Effects report created by ESLR2RH1Flandrea_silvasantos at 04/11/2015 15:54:03

Case description: scenario 22A release from bund

Model: Liquid release

version: 5.08 (06/04/2016)

Paragraph 2.5.4

Parameters

Inputs

Chemical name (I	n-PENTADECANE (DIPPR)
Use which repres	First 20% average (flammable)
Type of release	Release through hole in vessel
Pipeline length (m)	
Pipeline diameter (mm)	
Pipeline roughness (mm)	
Hole diameter (inc	6
Hole rounding	Sharp edges
Discharge coeffici	0,62
Vessel type	Vertical cylinder
Vessel volume (m	8598
Height cylinder (m	5
Filling degree (%)	95
Overpressure abc	0
Height leak above	0
Initial temperature	65
Type of calculation	Calculate until specified time
Time t after start r	1800

Results

Initial mass in ves	6,02E+06
Mass flow rate at	79,51
Total mass releas	1,45E+05
Time needed to empty vessel (s)	
Filling degree at ti	92,717
Height of liquid at	4,6359
Maximum mass fl	80,483
Representative re	80,387
Representative α	1800
Representative pr	1,0151

Other information

Main program	Effects 8.1.8.6673
Chemical databas	DIPPR database
Chemical source	DIPPR Jan2010
Chemical source i	14/09/2010

Effects report created by ESLR2RH1Flandrea_silvasantos at 06/04/2016 11:33:27