SAFETY DATA SHEET

Annex II

Exposure scenario

Low boiling point naphta, Gasoline

EC Number: 265-192-2

CAS Number: 64742-89-8

Contents

1. EXPOSURE ASSESSMENT

Table 1. Identified Use Description and Exposure

IU	Category	Identified use name	Sector	ES Number	Sector of Use (SU)	Product Category (PC)	Process Category (PROC)	Environmental Release Category (ERC)	Specific Environmental Release Category (SpERC)
1	Low boiling point naphtha (Gasoline)	01 - Manufacture of Substances (classified as R45 and/or R46 and/or R62 and/or R63; (containing equal to or greater than 1% to 5% benzene))	Industrial	ES 9.1.1c	3, 8, 9	NA	1, 2, 3, 8a, 8b, 15	1 ,4	ESVOC SpERC 1.1.V1
2	Low boiling point naphtha (Gasoline)	01b- Use of substance as intermediate (classified as R45 and/or R46 and/or R62 and/or R63; (containing equal to or greater than 1 % to 5% benzene))	Industrial	ES 9.2.1c	3, 8, 9	NA	1, 2, 3, 8a, 8b, 15	6a	ESVOC SpERC 6.1a.v1
2	Low boiling point naphtha (Gasoline)	01a - Distribution of substance (classified as R45 and/or R46 and/or R62 and/or R63; (containing 0% to 1% benzene))	Industrial	ES 9.3.1b	3	NA	1, 2, 3, 8a, 8b, 15	1, 2, 3, 4, 5, 6a, 6b, 6c, 6d, 7	ESVOC SpERC 1.1b.v1
4	Low boiling point naphtha (Gasoline)	02 - Formulation & (re)packing of substances and mixtures (classified as R45 and/or R46 and/or R62 and/or R63; (containing equal to or greater than 1 % to 5% benzene))	Industrial	ES 9.4.1c	3, 10	NA	1, 2, 3, 8a, 8b, 15	2	ESVOC SpERC 2.2.V1

1.1. Manufacture of Low Boiling Point Naphthas (Gasoline) Industrial

1.1.1c. Exposure Scenario

Section 1 Section 1 Exposure Scenario Title Low boiling point naphthas (Gasoline) that is classified as R45 and/or R46 and/or R62 and/or R63; (containing equal to or greater than 1% to 5% benzene)	
Title	
Manufacture of substances	
Use Descriptor	
Sector(s) of Use 3, 8, 9	
Process Categories	1, 2, 3, 4, 8a, 8b, 15 Further information on the mapping and allocation of PROC codes is contained in Table 1.1
Environmental Release Categories	1, 4
Specific Environmental Release Category	ESVOC SpERC 1.1.v1
Processes, tasks, activities covered	
Manufacture of the substance or use as a process chemical or extraction agent within closed or contained systems. Includes incidental exposures during recycling/ recovery, material transfers, storage, sampling, associated laboratory activities, maintenance and loading (including marine vessel/barge, road/rail car and bulk container).	
Assessment Method	
See Section 3.	
Section 2 Operational conditions and risk management measures	
Section 2.1 Control of worker exposure	
Product characteristics	Physical form of product Liquid, vapour pressure > 10 kPa at STP OC5
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) G13
	Not applicable
Frequency and duration of use/exposure	Covers daily exposures up to 8 hours (unless stated differently) G2
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting exposure	Operation is carried out at elevated temperature (> 20°C above ambient temperature). OC7. Assumes a good basic standard of occupational hygiene is implemented G1.
Contributing Scenarios	**Specific Risk Management Measures and Operating Conditions**
General Measures (skin irritants). G19.	Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. Wash off skin contamination immediately. Provide basic employee training to prevent / minimise exposures

	and to report any skin effects that may develop. E3
General Measures (carcinogens). G18.	Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised staff; provide specific activity training to operators to minimise exposures; wear suitable gloves (tested to EN374) and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. G20.
CS15 General exposures (closed systems). + CS56 With sample collection.	Handle substance within closed systems. E47. Sample via a closed loop or other system intended to avoid exposure. E8. Wear suitable gloves tested to EN374. PPE15.
CS15 General exposures (closed systems).	Provide extract ventilation to points where emissions occur. E54. Handle substance within closed systems. E47.
CS36 Laboratory activities	Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure. E12.
CS14 Bulk transfers	Ensure material transfers are under containment or extract ventilation. E66.
CS39 Equipment cleaning and maintenance	Drain down and flush system prior to equipment break-in or maintenance.E55. Retain drain downs in sealed storage pending disposal or for subsequent recycle. ENVT4. Clear spills immediately. C&H13. Wear chemically resistant gloves (tested to EN374) in combination with intensive management supervision controls. PPE18.
CS67 Storage.	Store substance within a closed system. E84. Wear suitable gloves tested to EN374. PPE15.
Additional information on the basis for the allocation of the identified OCs and RMMs is contained in Appendices 1 to 3	
Section 2.2 Control of environmental exposure	
Product characteristics	
ɔstance is complex UVCB [PrC3]. Predominantly hydrophobic [PrC4a].	
Amounts used	
Fraction of EU tonnage used in region	0.1
Regional use tonnage (tonnes/year)	1.87E7
Fraction of Regional tonnage used locally	0.03
Annual site tonnage (tonnes/year)	6.0e5
Maximum daily site tonnage (kg/day)	2.0e6
Frequency and duration of use	
Continuous release [FD2].	
Emission days (days/year)	300
Environmental factors not influenced by risk management	
Local freshwater dilution factor	10
Local marine water dilution factor	100
Other given operational conditions affecting environmental exposure	

Release fraction to air from process (initial release prior to RMM)	0.05
Release fraction to wastewater from process (initial release prior to RMM)	0.003
Release fraction to soil from process (initial release prior to RMM)	0.0001
Technical conditions and measures at process level (source) to prevent release	
Common practices vary across sites thus conservative process release estimates used [TCS1].	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Prevent discharge of undissolved substance to or recover from wastewater [TCR14]. Risk from environmental exposure is driven by humans via indirect exposure (primarily inhalation) [TCR1k] Onsite wastewater treatment required [TCR13].	
Treat air emission to provide a typical removal efficiency of (%)	99.0
Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency ≥ (%)	95.2
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of ≥ (%)	80.4
Organisation measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils [OMS2]. Sludge should be incinerated, contained or reclaimed [OMS3].	
Conditions and measures related to municipal sewage treatment plant	
Estimated substance removal from wastewater via domestic sewage treatment (%)	95.5
Total efficiency of removal from wastewater after onsite and off site (domestic treatment plant) RMMs (%)	99.1
Maximum allowable site tonnage (M_{Safe}) (kg/d)	2.0e6
Assumed domestic sewage treatment plant flow (m^3/d)	10000
Conditions and measures related to external treatment of waste for disposal	
During manufacturing no waste of the substance is generated [ETW4].	
Conditions and measures related to external recovery of waste	
During manufacturing no waste of the substance is generated [ERW2].	
Additional information on the basis for the allocation of the indentified OCs and RMMs is contained in Petrorisk file	
Section 3 Exposure Estimation	
3.1. Health	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise	

indicated. G21.	
3.2. Environment	
The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model [EE2].	
Section 4 Guidance to check compliance with the Exposure Scenario	
4.1. Health	
Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented. G22. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. G23. Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. G32. Available hazard data do not support the need for a DNEL to be established for other health effects. G36. Risk Management Measures are based on qualitative risk characterisation. G37.	
4.2. Environment Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures [DSU1]. Required removal efficiency for wastewater can be achieved using onsite/offsite technologies, either alone or in combination [DSU2]. Required removal efficiency for air can be achieved using onsite technologies, either alone or in combination [DSU3]. Further details on scaling and control technologies are provided in SpERC factsheet (http://cefic.org/en/reach-for-industries-libraries.html) [DSU4]. Scaled local assessments for EU refineries have been performed using site-specific data and are attached in Annex III (PETRORISK file) [DSU6]. If scaling reveals a condition of unsafe use (i.e., RCRs > 1), additional RMMs or a site-specific chemical safety assessment is required [DSU8]. Measured data have been used to demonstrate that the PETRORISK predicted fence-line concentrations in air are overestimated. These data support the conclusion that no refineries have RCRs>1 (Appendix 2 and Annex III (PETRORISK file).	

1.1.2. Exposure Estimation

1.1.2.1. Human Health

See Appendix 1 and Appendix 2.c.

1.1.2.2. Environment

See Annex III (PETRORISK file)

1.2. Use of Low Boiling Point Naphthas (Gasoline) as Intermediate – Industrial

Section 1 Exposure Scenario Title Low boiling point naphthas (Gasoline) that is classified as R45 and/or R46 and/or R62 and/or R63; (containing equal to or greater than 1% to 5% benzene)	
Title	
Use of substance as intermediate	
Use Descriptor	
Sector(s) of Use	3, 8, 9
Process Categories	1, 2, 3, 8a, 8b, 15 Further information on the mapping and allocation of PROC codes is contained in Table 1.1
Environmental Release Categories	6a
Specific Environmental Release Category	ESVOC SpERC 6.1a.v1
Processes, tasks, activities covered	
Use of substance as an intermediate (not related to strictly controlled conditions) within closed or contained systems. Includes incidental exposures during recycling/ recovery, material transfers, storage, sampling, associated laboratory activities, maintenance and loading (including marine vessel/barge, road/rail car and bulk container).	
Assessment Method	
See Section 3.	
Section 2 Operational conditions and risk management measures	
Section 2.1 Control of worker exposure	
Product characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa at STP OC5
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) G13
Amount used	Not applicable
Frequency and duration of use/exposure	Covers daily exposures up to 8 hours (unless stated differently) G2
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting exposure	Operation is carried out at elevated temperature (> 20°C above ambient temperature). OC7. Assumes a good basic standard of occupational hygiene is implemented G1.
Contributing Scenarios	**Specific Risk Management Measures and Operating Conditions**
General Measures (skin irritants). G19.	Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. Wash off skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin effects that may develop. E3
General Measures (carcinogens). G18.	Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and

	suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised staff; provide specific activity training to operators to minimise exposures; wear suitable gloves (tested to EN374) and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. G20.
CS15 General exposures (closed systems). + CS56 With sample collection.	Handle substance within closed systems. E47. Sample via a closed loop or other system intended to avoid exposure. E8. Wear suitable gloves tested to EN374. PPE15.
CS15 General exposures (closed systems).	Provide extract ventilation to points where emissions occur. E54. Handle substance within closed systems. E47.
CS67 Storage.	Wear suitable gloves tested to EN374. PPE15. Store substance within a closed system. E84.
CS36 Laboratory activities	Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure. E12.
CS14 Bulk transfers	Ensure material transfers are under containment or extract ventilation. E66.
CS39 Equipment cleaning and maintenance	Drain down and flush system prior to equipment break-in or maintenance.E55. Retain drain downs in sealed storage pending disposal or for subsequent recycle. ENVT4. Clear spills immediately. C&H13. Wear chemically resistant gloves (tested to EN374) in combination with intensive management supervision controls. PPE18.

Additional information on the basis for the allocation of the identified OCs and RMMs is contained in Appendices 1 to 3	
Section 2.2 Control of environmental exposure	
Product characteristics	
Substance is complex UVCB [PrC3]. Predominantly hydrophobic [PrC4a].	
Amounts used	
Fraction of EU tonnage used in region	0.1
Regional use tonnage (tonnes/year)	2.21E6
Fraction of Regional tonnage used locally	0.0068
Annual site tonnage (tonnes/year)	1.5e4
Maximum daily site tonnage (kg/day)	5.0e4
Frequency and duration of use	
Continuous release [FD2].	
Emission days (days/year) 300	
Environmental factors not influenced by risk management	
Local freshwater dilution factor	10
Local marine water dilution factor	100
Other given operational conditions affecting environmental exposure	
Release fraction to air from process (initial release prior to RMM)	0.025
Release fraction to wastewater from process (initial release prior to RMM)	0.003
Release fraction to soil from process (initial release prior to RMM)	0.001

Technical conditions and measures at process level (source) to prevent release	
Common practices vary across sites thus conservative process release estimates used [TCS1].	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Prevent discharge of undissolved substance to or recover from wastewater [TCR14]. Risk from environmental exposure is driven by freshwater sediment [TCR1b]. If discharging to domestic sewage treatment plant, no onsite wastewater treatment required [TCR9]	
Treat air emission to provide a typical removal efficiency of (%)	80
Treat onsite wastewater (prior to receiving water discharge) to provide [the required removal efficiency ≥ (%)	92.9
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of ≥ (%)	0
Organisation measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils [OMS2]. Sludge should be incinerated, contained or reclaimed [OMS3]	
Conditions and measures related to municipal sewage treatment plant	
Estimated substance removal from wastewater via domestic sewage treatment (%)	95.5
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs (%)	95.5
Maximum allowable site tonnage (MSafe) (kg/d)	7.8e4
Assumed domestic sewage treatment plant flow (m3/d)	2000
Conditions and measures related to external treatment of waste for disposal	
This substance is consumed during use and no waste of the substance is generated [ETW5].	
Conditions and measures related to external recovery of waste	
This substance is consumed during use and no waste of the substance is generated [ERW3].	
Additional information on the basis for the allocation of the indentified OCs and RMMs is contained in Petrorisk file	
Section 3 Exposure Estimation	
3.1. Health	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated. G21	
3.2. Environment	
The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model [EE2].	
Section 4 Guidance to check compliance with the Exposure Scenario	
4.1. Health	
Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented. G22. Where other Risk Management Measures/Operational Conditions are adopted, then users	

should ensure that risks are managed to at least equivalent levels. G23. Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. G32. Available hazard data do not support the need for a DNEL to be established for other health effects. G36. Risk Management Measures are based on qualitative risk characterisation. G37.
4.2. Environment
Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, Low Boiling Point Naphthas (Gasoline) 2010-06-10 CSR 310 scaling may be necessary to define appropriate site-specific risk management measures [DSU1]. Required removal efficiency for wastewater can be achieved using onsite/offsite technologies, either alone or in combination [DSU2]. Required removal efficiency for air can be achieved using onsite technologies, either alone or in combination [DSU3]. Further details on scaling and control technologies are provided in SpERC factsheet (http://cefic.org/en/reach-for-industries-libraries.html) [DSU4].

1.2.2. Exposure Estimation

1.2.2.1. Human Health

See Appendix 1 and Appendix 2.c.

1.2.2.2. Environment

See Annex III (PETRORISK file)

1.3. Distribution of Low Boiling Point Naphthas (Gasoline) Industrial
Exposure Scenario 3

Section 1 Exposure Scenario Title Low boiling point naphthas (Gasoline) that is classified as R45 and/or R46 and/or R62 and/or R63; (containing equal to or greater than 1% to 5% benzene)	
Title	
Distribution of substance	
Use Descriptor	
Sector(s) of Use	3
Process Categories	1, 2, 3, 8a, 8b, 15 Further information on the mapping and allocation of PROC codes is contained in Table 1.1
Environmental Release Categories	1, 2, 3, 4, 5, 6a, 6b, 6c 6d, 7
Specific Environmental Release Category	ESVOC SpERC 1.1b.v1
Processes, tasks, activities covered	
Bulk loading (including marine vessel/barge, rail/road car and IBC loading) of substance within closed or contained systems, including incidental exposures during its sampling, storage, unloading, maintenance and associated laboratory activities.	
Assessment Method	
See Section 3.	
Section 2 Operational conditions and risk management measures	
Section 2.1 Control of worker exposure	
Product characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa at STP OC5
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) G13
Amount used	Not applicable
Frequency and duration of use/exposure	Covers daily exposures up to 8 hours (unless stated differently) G2
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting exposure	Assumes use at not more than 20°C above ambient temperature, unless stated differently. G15. Assumes a good basic standard of occupational hygiene is implemented G1.
Contributing Scenarios	**Specific Risk Management Measures and Operating Conditions**
General Measures (skin irritants). G19.	Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. Wash off skin contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin effects that may develop. E3

General Measures (carcinogens). G18.	Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised staff; provide specific activity training to operators to minimise exposures; wear suitable gloves (tested to EN374) and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. G20.
CS15 General exposures (closed systems). + CS56 With sample collection.	Handle substance within closed systems. E47. Sample via a closed loop or other system intended to avoid exposure. E8. Wear suitable gloves tested to EN374. PPE15.
CS15 General exposures (closed systems).	Provide extract ventilation to points where emissions occur. E54. Handle substance within closed systems. E47.
CS2 Process sampling	Sample via a closed loop or other system to avoid exposure. E8.
CS36 Laboratory activities.	Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure. E12.
CS501 Bulk closed loading and unloading.	Ensure material transfers are under containment or extract ventilation. E66.
CS39 Equipment cleaning and maintenance	Drain down and flush system prior to equipment break-in or maintenance. E55. Retain drain downs in sealed storage pending disposal or for subsequent recycle. ENVT4. Clear spills immediately. C&H13. Wear chemically resistant gloves (tested to EN374) in combination with intensive management supervision controls. PPE18.
CS67 Storage.	Ensure operation is undertaken outdoors. E69. Store substance within a closed system. E84.
Additional information on the basis for the allocation of the identified OCs and RMMs is contained in Appendices 1 to 3	
Section 2.2 Control of environmental exposure	
Product characteristics	
Substance is complex UVCB [PrC3]. Predominantly hydrophobic [PrC4a].	
Amounts used	

Fraction of EU tonnage used in region	0.1
Regional use tonnage (tonnes/year)	1.87E7
Fraction of Regional tonnage used locally	0.002
Annual site tonnage (tonnes/year)	3.75E4
Maximum daily site tonnage (kg/day)	1.2E5
Frequency and duration of use	
Continuous release [FD2].	
Emission days (days/year) 300	
Environmental factors not influenced by risk management	
Local freshwater dilution factor 10	
Local marine water dilution factor	100
Other given operational conditions affecting environmental exposure	
Release fraction to air from process (initial release prior to RMM)	0.001
Release fraction to wastewater from process (initial release prior to RMM)	0.00001
Release fraction to soil from process (initial release prior to RMM)	0.00001
Technical conditions and measures at process level (source) to prevent release	
Common practices vary across sites thus conservative process release estimates used [TCS1]	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Risk from environmental exposure is driven by humans via indirect exposure (primarily inhalation)[TCR1k]. If discharging to domestic sewage treatment plant, no onsite wastewater treatment required [TCR9]	
Treat air emission to provide a typical removal efficiency of (%)	90
Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency ≥ (%)	12
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of ≥ (%)	0
Organisation measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils [OMS2]. Sludge should be incinerated, contained or reclaimed [OMS3].	
Conditions and measures related to municipal sewage treatment plant	
Estimated substance removal from wastewater via domestic sewage treatment (%)	95.5
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs (%)	95.5

Maximum allowable site tonnage (MSafe) (kg/d)	1.1E6
Assumed domestic sewage treatment plant flow (m3/d)	2000
Conditions and measures related to external treatment of waste for disposal	
External treatment and disposal of waste should comply with applicable local and/or national regulations [ETW3].	
Conditions and measures related to external recovery of waste	
External recovery and recycling of waste should comply with applicable local and/or national regulations [ERW1].	
Additional information on the basis for the allocation of the indentified OCs and RMMs is contained in Petrorisk file	
Section 3 Exposure Estimation	
3.1. Health	
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.G21	
3.2. Environment	
The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model [EE2].	
Section 4 Guidance to check compliance with the Exposure Scenario	
4.1. Health	
Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented. G22. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. G23. Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. G32. Available hazard data do not support the need for a DNEL to be established for other health effects. G36. Risk Management Measures are based on qualitative risk characterisation. G37.	
4.2. Environment	
Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures [DSU1]. Required removal efficiency for wastewater can be achieved using onsite/offsite technologies, either alone or in combination [DSU2]. Required removal efficiency for air can be achieved using onsite technologies, either alone or in combination [DSU3]. Further details on scaling and control technologies are provided in SpERC factsheet (http://cefic.org/en/reach-for-industries-libraries.html) [DSU4].	

1.3.2 Exposure Estimation.

1.3.2.1. Human Health

See Appendix 1 and Appendix 2.c.

1.3.2.2. Environment

See Annex III (PETRORISK file)

1.4. Formulation & (re)packing of Low Boiling Point Naphthas (Gasoline) - Industrial

Exposure Scenario

Section 1 Exposure Scenario Title Low boiling point naphthas (Gasoline) that is classified as R45 and/or R46 and/or R62 and/or R63; (containing equal to or greater than 1% to 5% benzene)	
Title	
Formulation & (re)packing of substances and mixtures	
Use Descriptor	
Sector(s) of Use	3, 10
Process Categories	1, 2, 3, 8a, 8b, 15 Further information on the mapping and allocation of PROC codes is contained in Table 1.1
Environmental Release Categories	2
Specific Environmental Release Category	ESVOC SpERC 2.2.v1
Processes, tasks, activities covered	
Formulation of the substance and its mixtures in batch or continuous operations within closed or contained systems, including incidental exposures during storage, materials transfers, mixing, maintenance, sampling and associated laboratory activities.	
Assessment Method	
See Section 3.	
Section 2 Operational conditions and risk management measures	
Section 2.1 Control of worker exposure	
Product characteristics	
Physical form of product	Liquid, vapour pressure > 10 kPa at STP OC5
Concentration of substance in product	Covers percentage substance in the product up to 100 % (unless stated differently) G13
Amount used	Not applicable
Frequency and duration of use/exposure	Covers daily exposures up to 8 hours (unless stated differently) G2
Human factors not influenced by risk management	Not applicable
Other Operational Conditions affecting exposure	Assumes use at not more than 20°C above ambient temperature, unless stated differently. G15. Assumes a good basic standard of occupational hygiene is implemented G1.
Contributing Scenarios	**Specific Risk Management Measures and Operating Conditions**
General Measures (skin irritants). G19.	Avoid direct skin contact with product. Identify potential areas for indirect skin contact. Wear gloves (tested to EN374) if hand contact with substance likely. Clean up contamination/spills as soon as they occur. Wash off skin

	contamination immediately. Provide basic employee training to prevent / minimise exposures and to report any skin effects that may develop. E3
General Measures (carcinogens). G18.	Consider technical advances and process upgrades (including automation) for the elimination of releases. Minimise exposure using measures such as closed systems, dedicated facilities and suitable general / local exhaust ventilation. Drain down systems and clear transfer lines prior to breaking containment. Clean / flush equipment, where possible, prior to maintenance. Where there is potential for exposure: Restrict access to authorised staff; provide specific activity training to operators to minimise exposures; wear suitable gloves (tested to EN374) and coveralls to prevent skin contamination; wear respiratory protection when its use is identified for certain contributing scenarios; clear up spills immediately and dispose of wastes safely. Regularly inspect, test and maintain all control measures. Consider the need for risk based health surveillance. G20.
CS15 General exposures (closed systems). + CS56 With sample collection.	Handle substance within closed systems. E47. Sample via a closed loop or other system intended to avoid exposure. E8. Wear suitable gloves tested to EN374. PPE15.
CS15 General exposures (closed systems).	Provide extract ventilation to points where emissions occur. E54. Handle substance within closed systems. E47.
CS2 Process sampling	Sample via a closed loop or other system to avoid exposure. E8.
CS36 Laboratory activities.	Handle within a fume cupboard or implement suitable equivalent methods to minimise exposure. E12.
CS14 Bulk transfers	Ensure material transfers are under containment or extract ventilation. E66.
CS8 Drum/batch transfers.	Ensure material transfers are under containment or extract ventilation E66.
CS39 Equipment cleaning and maintenance	Drain down and flush system prior to equipment break-in or maintenance.E55. Retain drain downs in sealed storage pending disposal or for subsequent recycle. ENVT4. Clear spills immediately. C&H13. Wear chemically resistant gloves (tested to EN374) in combination with intensive management supervision controls. PPE18.
CS67 Storage.	Store substance within a closed system. E84. Wear suitable gloves tested to EN374. PPE15.
Additional information on the basis for the allocation of the identified OCs and RMMs is contained in Appendices 1 to 3	
Section 2.2 Control of environmental exposure	
Product characteristics	
Substance is complex UVCB [PrC3]. Predominantly hydrophobic [PrC4a].	
Amounts used	
Fraction of EU tonnage used in region	0.1
Regional use tonnage (tonnes/year)	1.65E7

Fraction of Regional tonnage used locally	0.0018
Annual site tonnage (tonnes/year)	3.0E4
Maximum daily site tonnage (kg/day)	1.0E5
Frequency and duration of use	
Continuous release [FD2].	
Emission days (days/year)	300
Environmental factors not influenced by risk management	
Local freshwater dilution factor	10
Local marine water dilution factor	100
Other given operational conditions affecting environmental exposure	
Release fraction to air from process (initial release prior to RMM)	0.025
Release fraction to wastewater from process (initial release prior to RMM)	0.002
Release fraction to soil from process (initial release prior to RMM)	0.0001
Technical conditions and measures at process level (source) to prevent release	
Common practices vary across sites thus conservative process release estimates used [TCS1]	
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil	
Risk from environmental exposure is driven by humans via indirect exposure (primarily inhalation) [TCR1k]. If discharging to domestic sewage treatment plant, no onsite wastewater treatment required [TCR9]	
Treat air emission to provide a typical removal efficiency of (%)	56.5
Treat onsite wastewater (prior to receiving water discharge) to provide the required removal efficiency ≥ (%)	94.7
If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of ≥ (%)	0
Organisation measures to prevent/limit release from site	
Do not apply industrial sludge to natural soils [OMS2]. Sludge should be incinerated, contained or reclaimed [OMS3].	
Conditions and measures related to municipal sewage treatment plant	
Estimated substance removal from wastewater via domestic sewage treatment (%)	95.5
Total efficiency of removal from wastewater after onsite and offsite (domestic treatment plant) RMMs (%)	95.5
Maximum allowable site tonnage (M_{Safe}) (kg/d)	1.0E5
Assumed domestic sewage treatment plant flow (m3/d)	2000
Conditions and measures related to external treatment of waste for disposal	

External treatment and disposal of waste should comply with applicable local and/or national regulations [ETW3].
Conditions and measures related to external recovery of waste
External recovery and recycling of waste should comply with applicable local and/or national regulations [ERW1].
Additional information on the basis for the allocation of the indentified OCs and RMMs is contained in Petrorisk file
Section 3 Exposure Estimation
3.1. Health
The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.G21
3.2. Environment
The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model [EE2].
Section 4 Guidance to check compliance with the Exposure Scenario
4.1. Health
Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented. G22. Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels. G23. Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. G32. Available hazard data do not support the need for a DNEL to be established for other health effects. G36. Risk Management Measures are based on qualitative risk characterisation. G37.
4.2. Environment
Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures [DSU1]. Required removal efficiency for wastewater can be achieved using onsite/offsite technologies, either alone or in combination [DSU2]. Required removal efficiency for air can be achieved using onsite technologies, either alone or in combination [DSU3]. Further details on scaling and control technologies are provided in SpERC factsheet (http://cefic.org/en/reach-for-industries-libraries.html) [DSU4].

1.4.2. Exposure Estimation

1.4.2.1. Human Health

See Appendix 1 and Appendix 2.c.

1.4.2.2. Environment

See Annex III (PETRORISK file)

Appendix 1.

Exposure Estimation - Qualitative Exposure Estimation

Qualitative Exposure Estimation for R45 substances (where applicable)

The R45 risk phrase (may cause cancer) relates to the strength of evidence to indicate that the substance may cause cancer in humans. When a carcinogenic substance is considered a threshold carcinogen and/or if appropriate dose-response data from epidemiological and/or animal studies are available, it may be possible to derive a DMEL which should then be used in quantitative risk characterisation to define the appropriate RMMs... However, when a carcinogenic substance is considered a non-threshold carcinogen and/or if appropriate dose-response data from epidemiological and/or animal studies are not available, it is not possible to derive a DMEL, and hence a qualitative approach to the CSA will be required. This general qualitative CSA approach aims to reduce/avoid exposure or incidents with the substance consistent with the expectations of Directive 2004/37/EC. The general philosophy is twofold:

1. That the uses of any R45 substance are limited to suitably equipped industrial or professional settings and will only be supported in circumstances where exposure potential is limited (PROCs *1, 2, 3, 8a (maintenance only), 8b, 9, 15, and 16)* and will not cover those situations where exposure to the substance might be expected to be significant (such as PROCs 7, 11, 17, 18, etc). This limitation on use is consistent with the current expectations of Directive 2004/37/EC.

2. That a stringent set of RMMs will be applied. Firstly, exposures should be controlled to at least the levels that represent an acceptable level of risk (i.e. represent a RCR of <1 for the DMEL or the otherwise critical non-carcinogenic adverse effect associated with exposure to the substance (the lowest DNEL is used for a quantitative CSA)). Secondly, that rigorous systems of control are implemented to manage exposures in addition to and independent of the risk measures required to manage non-cancer endpoints (and which are described via the use of standard phrases linked to defined circumstances of use), with the aim that the net outcome is the description of the RMMs that when implemented ensure that the likelihood of cancer occurring is minimised, and the risk is considered to be controlled.

Qualitative Exposure Estimation for R65 substances

'Aspiration' means the entry of a liquid substance directly into the trachea and lower respiratory tract. Aspiration of hydrocarbon substances can result in severe acute effects such as chemical pneumonitis, varying degrees of pulmonary injury or death. This property relates to the potential for low viscosity material to spread quickly into the deep lung and cause severe pulmonary tissue damage. Classification of a hydrocarbon substance for aspiration hazard is made on the basis of reliable human evidence or on the basis of physical properties.

The R65 risk phrase (Harmful: may cause lung damage if swallowed) relates to potential for aspiration, a non-quantifiable hazard determined by physico-chemical properties (i.e. viscosity) that can occur during ingestion and also if it is vomited following ingestion. A DNEL cannot be derived. This general qualitative CSA approach aims to reduce/avoid contact or incidents with the substance. However, implementation of risk management measures (RMMs) and operational conditions (OCs) need to be proportional to the degree of concern for the health hazard presented by the substance. Exposures should be controlled to at least the levels that represent an acceptable level of risk such that the implementation of the chosen RMMs will ensure that the likelihood of an event occurring

due to the substance hazard is negligible, and the risk is considered to be controlled to a level of no concern.

There are no routine anticipated exposures by ingestion related to any supported uses of the substance. The risk arising from aspiration hazard is solely related to the physico-chemical properties of the substance. The risk can therefore be controlled by implementing risk management measures tailored to this specific risk. For any substance, classified as R65, these measures should be communicated via the safety data sheet by use of the following phrase:

- Do not ingest. If swallowed then seek immediate medical assistance.

Furthermore it should be noted that where the substance is sold for use in lamp oils and grill lighters by the general public (Consumers), then these must be visibly, legibly and indelibly marked as follows, in accordance with REACH Annex XVII update of 1.4.2010:

- Keep lamps filled with this liquid out of the reach of children.

Just a sip of lamp oil - or even sucking the wick of lamps may lead to life threatening lung damage.

APPENDIX 2:
REACH Tier 2 Risk Assessment of Low Boiling Point Naphthas (Gasolines): Overview of European Refinery Benzene Monitoring Data

Summary:

Using the prescribed risk assessment models, calculations made for the Risk Assessment of Low Boiling Point Naphthas (Gasolines) in the framework of REACH gave unrealistically high predicted values for concentrations of benzene in the air compartment. To assess the degree of conservatism involved, measured ambient air concentrations of benzene in the vicinity of refineries have been investigated using refinery and national data. No agreement was found between the measured data and the risk assessment concentrations. There is no evidence in the measured data that concentrations exceed the air quality standards intended to protect human health.

1. Introduction

Benzene is a priority substance because of the adverse health effects associated with long term chronic exposure. It is one of several priority substances for which regulatory standards are set for their ambient air quality concentrations. The European Union (and its member states) has a long term objective to reduce ambient benzene concentrations, expressed as annual averages, The current Air Quality Directive (2008/50/EC) requires ambient air concentrations of benzene to be below 5 ug/m^3 by January 1st 2010 having reduced from a maximum of 10 ug/m^3 in July 1999 and decreasing by 1 ug/m^3 per year from 2006. Furthermore the Air Quality Directive requires monitoring of benzene levels wherever they exceed an upper assessment threshold of 3.5 ug/m^3. Lesser monitoring requirements apply where benzene is below the upper threshold but still above a lower threshold of 2.5 ug/m^3. Modelling may be used as an alternative to monitoring subject to verification of methodology. To reflect that the purpose of ambient air quality standards is to protect public health, the number of monitoring stations needed to establish that air quality standards are met is linked to population density. Benzene monitoring is required to be made downwind of industrial sites where populations exceed 249,000 in a declared air quality zone.

Member states may set their own (stricter) tolerance for benzene concentrations. These may alternatively be expressed as Air Quality Objectives which are generally non-binding but carry with them the requirement to monitor in order to demonstrate trends in the reduction of ambient air concentrations.

It is important to note that air quality standards do not apply within refinery boundaries on the grounds that health and safety legislation adequately governs worker exposure for the limited time they are on site.

In the context of REACH risk assessments have been carried out using a screening tool, PETRORISK, that predicts environmental concentrations based on category-specific site tonnages and conservative emission release factors. For the majority of refineries, conservative human exposure estimates derived from PETRORISK have resulted in risk characterisation ratios significantly greater than 1.0. As a result, a refined assessment is required.

It is worth noting that:

- Refinery releases to atmosphere of benzene take place as fugitive or diffuse emissions, where the benzene is a minority component in process and product streams. Benzene *per se* is never released as a channeled emission of pure substance which is the assumption made in the risk assessment.
- The modelled risk factors are so large that the implied environmental concentrations are not considered realistic. For example, the risk characterisation ratio at one site of 8.61 for the benzene component implies a "typical" environmental concentration of 28 ug/m^3 using the risk assessors chosen DMEL of 3.25 ug/m^3 (1 ppb) which is more than 5 times the permitted AQ standard in 2010.

To secure our view of this 'credibility gap", CONCAWE has asked its member companies for information on benzene concentrations obtained via refinery monitoring prog$_1$r$_0$ammes. Furthermore, an analysis of data from the European AQ monitoring network [0] was also made with focus on measurement stations placed (approximately) 3 km or less[11] from refineries. In remote areas and particularly where the station was separated from the refinery by a water body, over which dispersion is less than overland, this distance was extended to 5 km. The judgement on relative positions of refineries and monitoring stations was made visually using Google Earth, a Google Earth refinery location file and the monitoring station location data provided by the European Environment Agency,

Information on benzene monitoring was provided by 50 refineries following a request for data. The extent of monitoring ranged from continuous measures to short duration surveys. A typical short duration measure is a 2 week diffusion tube sample or a 2 week campaign of daily diffusion tube samples. It is clear from this response that a majority of refineries are actively undertaking risk management measures with respect to Benzene in air.

The time frame in which measurements have been made varied considerably. Generally a short duration campaign (typically between 2 weeks and 2 months duration) was carried out to establish typical concentrations. Such studies started in the mid 1990's. In some refineries results showed low concentrations and no further measurements were made. In other refineries there are periodic monitoring campaigns to verify that the low measured concentrations remain so over a number of years. In other refineries a requirement for detailed monitoring is a condition of the operating permit (either discrete campaigns or continuous monitoring) providing times-series of concentrations.

The purpose of monitoring varies. In some cases the focus is on inspecting likely "hot spots" of benzene by looking at points where the potential for leaks or releases to atmosphere are greatest. Measures here are not spatially representative of either the refinery site (inside the fence) or of concentrations outside the site. In other cases measurements focus on fenceline concentrations in order to understand the maximal impact outside the fence where ambient air quality standards apply. In further cases the measurements extend into the neighbourhood around the site to establish ambient concentrations. These are the most relevant for risk assessment to public health. External measurements may be carried out in collaboration with or by local authorities. This investigation has shown that such data very rarely appear in the European AQ database.

2. Overview of air quality data

Short duration measures, especially on the sites themselves can show concentrations above 5 ug/m^3, when made close to process plant, water treatment and loading/unloading facilities. The more complete surveys show that the spatial extent of these areas is very limited and away from the sources, the concentrations on site rapidly fall to fenceline values.

Fenceline surveys generally show concentrations that are (well) below 5 ug/m^3 at any time of year. Where time-series are available, there is a tendency for concentrations to be higher in the winter months than in the summer months. This could be due to differences in meteorological conditions

affecting dispersion or changes in refining product slate for the winter months or a combination of these factors. There are however some exceptions to this where summer concentrations are higher.
Measurements outside the fenceline were reported for stations ranging from a few meters to 5 kilometres distance. Generally concentrations were well below 5 ug/m^3. For those cases of elevated levels, it was commented by the investigating national body that traffic contributions were probably significant and possibly accounted for between 20-50% of the measured concentrations. The spatial extent of hot spots appears to be of order 400 m diameter maximum based on observations.
The European AQ database holds some information on benzene and, as described above, the AQ Directive requires benzene to be monitored if concentrations near to populated areas are above the lower threshold. The 5 ug/m^3 standard is substantially met[13] throughout Europe but European Environment Agency use a traffic light system to assess compliance which gives no quantitative information. Therefore statistical data on concentrations obtained from Airbase[14] were examined. We chose records from measurement stations sited (approximately) <3 km from refinery sites noting that, although their proximity to refineries makes them useful indicators, it is still possible that other benzene sources would influence their measurements.
The Airbase station results are summarised in Table 1 below. This table is a list of benzene measurements, expressed as annual averages, reported in Airbase. Not all stations that are near to refineries report benzene. A single station may cover more than one refinery in areas where there are several. A refinery may be covered by more than one station. Only 4 data points exceed the 2010 EU standard of 5 ug/m^3. For one station in Belgium the 1997 value is completely different to the data for all other years and seems to be an outlier. In France the 2007 value for one of the stations of 5.7 ug/m^3 just exceeds the 2010 current standard. However in 2008 the reported value for this station is below this standard. In Italy, two 2008 measurements (5.5 and 8.4 ug/m^3) exceed this standard. It should be noted that multiple sources contribute to these concentrations and the neighbouring refinery is not necessarily responsible for the exceedence. Overall the impression of the data is that benzene concentrations are low and have been since detailed monitoring started in the mid 1990's. The typical air concentration for benzene appears to be < 2 ug/m^3.
The mean of the data from stations in Table 1 is 1.95 ug/m^3 and the median is 1.48 ug/m^3. Some 90% of measurements are below 3.34 ug/m^3 and 95% below 4.44 ug/m^3.

Table 1. Annual Average Concentrations from Airbase stations located near (~ 3 km from) refineries.

Country	Station id	Year	Concentration ug/m^3
AT	AT32701	2006	1.00
		2007	0.98
BG	BG0044A	2006	2.56
		2008	4.41
RO	RO0106A	2008	3.57
GB	GB0814A	2002	1.61
		2003	1.69
		2004	1.61
		2005	1.65
		2006	1.74
CZ	CZ0EPAO	2005	1.90
		2006	2.60
		2007	0.57
		2008	1.17
	CZEPAU	2005	0.92
		2006	1.26
		2007	0.98
		2008	1.44
DE	DENW147	2005	4.10
		2006	4.48
	DENW152	2005	1.50
		2006	1.59
	DENW149	2005	1.60
		2006	1.36
	DEBW022	2005	1.20
NL	NL00415	1997	2.48
		1998	1.52
		1999	1.41
		2000	1.29
		2001	1.33
		2002	1.75
		2003	1.68
		2004	1.22
		2005	1.21
		2006	0.98
		2007	1.13
		2008	0.94
BE	BE0457A	1996	3.37
		1997	2.38
		1998	1.66

		1999	1.48
	BEVR833	1994	2.90
		1995	2.44
		1996	2.11
		1997	18.13
		1998	1.46
		1999	1.60
		2000	1.27
		2001	1.08
		2002	1.36
		2003	1.27
		2004	1.17
		2005	1.26
		2006	0.17
		2007	0.14
		2008	1.11
	BETR833	2007	1.23
		2008	1.37
FR	FR20029	2004	6.35
		2005	6.64
		2007	5.78
		2008	2.62
	FR10007	2005	1.51
		2007	1.43
		2008	0.99
ES	ES1279A	2002	2.21
		2003	2.30
		2004	2.48
		2005	2.17
		2006	1.00
		2007	3.23
		2008	3.21
	ES0892A	2004	0.23
		2005	0.37
		2006	0.63
		2007	1.21
		2008	1.48
	ES0893A	2008	2.01
	ES0651A	2005	1.20
		2006	1.40
		2007	1.32
		2008	1.10
	ES1312A	2007	2.28
		2008	1.98
	ES1666A	2005	1.22

		2006	1.17
		2007	1.13
		2008	0.99
	ES0556A	2005	1.55
	ES0556A	2006	1.57
IT	IT1270A	2003	1.90
		2004	1.78
		2005	1.02
		2006	2.86
		2007	3.01
		2008	5.54
	IT1269A	2002	0.69
		2003	1.00
		2004	0.93
		2005	0.65
		2006	1.13
		2007	1.33
		2008	1.59
	IT1373A	2004	1.26
		2005	0.63
		2006	1.30
		2007	1.41
		2008	1.19
	IT12688A	2008	8.44
	IT0461A	2003	3.95
		2004	2.25
		2005	2.03
		2006	2.40
		2007	2.79
		2008	3.46
	IT0462A	2001	1.58
		2008	3.85
	IT0463A	2008	1.58
	IT1153A	2003	2.27
		2004	1.22
		2005	0.75
		2006	0.86
		2007	0.82
		2008	0.82
	IT1611A	2004	1.08
		2005	1.09
		2007	1.52
		2008	1.59
	IT1751A	2007	2.35
		2008	1.48

	IT0612A	2007	1.02
		2008	0.92
	IT1786A	2006	2.06

3. Overview of Refinery Monitoring Data

A summary of the refinery survey data is given in Table 2 below. To preserve anonymity the refineries are only referenced according to their internal CONCAWE codes used in the REACH Risk Assessments for refined hydrocarbon products.

Also shown is the risk characterisation ratio derived from the Low Boiling Point Naphthas (Gasolines) REACH risk assessment and the implied "typical" benzene air concentration. A value of 3.25 ug/m^3 (1 ppb) represents a risk characterisation ratio of one in the risk assessment. A more useful (but almost identical value) of 3.5 ug/m^3 is the upper monitoring threshold under the Air Quality Directive. Results are provided in reverse sorted risk order (highest to lowest) for refineries who replied to the survey request. Refineries provided documented evidence of surveys made or monitoring system results. In some cases reports of (independent) local authority investigations were submitted. In a few cases no data were reported. It was hoped that there might be a correspondence between sites responding to the survey and those covered by the Airbase network but this proved not to be the case so there is not a robust evidence base for comparing refinery monitoring fenceline concentrations with those captured by the AQ network.

For reasons of space the refinery responses have been summarised in terms of their scope and only indicative concentrations have been provided here. The time-frame the measurements apply to is also noted because they span a period from 1995 to 2010. Within this period the EU air qu$_3$ality standard ha$_3$s decreased (10 u$_3$ g/m^3 through 2005$_3$ then decreasing 9 ug/m^3 in 2006, 8 ug/m^3 in 2007, 7 ug/m^3 in 2008, 6 ug/m^3 in 2009 to 5 ug/m^3 in 2010). All responses are filed in a secure data system in CONCAWE.

Table 2 shows that there is a clear disconnect between the concentrations predicted by the Risk Assessment and the measured values. Overall there is a clear indication that fenceline concentrations are overall low and (even allowing for the preponderance of campaign vs. continuous monitoring) consistent with ambient air quality standards being met by a margin of typically a factor 2.

Table 2. Summary of Refinery Monitoring Data.

The RA code is the Reach Assessment code used to denote refinery sites while preserving anonymity.
The RA RCR is the Reach Assessment Risk Characterisation Ratio.
The Implied Concentration is this ratio multiplied by 3.25 pg/m3 (1 ppb) used in its derivation
The Data Concentration is the best judgment of a representative concentration from the monitoring which may not be a true annual average
The Revised RCR is the concentration divided by 3.5 pg/m3which is an EU wide regulatory value for health protection and for required benzene monitoring.
A symbol < means that at least one data point has been reported as less than a value, that maximal value has been used.

RA Code	RCR	Implied Concentration ug/m^3	Data Concentration ug/m^3	Revised RCR	Comments	Date
5.05	8.61	30.13	2.1 (average of the 8 stations closest fenceline)	0.60	Independent Intensive campaign of measurements at 36 locations over 2 weeks to map community values. Estimated non-industrial sources contribute 20-50% of measured concentrations. Multiple industrial sources. Community concentrations (over the 12 weeks) were on average less than the upper reporting threshold of 3.5 ug/m^3 (annual). Hot spot (highest average 18.2 ug/m^3) on access road dividing site.	first quarter 2007
10.02	6.15	21.54			No recent data	1994-1995
13.00	5.87	20.55	1.03 (6 year average)	0.29	Detailed monitoring of boundary and on-site locations. Results consistent over measurement period. Given as average of 8 boundary station measures. Annual results very similar with one year of low concentration means varied 0.19 to 1.56 ug/m^3	2003-2009
13.12	5.57	19.49			no data provided	
4.00	4.63	16.21	1 - 4 (19931996) 1 -2 (19972000)	0.57	Continuous monitoring at downwind station for 1993-1996 within boundary and 1997-2000 outside boundary in direction of prevailing wind. Measurements in discussion with environmental authorities and discontinued in 2000 in the face of evidence that concentrations were well below environmental limits. Values are medians.	1993-2000
23.00	4.31	15.08	4, 6 , < 1., <1.	0.85 Average RCR	4 monitoring stations taking 1/2 hour samples and reporting daily (362 measures in year) average for two stations below 1 ug/m3. Data precision to 1 significant figure.	2009

2.00	3.75	13.14	3.4 average over all data	0.9 7	Measurements at 20 locations on site in 2005, 2007 and 2008 including 5 boundary points. Campaigns lasted one month. Average 3.5 ug/m3 in Sep 2005, 5.2 ug/m3 in Nov 2006 and 1.6 ug/m3 in Nov 2008. Overall highest station value was 6.4 ug/m3 in Nov 2006. All stations showed low concentrations in Nov 2008.	2005,2006,2008 one month only
13.11	3.66	12.82	1.28 (2 week average of all sites)	0.37	Thorough survey conducted for 14 day period once a year. No change in observed concentration in 2 years. Sampling locations cover local community. Highest single reading in 2009 was 4 ug/m3.	2008 - 2009
13.02	3.62	12.66	2.5	0.71	Local authority monitoring at 2 sites remote from traffic sources since 2004. Little variation all values between 2.03 and 3.25 ug/m3 annual mean. Average is 2.5 ug/m3	2004 - 2008
6.26	3.36	11.75	1.5 boundary one month data	0.43	Measurements at 20 locations in Nov 2007 including 8 on external boundary. All concentrations < 1.5 ug/m3	Nov-07
6.08	3.04	10.66	< 0.3	< 0.08	Benzene concentrations assessed on the basis of dispersion modelling using inventory. Very low concentrations predicted	2006 and 2008
7.00	3.01	10.52	0.83	0.24	Continuous Monitoring . Station location unknown. Year 2010 to date average 0.83 with max 3.42.	2009-2010
13.10	2.95	10.33	< 2.9 in any year (average perimeter)	0.83	2 week diffusion tube study carried out every 6 months all around refinery boundary. One non-public "hot spot" less than 400m across where concentrations vary between 4 -11.2 ug/m3 in the 5 year period	2004 - 2009
24.01	2.95	10.33	1.74 (average of 4 stations over 5 years)	0.50	Permanent Community Monitoring with 4 automatic monitoring sites giving annual averages. Maximum was at the closest site in 2005 and was 2.48 ug/m Yearly concentrations fluctuate about central values of 1.86, 1.86, 1.32 and 1.92 ug/m3 for the 4 stations respectively.	2005-2009 incl.
5.02	2.88	10.10	3.1 (average of fence and outside measures)	0.89	Measurements for 16 locations both inside and outside the refinery. Duration of monitoring unknown. Average of outside measures 3.2 ug/m3 with max station 6.6 ug/m3. Average of fence line measures 3.0 ug/m3 with max 8.5 ug/m3.	2004
5.12	.63	9.20	< 2	< 0.57	Measurement campaign at 20 locations including 7 fence line and	Jul-08

			boundary one month		one external point. Fence line all < 1.5 ug/m3 and external 2.0 m3	
12.01	2.48	8.68	< 1 (average concentrations for the year, the 4 month and the 4 x1 month sites)	< 0.29	Thorough survey of refinery environs including a year survey of hourly concentrations downwind of refinery. One month per season at 3 further locations and weekly averages for 4 months at 10 further locations.	2007
6.10	2.47	8.66	0.2 - 0.5 (summer) 0.8 - 1.1 (winter)	< 0.31	Fence line monitoring at 6 locations for 9 weeks (summer) in 2006 and 16 weeks (winter) in 2009	2006 and 2009
9.03	2.25	8.57	0.4	0.11	Dispersion modelling on basis of emission inventory - closest contour to boundary.	unknown
5.11	2.29	3	6.5 boundary one month	0.80	Measurements in 28 locations in October 2006 included 7 boundary and 5 external stations. The boundary average was 6.5 ug/m^3 and the external average 5.3 ug/m^3due to a high value traffic station (15.6). Excluding this the external average was 2.8 ug/m^3 which is used here for the RCR.	Oct-06
5.10	2.15	7.52	2.7 boundary one month	0.77	Campaign in June 2007 included 8 boundary stations average 2.7 ug/m and max 4.7 ug/m3	Jun-07
6.17	2.05	7.17	1.6 and 1.3	0.45	Detailed monitoring at two stations (E and W) of refinery.	2009
9.11	1.93	6.77	not available		Permit requires inventory only as per PRTR regulation	
24.00	1.92	6.72	51 0.53 - 1.96 52 0.59 - 1.19 53 0.87 - 1.17	0.56 0.34 0.33	Monitoring for Benzene at 3 locations outside of the fenceline is a requirement of permit. All within 1 km.	2007, 2008, 2009
2.04	1.90	6.65	2.5 (average public access perimeter in survey)	0.71	Survey at 9 perimeter locations for 4 weeks in 2001 when the ambient air quality standard was 10 ug/m ug/m3. "hot spot" of extent < 400 m near loading facility with conc 7.7 ug/m ug/m3.	2001
11.00	1.82	6.36	< 5.2		Five continuous monitoring stations at distances between 0.4 and 1.4 km from fenceline supported by campaigns near an integrated petrochemical site. Unfortunately refinery contributions cannot be determined and so a revised RCR is not estimated. The largest concentrations reported to be 4.5 ug/m3 in 2008 and 5.2 ug/m3 in 2009 and short duration campaigns gave support to this number.	2008-2009

					However, the national air quality network reports less than half this value for 2008 so the figures above may not represent annual averages.	
1.00	1	6.32	3.5 (year)	1	Fenceline sampling over a year at 9 equally spaced locations and 3 outside stations at up to 2 km downwind. Fenceline measures averaged 3.5 ug/m3 (range 2.2 to 4.6 ug/m3) and external 2.2 ug/m3 (range 2.1-2.2 ug/m3)	April 1995 -March 1996
6.15	1.79	6.26	1.7	0.49	3 Measuring Stations within 1.1 km. Required Monitoring since 2004. All stations less then 1.5 (2005). The average over the 3 stations was 1.07 for 2007 and the average over all the data was also 1.07.	2004 - 2007
5.04	1.73	6.06	2.9	0.83	2 week long survey at 23 locations both on and off refinery site. Max concentration in habited areas 3.4 ug/m3, average refinery boundary 4.04 ug/m3 excluding hot spot, 6.76 ug/m3 with hot spot. The average in populated areas surrounding the refinery was 2.9 ug/m3.	year not known
5.04	1.73	6.06	3 (boundary averaged over the 3 months measured in 3 years)	0.86	Campaign using 23 locations including 7 fenceline and 3 external locations in July 2006. A focus on boundary measurements in September with 8 fenceline and 5 external measurements. A smaller study in July 2008. In July 2006 the average fenceline was 2.8 ug/m3 and outside stations 3.03jg/m3. In Sept 2008 fenceline and external were < 1.5 ug/m3 and in July 2009 fenceline average was 3.1 ug/m3 due to one high point.	july 2006, sep 2008, july 2009
13.07	1.68	5.87	0.3 - 2.2 (typical fenceline in range across surveys.)	0.63	Short (2 week long) surveys comprising diffusion tube surveys around fenceline. Measurements include rail-loading facility just inside boundary which is not characteristic of perimeter. Timing survey in 2001 is not known. In the loading zone the spot measures are variable. Overall highest 12.1 ug/m3 but more typically varying in range 3-7 ug/m3	2001, 2003 (summer), 2004 (autumn) 2004(winter)
3.01	1.64	5.76			No Fenceline measurements.	2006
17.00	1.61	5.63	mean 0.83 and 1.2 overall max 3.6	0.34	A year of monitoring reporting 3 times a week (2 stations report 48 hour averages and 1 a 72 hour average). The location of the 2 stations is not known.	2009
6.04	1.60	5.61	0.4 over 3 summer	0.46	2 surveys carried out in residential area next to tanks. One for 3	2008

			months and 1.6 over 1 fall month.		months in the summer and one for 4 weeks in the autumn. Results compared with city centre measures 65 km away (no refinery) and concentrations were lower than in the city centre (1.3 c.f. 0.4 ug/m3 and 1.9 c.f. 1.6 ug/m3) (city c.f. refinery)	
15.01	1.38	4.82	2.1 in 2005	0.60	Two 2-week long surveys with 50 and 52 sampling points (49 data points) to look at community and site values. A reduction in benzene concentrations between 2004 to 2005 was observed for some measuring points which implies VOC control measures were taken. Median reduces 7.38 ug/m3 to 1.2 ug/m3 and mean reduces 10.9 ug/m3 to 2.1 ug/m3 (over all samplers)	January 2004, June 2005
6.24	1.34	4.68	4-7 (background is 3-4)	0.86	Monitoring has taken place since 1988. About 200 spot measurements are made each of the measuring stations. These are sited to take account of the prevailing wind. Since 2004 the concentrations have been fairly similar. On the upwind side of there refinery values are typically 3 - 4 ug/m3 and downwind 4- 7 ug/m3.	1995-2008
27.04	1.31	4.57	< 0.1 spot sample	< 0.03	Fenceline samples are taken at 2 locations. Concentrations of 0.1 ug/m3 and 0 ug/m3 detected. Major on-site survey conducted in recent years resulted in major changes to reduce benzene emissions.	2010
4.01	1.13	3.95	1 - 2	0.56	Short term measures to determine values	unknown
10.00	1.01	3.53	1.2 and 1.5 (29 month average)	0.43	2 Monitoring stations on refinery fence generating annual averages using 1-2 month sampling periods. (22 sampling periods at each station). Very low variability. Max sample value 3.9 ug/m3 at station 1 and 2.9 ug/m3 at station 2.	mid 2007- end 2009
21.00	0.97	3.42	1.73	0.49	AQ monitoring station 500m from fence at nearest community, annual average.	2009
5.03	0.95	3.33	1.9 average since campaign	0.54	Monitoring Program since 2001 comprising quarterly campaigns on process plant, storage, waste water treatment and external boundary. Boundary concentrations were on average 4.8 up to and including 2007. A campaign to reduce VOC emissions resulted in average concentration below 2.1 ug/m3 in 2008 and 1.6 ug/m3 in 2009.	2001 - present
8.07	0.87	3.04	2.74	0.78	Local authority monitors refinery with station 300 m from fence.	09

			(year average excluding non detects) 1.98 (with non-detects as 0.0)		Daily averages reported for entire year.	
5.08	0.85	2.97	< 3.8 (typical concentration is 2.5)	0.71	of 6 2 week long campaigns (12 weeks) downwind of refinery.	Oct 2007 - Jan 2008
11.01	0.84	2.92	2	0.57	Continuous monitoring information is supported by campaigns. Monitoring stations (4) cover local community at distances up to 1.07 km from fence line. In 2008 and 2009 only one station measured above its detection limit and this was 500m from boundary. Campaigns verified concentrations < 1.5 ug/m3 in 2008 and < 1 ug/m3 in 2009 at stations.	2008 - 2009
5.07	0.83	2.92	2.7	0.77	Passive Samplers across region surrounding the site with focus on nearby town. One continuous sampler. Data for 4 months June to September. Average over nearest samples was 2.7 ug/m3. Highest single monthly measure was 5 ug/m3. At sample location away from town (op3posite side of site) av3erage concentration was 1.1 ug/m (maximum 1.7 ug/m3)	2006
7.01	0.75	2.64	3	0.86	Continuous monitoring. Station location unknown. Value for 2009 was 3 ug/m3. Jan - May 2010 average was 1.8 ug/m3	2009 - 2010
14.00	0.71	2.48	2.8 +/- 1.05	0.80	One month survey making 1/2 hour averages 1.7 km (approx) from fenceline	2010
9.02	0.68	2.36	1.85 one month	0.53	Campaign in September 2009 with 6 of 7 measurement stations on the boundary measuring < 1.5 ug/m3 and one measuring 1.85 ug/m3. Two outside stations one reported < 1.5 ug/m3 and the other 3.82 ug/m3.	Sep-09
5.06	0.52	1.81	1.3 for year. 1.63, 1.73, 1.77 for Q1 at stations.	0.51	Local authority monitoring outside of refinery at distances of 1.6, 1,7 and 2.8 km from fence. Whole year at one station which is also in town, Jan-Mar at other stations. Monitoring station at nearby (5.2 km to Ref) storage depot shows concentrations. of 1.2 ug/m3 in 2007 and 1.0 ug/m3 in 2005.	2009
5.16	0.34	1.19	7.3 average one month		Campaign in Feb 2009 measured 3 fence line and 3 outside	Feb-09

			with 2 high values.		locations. One outside and one boundary measure were high 15.5 and 10.8 respectively - not known if there were traffic sources or location on hot spot so implied RCR not given. Other data-points suggest 3.8 - 4.0 ug/m3 which is within AQ standard but above threshold requiring monitoring Average 7.3 ug/m3	

Conclusions

The combination of evidence from site monitoring and ambient AQ network monitoring shows that the estimated concentrations, coming from the REACH risk assessment for Low Boiling Point Naphthas (Gasolines), have no basis in fact.

Benzene is a priority chemical and risk management processes need to be in place to limit its accidental release to the environment. Evidence obtained here shows that such management takes place widely in the form of campaign or continuous monitoring of benzene.

The evidence points to annual average concentrations at the boundary of refinery sites being within the current European Ambient Air Quality standard of 5 ug/m^3 by a significant margin.

Using the measured benzene air concentration all reporting location have RCRs <=1. The air quality monitoring network measurements suggest a typical annual benzene concentration of 2 ug/m^3 for the industrial areas surrounding refineries which would set the RCR to be 0.6 using the current upper assessment threshold of the Air Quality Directive.

Appendix 2.c.
Exposure Estimation – Low boiling point naphthas (Gasoline) that is classified as R45 and/or R46 and/or R62 and/or R63; (containing equal to or greater than 1% to 5% benzene)

Worker

	A	B	C	D	E	F	G	H	I	J	R
1	**Low boiling point naphthas (Gasoline) R45R46; R62R63; (5 percent Benzene containing Naphtha)**					**DMEL value (inhalation, ppm) =**	**1**	**DMEL value (dermal) = mg/kg/d (100% TRA absorption modified)**	**0.234**	**Inhalation DMEL in mg/m3**	Notes: High Volatility (12.6 kPa)
2		**Table 1: Mapping Uses in the Supply Chain**								**Table 2: Characterising the Risk - Chemical Safety Assessment - Evaluation of Safe Use**	
3							**Use Descriptor**	**Tier 1 assumptions and adjustments where required**		**Inhalation Exposure**	**Dermal Exposure**
4	**Short Title**	**Sector of use [SU]**	**Contributing Scenarios**	**Contributing Scenario Ref:**	**Typical Mapped Operating Conditions**	**Typical Mapped RMMs**	**Process Category (PROC)**	**Duration Temperature**	**LEV Yes / No and adjustments to Tier 1 prediction**	**TRA Predicted Inhalation Exposure (ppm)** No Modifiers	**TRA Predicted Dermal Exposure (mg/kg/d)** No Modifiers
5	**Manufacture of substance - Industrial**										
6	**Manufacture of substance - Industrial**	**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU8** - Manufacture of bulk, large scale chemicals (including petroleum products) **SU9** - Manufacture of fine chemicals.	General continuous process exposures with no sampling.	CS15 General exposures (closed systems).	Continuous; daily; 15 - 1 hour; product temp. Outdoor	Closed processes.	PROC1 Use in closed process, no exposure or exposure	>4 hours; ambient temp.	No LEV	0.01	0.34
7	**Consolidate with the above**	**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU8** - Manufacture of bulk, large scale chemicals (including petroleum products) **SU9** - Manufacture of fine chemicals	General continuous process exposures with sampling.	CS15 General exposures (closed systems). + CS56 With sample collection.	Continuous; daily; 15 mins - 1 hour; product temp. Outdoor	Enclosed process; Outdoor location; closed/semi-closed sampling point	PROC2 Use in closed, continuous process with occasional controlled exposure.	>4 hours; ambient temp.	No LEV	50	1.37
8		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU8** - Manufacture of bulk, large scale chemicals (including petroleum products) **SU9** - Manufacture of fine chemicals	General batch process exposures with sampling.	CS15 General exposures (closed systems).	Batch process; daily; 15 - 1 hour; product temp.; Outdoor	Closed equipment, enclosed or vented sampling points	PROC3 Use in closed batch process (synthesis or formulation)	>4 hours; ambient temp.	No LEV	100	0.03
9		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU8** - Manufacture of bulk, large scale chemicals (including petroleum products) **SU9** - Manufacture of fine chemicals	Laboratory activities	CS36 Laboratory activities	Daily; 1-4 hours; product temp.; Indoor	Fume cupboard. PPE	PROC15 Use as laboratory reagent.	>4 hours; ambient temp.	With LEV	50	0.03
10		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU8** - Manufacture of bulk, large scale chemicals (including petroleum products) **SU9** - Manufacture of fine chemicals	Bulk transfers (no LEV)	CS14 Bulk transfers	Daily; 1-4 hours; product temp.; Outdoor	Enclosed transfers; clear lines prior to decoupling	PROC8b Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities.	>4 hours; ambient temp.	No LEV	150	0.69
11		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU8** - Manufacture of bulk, large scale chemicals (including petroleum products) **SU9** - Manufacture of fine chemicals	Clean down and Maintenance	CS39 Equipment cleaning and maintenance	Daily; 8 hours; product temp; collection of line waste in container; Outdoor	Enclosed lines; retain wash down in sealed storage pending disposal or use as recycled material for subsequent formulation. PPE.	PROC8a Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities.	>4 hours; ambient temp.	No LEV	250	13.71
12		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU8** - Manufacture of bulk, large scale chemicals (including petroleum products) **SU9** - Manufacture of fine chemicals	Storage	CS67 Storage.	Daily; 8 hrs; product temp; Outdoor	Samples collected at dedicated sample points (incl. tank dipping)	PROC2 Use in closed, continuous process with occasional controlled exposure.	daily; ambient temp.	No LEV Outdoor activity	50	1.37
13	**Use of substance as intermediate - Industrial**										
14	**Use of substance as intermediate - Industrial**	**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU8** - Manufacture of bulk, large scale chemicals (including petroleum products) **SU9** - Manufacture of fine chemicals.	General continuous process exposures with no sampling.	CS15 General exposures (closed systems).	Continuous; daily; 15 - 1 hour; product temp. Outdoor	Closed processes.	PROC1 Use in closed process, no likelihood of exposure.	>4 hours; ambient temp.	No LEV	0.01	0.34
15	**Consolidate with the above**	**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU8** - Manufacture of bulk, large scale chemicals (including petroleum products) **SU9** - Manufacture of fine chemicals	General continuous process exposures with sampling.	CS15 General exposures (closed systems). + CS56 With sample collection.	Continuous; daily; 15 mins - 1 hour; product temp. Outdoor	Enclosed process; Outdoor location; closed/semi-closed sampling point	PROC2 Use in closed, continuous process with occasional controlled exposure.	>4 hours; ambient temp.	No LEV	50	1.37
16		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU8** - Manufacture of bulk, large scale chemicals (including petroleum products) **SU9** - Manufacture of fine chemicals	General batch process exposures with sampling.	CS15 General exposures (closed systems).	Batch process; daily; 15 - 1 hour; product temp.; Outdoor	Closed equipment, enclosed or vented sampling points	PROC3 Use in closed batch process (synthesis or formulation)	>4 hours; ambient temp.	No LEV	100	0.34
17		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU8** - Manufacture of bulk, large scale chemicals (including petroleum products) **SU9** - Manufacture of fine chemicals	Laboratory activities	CS36 Laboratory activities	Daily; 1-4 hours; product temp.; Indoor	Fume cupboard. PPE.	PROC15 Use as laboratory reagent.	>4 hours; ambient temp.	With LEV	50	0.03
18		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU8** - Manufacture of bulk, large scale chemicals (including petroleum products) **SU9** - Manufacture of fine chemicals	Bulk transfers (no LEV)	CS14 Bulk transfers	Daily; 1-4 hours; product temp.; Outdoor	Enclosed transfers; clear lines prior to decoupling	PROC8b Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities.	>4 hours; ambient temp.	No LEV	150	0.69
19		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU8** - Manufacture of bulk, large scale chemicals (including petroleum products) **SU9** - Manufacture of fine chemicals	Clean down and Maintenance	CS39 Equipment cleaning and maintenance	Daily; 8 hours; product temp; collection of line waste in container; Outdoor	Enclosed lines; retain wash down in sealed storage pending disposal or use as recycled material for subsequent formulation. PPE.	PROC8a Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities.	>4 hours; ambient temp.	No LEV	250	13.71

	A	B	C	D	E	F	G	H	I	J	R
20		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU8** - Manufacture of bulk, large scale chemicals (including petroleum products) **SU9** - Manufacture of fine chemicals	Storage	CS67 Storage.	Daily; 8 hrs; product temp; Outdoor	Samples collected at dedicated sample points (incl. tank dipping)	PROC2 Use in closed, continuous process with occasional controlled exposure.	daily; ambient temp.	No LEV Outdoor activity	50	1.37
21	**Distribution of substance - Industrial**										
22	**Distribution of substance - Industrial**	**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites	General continuous process exposures with no sampling.	CS15 General exposures (closed systems).	Continuous; daily; 15; 1 hour; product temp; Outdoor	Closed processes.	PROC1 Use in closed process, no likelihood of exposure	>4 hours; ambient temp.	Closed product; No exposure.	0.01	0.34
23		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites	General continuous process exposures with sampling.	CS15 General exposures (closed systems) + CS56 With sample collection.	Continuous; daily; 15 mins - 1 hour; product temp; Outdoor	Enclosed process; Outdoor location; closed/semi-closed sampling point	PROC2 Use in closed, continuous process with occasional controlled exposure.	>4 hours; ambient temp.	No LEV	50	1.37
24		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites	General batch process exposures with no sampling.	CS15 General exposures (closed systems).	Batch process; daily; 15 - 1 hour; product temp.; Outdoor	Closed equipment, enclosed or vented sampling points	PROC3 Use in closed batch process (synthesis or formulation)	>4 hours; ambient temp.	No LEV	100	0.34
25		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites	Sample collection	CS2 Process sampling	Daily; <15 mins; product temp.; Outdoor;	Closed or ventilated sampling points	PROC3 Use in closed batch process (synthesis or formulation)	>4 hours; ambient temp.	No LEV	100	0.34
26		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites	Laboratory activities	CS36 Laboratory activities.	Daily; 1-4 hours; product temp.; Indoor	Fume cupboard; PPE.	PROC15 Use as laboratory reagent.	>4 hours; ambient temp.	With LEV	50	0.03
27		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites	Bulk closed loading and unloading (e.g. road/rail car bottom loading; loading/unloading; marine vessel/barge loading/unloading.)	CS500 Bulk closed loading.	Daily; 15 - 1 hour; product temp.; exposure potential during breaking of hose connection; Outdoor	Enclosed transfers; clear lines prior to decoupling	PROC8b Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities.	>4 hours; ambient temp.	No LEV	150	0.69
28		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites	Bulk closed loading (e.g. road/rail car bottom loading; marine vessel/barge loading)	CS501 Bulk closed loading and unloading.	Daily; 15 - 1 hour; product temp.; exposure potential during breaking of hose connection; Outdoor	Enclosed transfers; clear lines prior to decoupling	PROC8b Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities.	>4 hours; ambient temp.	No LEV	150	0.69
29		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites	Clean down and Maintenance	CS39 Equipment cleaning and maintenance	Daily; 15 min - 1 hour; product temp; collection of line waste in container; Indoor	Enclosed lines; retain wash down in sealed storage pending disposal or use as recycled material for subsequent formulation. PPE.	PROC8a Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities.	daily; ambient temp.	No LEV	250	13.71
30		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites	Storage	CS67 Storage.	Daily; 8 hrs; product temp; Outdoors	Samples collected at dedicated sample points (incl. tank dipping)	PROC2 Use in closed, continuous process with occasional controlled exposure.	daily; ambient temp.	No LEV Outdoor activity	50	1.37
31	**Formulation & (re)packing of substances and mixtures - Industrial**										
32	**Formulation & (re)packing of substances and mixtures - Industrial**	**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU10** - Formulation [mixing] of preparations and/or re-packaging	General continuous process exposures with no sampling.	CS15 General exposures (closed systems).	Continuous; daily; 15; 1 hour; product temp.; Indoor	Closed processes.	PROC1 Use in closed process, no likelihood of exposure	>4 hours; ambient temp.	Closed process; No exposure.	0.01	0.34
33		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU10** - Formulation [mixing] of preparations and/or re-packaging	General continuous process exposures with sampling.	CS15 General exposures (closed systems) + CS56 With sample collection.	Continuous; daily; 15 mins - 1 hour; product temp.; Indoor	Enclosed process; Outdoor location; closed/semi-closed sampling point	PROC2 Use in closed, continuous process with occasional controlled exposure.	>4 hours; ambient temp.	No LEV	50	1.37
34		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU10** - Formulation [mixing] of preparations and/or re-packaging	General batch process exposures with no sampling.	CS15 General exposures (closed systems).	Batch process; daily; 15 - 1 hour; product temp.; Indoor	Closed equipment, enclosed or vented sampling points	PROC3 Use in closed batch process (synthesis or formulation)	>4 hours; ambient temp.	No LEV	100	0.34
35		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU10** - Formulation [mixing] of preparations and/or re-packaging	Storage	CS67 Storage.	Daily; 8 hrs; product temp.; Indoor	samples collected at dedicated sample point	PROC2 Use in closed, continuous process with occasional controlled exposure.	daily; ambient temp.	No LEV Outdoor activity	50	1.37
36		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU10** - Formulation [mixing] of preparations and/or re-packaging	Sample collection	CS2 Process sampling.	Daily; <15 mins; product temp.; Indoor	Closed or ventilated sampling points	PROC3 Use in closed batch process (synthesis or formulation)	>4 hours; ambient temp.	No LEV	100	1.37

	A	B	C	D	E	F	G	H	I	J	R
		Industrial: **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU10** - Formulation [mixing] of preparations and/or re-packaging	Laboratory activities	CS36 Laboratory activities	Daily 15 mins - 1 hour; product temp.; Indoor	Fume cupboard. PPE.	PROC15 Use as laboratory reagent.	>4 hours, ambient temp.	With LEV	50	0.03
37		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU10** - Formulation [mixing] of preparations and/or re-packaging	Bulk transfers	CS14 Bulk transfers	Daily; 15 min - 1 hour; product temp; collection of line waste in container; Indoor.	Enclosed transfers, vented transfer points; clear lines prior to decoupling	PROC8b Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-cedicated facilities.	daily; ambient temp	With LEV	150	0.69
38		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU10** - Formulation [mixing] of preparations and/or re-packaging	Drum/Batch transfers	CS8 Drum/batch transfers	Daily; 15 - 1 hour; product temp.; Indoor.	Drum pump or dedicated drum handling equipment	PROC8b Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities.	daily; ambient temp.	With LEV	150	0.69
39		**Industrial:** **SU3** - Industrial uses: uses of substances as such or in preparations at industrial sites **SU10** - Formulation [mixing] of preparations and/or re-packaging	Clean down and Maintenance	CS39 Equipment cleaning and maintenance	Daily; 1 - 4 hours; product temp; collection of line waste in container; Indoor.	Enclosed lines; retain wash down in sealed storage pending disposal or use as recycled material for subsequent formulation. PPE.	PROC8a Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities.	daily; ambient temp.	No LEV	250	13.71
40											