

Exposure scenarios for the uses of carbon monoxide.

This document summarises the worker risk assessment and protective measures that are required to ensure that the potential exposure to workers remains within acceptable levels.

Summary of Processes covered by each Exposure Scenario

Exposure Scenario No.	Identified uses	Associated Process Categories (PROCs)
1	Manufacture and distribution of the substance	PROC 1
2	Formulation of mixtures with gas in pressure receptacles, transfilling gas or liquid	PROC 1, 3, 9
3	Using gas for metal treatment	PROC 4
4	Use for electronic component manufacture	PROC 1
5	Use of gas to manufacture pharmaceutical products	PROC 2,3
6	Using gas alone or in mixtures for the calibration of analysis equipment	PROC 1
7	Use as a feedstock in chemical processes, use as an intermediate (transported, on-site isolated)	PROC 1
8	Use in (small) batch and other process (synthesis)	PROC 4
9	Use as a fuel	PROC 16
10	Using gas as a monomer in polymer production	PROC 1, 8b, 9
11	Control of polymerisation process	PROC 1

Summary of Minimum Risk Mitigation methods required by Process Category

PROC	Minimum Risk Management Measures	
	Acute/short-term	Chronic/long-term
1	None	None
2	LEV	LEV
3	LEV	LEV
4	LEV	LEV
8b	LEV	LEV
9	LEV	LEV
15	LEV	LEV
16	LEV	LEV

LEV: Local Exhaust Ventilation

Never use any kind of filtering respiratory protection equipment when working with this substance due to it having poor or no warning properties.

1. Title of Exposure scenario:	
Short title: Industrial use (SU 3). Manufacture and distribution of the substance	
Manufacture of bulk, large scale chemicals (SU 8)	
Manufacture of fine chemicals (SU 9)	
Formulation [mixing] of preparations and/or re-packaging (SU 10)	
Environment: Manufacture of substances	ERC 1
Worker	
Closed system. No contact to substance.	PROC 1

For further information on the use descriptor system refer to ECHA document "Guidance on information requirements and chemical safety assessment Chapter R12: Use descriptor system."

Physical form

Refer to Section 9 of the SDS for physical properties

Maximum Amount Used for this Exposure Scenario

The annual amount used per site covered by this scenario may be greater than 1000 tonnes per year

Composition

Refer to Section 3 of the SDS for information on the composition.

Duration and Frequency of Use

This scenario covers daily exposure of up to 8h/day (5 days a week/ 220 days per year).

Operational Conditions - General

This Exposure Scenario refers to closed systems. In **closed systems** exposure is **negligible**.

Risk Management Measures - Occupational

In these systems, workers exposure to carbon monoxide should be limited by physical containment of the substance within the system.

Workers should be trained in relevant procedures.

Containment plus good work practice should ensure negligible exposure.

Good general ventilation at workplace assumed.

Risk Management Measures – Environment

Locally measured concentrations of carbon monoxide have been estimated. The maximum estimated concentrations are of a similar level to global background levels.

Therefore there is no need for concern for air emissions.

No exposure to the soil or water has been considered as exposure is not expected.

Waste Related Measures

Not applicable as substance is a gas. Cylinders used for transport of carbon monoxide can be reused.

Predicted Exposure:

Risk Management Measures	Maximum Estimated Operator Exposure Concentration (mg/m ³)	
	Short-term	Long-term
None	0.0234	0.0117

Indicative Occupational Exposure Limit values:

Short-term (15 minutes) : 100 ppm (117 mg/m³)

Long-term (8 hours) : 20 ppm (23 mg/m³)

	Short-term	Long-term
Risk Characterisation Ratio	0.0002	0.0005

Calculation method

Assessment was performed using the ECETOC TRA model (May 2010 version) and EUSES v 2.1. In addition to the modelled exposure estimates, monitoring data has been collected on a systematic basis that provides a useful comparison between modelled and actual exposures.

Additional Advice:

The risk management measures presented here are based on the exposure estimates using indicated tools. In the case it is necessary to deviate from these risk management measures, you should perform your own analytical determination of the exposure levels under the operational conditions at your site in order to demonstrate that your existing control measures are sufficient to achieve the IOELV's communicated in this safety data sheet. In this case, you have implemented alternative risk management measures which provide at least an equally effective level of protection. To ensure continuous protection of workers, exposure monitoring should be based on appropriate systematic analytical determination of exposure levels with adequate interpretation of the data.

To better understand whether or not you have to prepare a downstream user's Chemical Safety Assessment (CSA) and Chemical Safety Report (CSR) please consult the ECHA Guidance for downstream users, and in particular the section regarding compliance with the exposure scenario.

2. Title of Exposure scenario:	
Short title: Industrial use (SU 3). Formulation of mixtures with gas in pressure receptacles, transfilling gas or liquid	
Formulation [mixing] of preparations and/or re-packaging (SU 10)	
Environment: Formulation of preparations	ERC 2
Worker	
Closed system. No contact to substance.	PROC 1
Closed batch process. All substance transfers closed. No regular manual interventions.	PROC 3
Enclosed substance transfer points.	PROC 9

For further information on the use descriptor system refer to ECHA document "Guidance on information requirements and chemical safety assessment Chapter R12: Use descriptor system."

Physical form

Refer to Section 9 of the SDS for physical properties

Maximum Amount Used for this Exposure Scenario

The annual amount used per site covered by this scenario is up to 100 tonnes per year

Composition

Refer to Section 3 of the SDS for information on the composition

Duration and Frequency of Use

This scenario covers daily exposure of up to 8h/day (5 days a week/ 220 days per year).

Operational Conditions - General

This Exposure Scenario refers to closed systems. In **closed systems** exposure is **negligible**.

In systems that are not designed to fully contain emissions, local exhaust ventilation is required. Clearly mark areas where the substance may be present with warning signs, control staff entry to work area. Train staff on the potential hazards associated with exposure to carbon monoxide and how exposure may occur. Process at room temperature.

Risk Management Measures - Occupational

In closed systems, workers exposure to carbon monoxide should be limited by physical containment of the substance within the system.

Technical Protective Measures: Where carbon monoxide is being transferred outside of a closed system local exhaust ventilation should be used.

Personal Protective Measures: Respiratory Protective Equipment (self-contained) may be used only in emergency situations where operators are exposed to carbon monoxide.

Workers should be trained in relevant procedures. Apply appropriate management supervision. Good general ventilation at workplace assumed.

Risk Management Measures – Environment

Locally measured concentrations of carbon monoxide have been estimated. The maximum estimated concentrations are of a similar level to global background levels. Therefore there is no need for concern for air emissions.

No exposure to the soil or water has been considered as exposure is not expected.

Waste Related Measures

Not applicable as substance is a gas. Cylinders used for transport of carbon monoxide can be reused.

Predicted Exposure

Risk Management Measures	Maximum Estimated Operator Exposure Concentration (mg/m ³)	
	Short-term	Long-term
None	466	233
Including LEV	46.7	23.3
Measured data	-	1.28

Indicative Occupational Exposure Limit Values:

Short-term (15 minutes) : 100 ppm (117 mg/m³)

Long-term (8 hours) : 20 ppm (23 mg/m³)

	Short-term	Long-term
Risk Characterisation Ratio	0.399	0.056

Calculation method

Assessment was performed using the ECETOC TRA model (May 2010 version) and EUSES v 2.1. In addition to the modelled exposure estimates, monitoring data has been collected on a systematic basis that provides a useful comparison between modelled and actual exposures.

Additional Advice:

The risk management measures presented here are based on the exposure estimates using indicated tools. In the case it is necessary to deviate from these risk management measures, you should perform your own analytical determination of the exposure levels under the operational conditions at your site in order to demonstrate that your existing control measures are sufficient to achieve the IOELV's communicated in this safety data sheet. In this case, you have implemented alternative risk management measures which provide at least an equally effective level of protection. To ensure continuous protection of workers, exposure monitoring should be based on appropriate systematic analytical determination of exposure levels with adequate interpretation of the data.

To better understand whether or not you have to prepare a downstream user's Chemical Safety Assessment (CSA) and Chemical Safety Report (CSR) please consult the ECHA Guidance for downstream users, and in particular the section regarding compliance with the exposure scenario.

3. Title of Exposure scenario:	
Short title: Industrial use (SU 3). Using gas for metal treatment	
Metal surface treatment products, including galvanic and electroplating products (PC 14) Intermediate (PC 19)	
Manufacture of basic metals, including alloys (SU 14) Manufacture of fabricated metal products, except machinery and equipment (SU 15)	
Environment: Industrial use of reactive processing aids	ERC 6b
Worker	
Partially closed batch manufacturing process. No open substance transfers.	PROC 4

For further information on the use descriptor system refer to ECHA document “Guidance on information requirements and chemical safety assessment Chapter R12: Use descriptor system.”

Physical form

Refer to Section 9 of the SDS for physical properties

Maximum Amount Used for this Exposure Scenario

The annual amount used per site covered by this scenario is up to 100 tonnes per year

Composition

Refer to Section 3 of the SDS for information on the composition Duration and Frequency of Use

This scenario covers daily exposure of up to 8h/day (5 days a week/ 220 days per year).

Operational Conditions - General

This Exposure Scenario refers to closed systems. In **closed systems** exposure is **negligible**.

In systems that are not designed to fully contain emissions, local exhaust ventilation is required in order to mitigate the risks posed by the flammability of the gas and the toxicity by inhalation. Process at room temperature.

Risk Management Measures - Occupational

In closed systems, workers exposure to carbon monoxide should be limited by physical containment of the substance within the system.

Technical Protective Measures: Where carbon monoxide is being used outside of a closed system local exhaust ventilation should be used.

Personal Protective Measures: Respiratory Protective Equipment (self-contained) may be used only in emergency situations where operators are exposed to carbon monoxide.

Workers should be trained in relevant procedures. Apply appropriate management supervision.

Good general ventilation at workplace assumed.

Risk Management Measures – Environment

Locally measured concentrations of carbon monoxide have been estimated. The maximum estimated concentrations are of a similar level to global background levels. Therefore there is no need for concern for air emissions.

No exposure to the soil or water has been considered as exposure is not expected.

Waste Related Measures

Not applicable as substance is a gas. Cylinders used for transport of carbon monoxide can be reused.

Predicted Exposure

Risk Management Measures	Maximum Estimated Operator Exposure Concentration (mg/m ³)	
	Short-term	Long-term
None	234	117
Including LEV	23.4	11.7

Indicative Occupational Exposure Limit Values:

Short-term (15 minutes) : 100 ppm (117 mg/m³)

Long-term (8 hours) : 20 ppm (23 mg/m³)

	Short-term	Long-term
Risk Characterisation Ratio	0.200	0.509

Calculation method

For this assessment the calculations were performed using the ECETOC TRA model (May 2010 version) and EUSES v 2.1.

Additional Advice:

The risk management measures presented here are based on the exposure estimates using indicated tools. In the case it is necessary to deviate from these risk management measures, you should perform your own analytical determination of the exposure levels under the operational conditions at your site in order to demonstrate that your existing control measures are sufficient to achieve the IOELV's communicated in this safety data sheet. In this case, you have implemented alternative risk management measures which provide at least an equally effective level of protection. To ensure continuous protection of workers, exposure monitoring should be based on appropriate systematic analytical determination of exposure levels with adequate interpretation of the data.

To better understand whether or not you have to prepare a downstream user's Chemical Safety Assessment (CSA) and Chemical Safety Report (CSR) please consult the ECHA Guidance for downstream users, and in particular the section regarding compliance with the exposure scenario.

4. Title of Exposure scenario:	
Short title: Industrial use (SU 3). Use for electronic component manufacture Semiconductors (PC 33) Manufacture of computer, electronic and optical products, electrical equipment (SU 16)	
Environment: Industrial use resulting in manufacture of another substance (use of intermediates)	ERC 6a
Worker	
Closed system. No contact to substance.	PROC 1

For further information on the use descriptor system refer to ECHA document “Guidance on information requirements and chemical safety assessment Chapter R12: Use descriptor system.”

Physical form

Refer to Section 9 of the SDS for physical properties

Maximum Amount Used for this Exposure Scenario

The annual amount used per site covered by this scenario is up to 10 tonnes per year

Composition

Refer to Section 3 of the SDS for information on the composition

Duration and Frequency of Use

This scenario covers daily exposure of up to 8h/day (5 days a week/ 220 days per year).

Operational Conditions - General

As this use is in **closed systems** exposure is **negligible**.

Risk Management Measures - Occupational

In these systems, workers exposure to carbon monoxide should be limited by physical containment of the substance within the system.

Workers should be trained in relevant procedures.

Containment plus good work practice should ensure negligible exposure.

Good general ventilation at workplace assumed.

Risk Management Measures – Environment

Locally measured concentrations of carbon monoxide have been estimated. The maximum estimated concentrations are of a similar level to global background levels. Therefore there is no need for concern for air emissions.

No exposure to the soil or water has been considered as exposure is not expected.

Waste Related Measures

Not applicable as substance is a gas. Cylinders used for transport of carbon monoxide can be reused.

Predicted Exposure:

Risk Management Measures	Maximum Estimated Operator Exposure Concentration (mg/m ³)	
	Short-term	Long-term
None	0.0234	0.0117

Indicative Occupational Exposure Limit Values:
 Short-term (15 minutes) : 100 ppm (117 mg/m³)
 Long-term (8 hours) : 20 ppm (23 mg/m³)

	Short-term	Long-term
Risk Characterisation Ratio	0.0002	0.0005

Calculation method

Assessment was performed using the ECETOC TRA model (May 2010 version) and EUSES v 2.1. In addition to the modelled exposure estimates, monitoring data has been collected on a systematic basis that provides a useful comparison between modelled and actual exposures.

Additional Advice:

The risk management measures presented here are based on the exposure estimates using indicated tools. In the case it is necessary to deviate from these risk management measures, you should perform your own analytical determination of the exposure levels under the operational conditions at your site in order to demonstrate that your existing control measures are sufficient to achieve the IOELV's communicated in this safety data sheet. In this case, you have implemented alternative risk management measures which provide at least an equally effective level of protection. To ensure continuous protection of workers, exposure monitoring should be based on appropriate systematic analytical determination of exposure levels with adequate interpretation of the data.

To better understand whether or not you have to prepare a downstream user's Chemical Safety Assessment (CSA) and Chemical Safety Report (CSR) please consult the ECHA Guidance for downstream users, and in particular the section regarding compliance with the exposure scenario.

5. Title of Exposure scenario:	
Short title: Industrial use (SU 3). Use of gas to manufacture pharmaceutical products Intermediate (PC 19) Manufacture of fine chemicals (SU 9)	
Environment: Industrial use resulting in manufacture of another substance (use of intermediates)	ERC 6a
Worker	
Closed continuous process, All substance transfers closed. No regular manual interventions.	PROC 2
Closed batch process. All substance transfers closed. No regular manual interventions.	PROC 3

For further information on the use descriptor system refer to ECHA document “Guidance on information requirements and chemical safety assessment Chapter R12: Use descriptor system.”

Physical form

Refer to Section 9 of the SDS for physical properties

Maximum Amount Used for this Exposure Scenario

The annual amount used per site covered by this scenario is up to 10 tonnes per year

Composition

Refer to Section 3 of the SDS for information on the composition

Duration and Frequency of Use

This scenario covers daily exposure of up to 8h/day (5 days a week/ 220 days per year).

Operational Conditions - General

In general these are **closed systems** and therefore exposure to carbon monoxide should be **negligible**. At periods where exposure to carbon monoxide is possible (e.g. when sampling is due to take place) local exhaust ventilation should be in place to mitigate the risks posed by the flammability of the gas and also the toxicity of the gas by inhalation.

Risk Management Measures - Occupational

In these systems, workers exposure to carbon monoxide should be limited by physical containment of the substance within the system.

Workers should be trained in relevant procedures.

Containment plus good work practice should ensure that carbon monoxide is used in a safe way. Good general ventilation at workplace assumed.

Risk Management Measures – Environment

Locally measured concentrations of carbon monoxide have been estimated. The maximum estimated concentrations are of a similar level to global background levels. Therefore there is no need for concern for air emissions.

No exposure to the soil or water has been considered as exposure is not expected.

Waste Related Measures

Not applicable as substance is a gas. Cylinders used for transport of carbon monoxide can be reused.

Predicted Exposure

Risk Management Measures	Maximum Estimated Operator Exposure Concentration (mg/m ³)	
	Short-term	Long-term
None	234	117
Including LEV	23.4	11.7

Indicative Occupational Exposure Limit Values:
 Short-term (15 minutes) : 100 ppm (117 mg/m³)
 Long-term (8 hours) : 20 ppm (23 mg/m³)

	Short-term	Long-term
Risk Characterisation Ratio	0.200	0.509

Calculation method

For this assessment the calculation was performed using the ECETOC TRA model (May 2010 version) and EUSES v 2.1.

Additional Advice

The risk management measures presented here are based on the exposure estimates using indicated tools. In the case it is necessary to deviate from these risk management measures, you should perform your own analytical determination of the exposure levels under the operational conditions at your site in order to demonstrate that your existing control measures are sufficient to achieve the IOELV's communicated in this safety data sheet. In this case, you have implemented alternative risk management measures which provide at least an equally effective level of protection. To ensure continuous protection of workers, exposure monitoring should be based on appropriate systematic analytical determination of exposure levels with adequate interpretation of the data.

To better understand whether or not you have to prepare a downstream user's Chemical Safety Assessment (CSA) and Chemical Safety Report (CSR) please consult the ECHA Guidance for downstream users, and in particular the section regarding compliance with the exposure scenario.

6. Title of Exposure scenario:	
<p>Short title: Industrial use (SU 3). Using gas alone or in mixtures for the calibration of analysis equipment</p> <p>Laboratory chemicals (PC 21)</p> <p>Manufacture of bulk, large scale chemicals (including petroleum products) (SU 8)</p> <p>Manufacture of fine chemicals (SU 9)</p> <p>Formulation [mixing] of preparations and/or re-packaging (excluding alloys) (SU 10)</p> <p>Manufacture of plastics products, including compounding and conversion (SU 12)</p> <p>Manufacture of basic metals, including alloys (SU 14)</p> <p>Manufacture of fabricated metal products, except machinery and equipment (SU 15)</p> <p>Manufacture of computer, electronic and optical products, electrical equipment (SU 16)</p>	
Environment: Wide dispersive outdoor use of processing aids in open systems	ERC 8d
Worker	
Closed system. No contact to substance.	PROC 1

For further information on the use descriptor system refer to ECHA document “Guidance on information requirements and chemical safety assessment Chapter R12: Use descriptor system.”

Physical form

Refer to Section 9 of the SDS for physical properties

Maximum Amount Used for this Exposure Scenario

The annual amount used per site covered by this scenario is up to 10 tonnes per year

Composition

Refer to Section 3 of the SDS for information on the composition

Duration and Frequency of Use

This scenario covers daily exposure of up to 8h/day (5 days a week/ 220 days per year).

Operational Conditions - General

This Exposure Scenario refers to closed systems. In **closed systems** exposure is negligible.

Risk Management Measures - Occupational

In these systems, workers exposure to carbon monoxide should be limited by physical containment of the substance within the system.

Workers should be trained in relevant procedures.

Containment plus good work practice should ensure negligible exposure.

Good general ventilation at workplace assumed.

Risk Management Measures – Environment

Locally measured concentrations of carbon monoxide have been estimated. The maximum estimated concentrations are of a similar level to global background levels. Therefore there is no need for concern for air emissions.

No exposure to the soil or water has been considered as exposure is not expected.

Waste Related Measures

Not applicable as substance is a gas. Cylinders used for transport of carbon monoxide can be reused.

Predicted Exposure:

Risk Management Measures	Maximum Estimated Operator Exposure Concentration (mg/m ³)	
	Short-term	Long-term
None	0.0234	0.0117

Indicative Occupational Exposure Limit Values:

Short-term (15 minutes) : 100 ppm (117 mg/m³)

Long-term (8 hours) : 20 ppm (23 mg/m³)

	Short-term	Long-term
Risk Characterisation Ratio	0.0002	0.0005

Calculation method

Assessment was performed using the ECETOC TRA model (May 2010 version) and EUSES v 2.1. In addition to the modelled exposure estimates, monitoring data has been collected on a systematic basis that provides a useful comparison between modelled and actual exposures

Additional Advice:

The risk management measures presented here are based on the exposure estimates using indicated tools. In the case it is necessary to deviate from these risk management measures, you should perform your own analytical determination of the exposure levels under the operational conditions at your site in order to demonstrate that your existing control measures are sufficient to achieve the IOELV's communicated in this safety data sheet. In this case, you have implemented alternative risk management measures which provide at least an equally effective level of protection. To ensure continuous protection of workers, exposure monitoring should be based on appropriate systematic analytical determination of exposure levels with adequate interpretation of the data.

To better understand whether or not you have to prepare a downstream user's Chemical Safety Assessment (CSA) and Chemical Safety Report (CSR) please consult the ECHA Guidance for downstream users, and in particular the section regarding compliance with the exposure scenario.

7. Title of Exposure scenario:	
Short title: Industrial use (SU 3). Use as feedstock in chemical processes, use as an intermediate (transported, on-site isolated) Intermediate (PC 19) Manufacture of bulk, large scale chemicals (including petroleum products) (SU 8) Manufacture of fine chemicals (SU 9)	
Environment: Industrial use resulting in manufacture of another substance (use of intermediates)	ERC 6a
Worker	
Closed system. No contact to substance.	PROC 1

For further information on the use descriptor system refer to ECHA document "Guidance on information requirements and chemical safety assessment Chapter R12: Use descriptor system."

Physical form

Refer to Section 9 of the SDS for physical properties

Maximum Amount Used for this Exposure Scenario

The annual amount used per site covered by this scenario may be greater than 1000 tonnes per year

Composition

Refer to Section 3 of the SDS for information on the composition

Duration and Frequency of Use

This scenario covers daily exposure of up to 8h/day (5 days a week/ 220 days per year).

Operational Conditions - General

This Exposure Scenario refers to closed systems. In **closed systems** exposure is negligible.

Risk Management Measures - Occupational

In these systems, workers exposure to carbon monoxide should be limited by physical containment of the substance within the system.

Workers should be trained in relevant procedures.

Containment plus good work practice should ensure negligible exposure.

Good general ventilation at workplace assumed.

Risk Management Measures – Environment

Locally measured concentrations of carbon monoxide have been estimated. The maximum estimated concentrations are of a similar level to global background levels. Therefore there is no need for concern for air emissions.

No exposure to the soil or water has been considered as exposure is not expected.

Waste Related Measures

Not applicable as substance is a gas. Cylinders used for transport of carbon monoxide can be reused.

Predicted Exposure:

Risk Management Measures	Maximum Estimated Operator Exposure Concentration (mg/m ³)	
	Short-term	Long-term
None	0.0234	0.0117

Indicative Occupational Exposure Limit Values:
 Short-term (15 minutes) : 100 ppm (117 mg/m³)
 Long-term (8 hours) : 20 ppm (23 mg/m³)

	Short-term	Long-term
Risk Characterisation Ratio	0.0002	0.0005

Calculation method

Assessment was performed using the ECETOC TRA model (May 2010 version) and EUSES v 2.1. In addition to the modelled exposure estimates, monitoring data has been collected on a systematic basis that provides a useful comparison between modelled and actual exposures

Additional Advice:

The risk management measures presented here are based on the exposure estimates using indicated tools. In the case it is necessary to deviate from these risk management measures, you should perform your own analytical determination of the exposure levels under the operational conditions at your site in order to demonstrate that your existing control measures are sufficient to achieve the IOELV's communicated in this safety data sheet. In this case, you have implemented alternative risk management measures which provide at least an equally effective level of protection. To ensure continuous protection of workers, exposure monitoring should be based on appropriate systematic analytical determination of exposure levels with adequate interpretation of the data.

To better understand whether or not you have to prepare a downstream user's Chemical Safety Assessment (CSA) and Chemical Safety Report (CSR) please consult the ECHA Guidance for downstream users, and in particular the section regarding compliance with the exposure scenario.

8. Title of Exposure scenario:	
Short title: Industrial use (SU 3). Use as a laboratory reagent Laboratory chemicals (PC 21) Manufacture of bulk, large scale chemicals (including petroleum products) (SU 8) Manufacture of fine chemicals (SU 9)	
Environment: Manufacture of substances	ERC 1
Worker	
Use in (small) batch and other process (synthesis)	PROC 4

For further information on the use descriptor system refer to ECHA document “Guidance on information requirements and chemical safety assessment Chapter R12: Use descriptor system.”

Physical form

Refer to Section 9 of the SDS for physical properties

Maximum Amount Used for this Exposure Scenario

The annual amount used per site covered by this scenario ranges up to 10 tonnes per year.

Composition

Refer to Section 3 of the SDS for information on the composition

Duration and Frequency of Use

This scenario covers daily exposure of up to 8h/day (5 days a week/ 220 days per year).

Operational Conditions - General

This scenario is based on small quantities of carbon monoxide being used as a laboratory reagent in small scale laboratories. Larger laboratories and R&D installations are considered as industrial processes. Process at room temperature.

Risk Management Measures - Occupational

In these systems, workers exposure to carbon monoxide should be limited by physical containment of the substance and the use of local exhaust ventilation.

Staff should be made aware that when carbon monoxide is used, local area ventilation should be used to mitigate the risks posed from the flammability of the gas and the toxicity of the gas of the gas by inhalation.

Workers should be trained in relevant procedures.

Containment plus good work practice should ensure safe use.

Good general ventilation at workplace assumed.

Risk Management Measures – Environment

Locally measured concentrations of carbon monoxide have been estimated. The maximum estimated concentrations are of a similar level to global background levels. Therefore there is no need for concern for air emissions.

No exposure to the soil or water has been considered as exposure is not expected.

Waste Related Measures

Not applicable as substance is a gas. Cylinders used for transport of carbon monoxide can be reused.

Predicted Exposure

Risk Management Measures	Maximum Estimated Operator Exposure Concentration (mg/m ³)	
	Short-term	Long-term
None	234	117
Including LEV	23.4	11.7

Indicative Occupational Exposure Limit Values:

Short-term (15 minutes) : 100 ppm (117 mg/m³)

Long-term (8 hours) : 20 ppm (23 mg/m³)

	Short-term	Long-term
Risk Characterisation Ratio	0.200	0.509

Calculation method

Assessment was performed using the ECETOC TRA model (May 2010 version) and EUSES v 2.1. In addition to the modelled exposure estimates, monitoring data has been collected on a systematic basis that provides a useful comparison between modelled and actual exposures

Additional Advice:

The risk management measures presented here are based on the exposure estimates using indicated tools. In the case it is necessary to deviate from these risk management measures, you should perform your own analytical determination of the exposure levels under the operational conditions at your site in order to demonstrate that your existing control measures are sufficient to achieve the IOELV's communicated in this safety data sheet. In this case, you have implemented alternative risk management measures which provide at least an equally effective level of protection. To ensure continuous protection of workers, exposure monitoring should be based on appropriate systematic analytical determination of exposure levels with adequate interpretation of the data.

To better understand whether or not you have to prepare a downstream user's Chemical Safety Assessment (CSA) and Chemical Safety Report (CSR) please consult the ECHA Guidance for downstream users, and in particular the section regarding compliance with the exposure scenario.

9. Title of Exposure scenario:	
Short title: Industrial use (SU 3). Use as a fuel	
Fuels (PC 13)	
Electricity, steam, gas water supply and sewage treatment (SU 23)	
Environment	
Wide dispersive indoor use of processing aids in open systems	ERC 8a
Wide dispersive indoor use of reactive substances in open systems	ERC 8b
Worker	
Fuel use in contained, dedicated equipment. No substance transfers	PROC 16

For further information on the use descriptor system refer to ECHA document "Guidance on information requirements and chemical safety assessment Chapter R12: Use descriptor system."

Physical form

Refer to Section 9 of the SDS for physical properties

Maximum Amount Used for this Exposure Scenario

The annual amount used per site covered by this scenario is up to 10 tonnes/year

Composition

Refer to Section 3 of the SDS for information on the composition

Duration and Frequency of Use

This scenario covers daily exposure of up to 8h/day (5 days a week/ 220 days per year).

Operational Conditions - General

Carbon monoxide is burned as a fuel in the generation of electricity. In this scenario there is limited exposure, however there may be exposure to some unburned material. In these instances local exhaust ventilation should be used to mitigate the risks posed from the flammability of the gas and the toxicity of the gas by inhalation. Process at room temperature.

Risk Management Measures - Occupational

In these systems, workers exposure to carbon monoxide should be limited by physical containment of the substance and the use of local exhaust ventilation.

Staff should be made aware that when carbon monoxide is used, local area ventilation should be used to mitigate the risks posed from the flammability of the gas and the toxicity of the gas of the gas by inhalation.

Workers should be trained in relevant procedures.

Containment plus good work practice should ensure safe use.

Good general ventilation at workplace assumed.

Risk Management Measures – Environment

Locally measured concentrations of carbon monoxide have been estimated. The maximum estimated concentrations are of a similar level to global background levels. Therefore there is no need for concern for air emissions.

No exposure to the soil or water has been considered as exposure is not expected.

Waste Related Measures

Not applicable as substance is a gas. Cylinders used for transport of carbon monoxide can be reused.

Predicted Exposure

Risk Management Measures	Maximum Estimated Operator Exposure Concentration (mg/m ³)	
	Short-term	Long-term
None	58.4	29.2
Including LEV	5.84	2.92

Indicative Occupational Exposure Limit Values:
 Short-term (15 minutes) : 100 ppm (117 mg/m³)
 Long-term (8 hours) : 20 ppm (23 mg/m³)

	Short-term	Long-term
Risk Characterisation Ratio	0.050	0.127

Calculation method

In this assessment the calculations were performed using the ECETOC TRA model (May 2010 version) and EUSES v 2.1.

Additional Advice:

The risk management measures presented here are based on the exposure estimates using indicated tools. In the case it is necessary to deviate from these risk management measures, you should perform your own analytical determination of the exposure levels under the operational conditions at your site in order to demonstrate that your existing control measures are sufficient to achieve the IOELV's communicated in this safety data sheet. In this case, you have implemented alternative risk management measures which provide at least an equally effective level of protection. To ensure continuous protection of workers, exposure monitoring should be based on appropriate systematic analytical determination of exposure levels with adequate interpretation of the data.

To better understand whether or not you have to prepare a downstream user's Chemical Safety Assessment (CSA) and Chemical Safety Report (CSR) please consult the ECHA Guidance for downstream users, and in particular the section regarding compliance with the exposure scenario.

10. Title of Exposure scenario:	
Short title: Industrial use (SU 3). Using gas as a monomer in polymer production Polymer preparations and compounds (PC 32) Manufacture of bulk, large scale chemicals (including petroleum products) (SU 8) Manufacture of plastics products, including compounding and conversion (SU 12)	
Environment: Formulation of preparations	ERC 2
Worker	
Closed system. No contact to substance.	PROC 1
Partially closed sub-stance transfers and control of exhaust air.	PROC 8b
Enclosed substance transfer points.	PROC 9

For further information on the use descriptor system refer to ECHA document “Guidance on information requirements and chemical safety assessment Chapter R12: Use descriptor system.”

Physical form

Refer to Section 9 of the SDS for physical properties

Maximum Amount Used for this Exposure Scenario

The annual amount used per site covered by this scenario is up to 100 tonnes per year

Composition

Refer to Section 3 of the SDS for information on the composition

Duration and Frequency of Use

This scenario covers daily exposure of up to 8h/day (5 days a week/ 220 days per year).

Operational Conditions - General

This Exposure Scenario refers to closed systems. In closed systems exposure is negligible.

In situations where carbon monoxide is being transferred into large or small vessels, there is the possibility of operator exposure. In these cases local exhaust ventilation is required. Clearly mark areas where substance contamination may be present with warning signs, control staff entry to work area. Train staff on the potential hazards associated with exposure to carbon monoxide and how exposure may occur. Process at room temperature.

Risk Management Measures - Occupational

In closed systems, workers exposure to carbon monoxide should be limited by physical containment of the substance within the system.

Technical Protective Measures: Where carbon monoxide is being transferred outside of a closed system local exhaust ventilation should be used.

Personal Protective Measures: Respiratory Protective Equipment (self-contained) may be used only in emergency situations where operators are exposed to carbon monoxide.

Workers should be trained in relevant procedures. Apply appropriate management supervision. Good general ventilation at workplace assumed.

Risk Management Measures – Environment

Locally measured concentrations of carbon monoxide have been estimated. The maximum estimated concentrations are of a similar level to global background levels. Therefore there is no need for concern for air emissions.

No exposure to the soil or water has been considered as exposure is not expected.

Waste Related Measures

Not applicable as substance is a gas. Cylinders used for transport of carbon monoxide can be reused.

Predicted Exposure

Risk Management Measures	Maximum Estimated Operator Exposure Concentration (mg/m ³)	
	Short-term	Long-term
None	466	233
Including LEV	46.6	23.3
Measured data	-	1.28

Indicative Occupational Exposure Limit Values:

Short-term (15 minutes) : 100 ppm (117 mg/m³)

Long-term (8 hours) : 20 ppm (23 mg/m³)

	Short-term	Long-term
Risk Characterisation Ratio	0.398	0.056

Calculation method

Assessment was performed using the ECETOC TRA model (May 2010 version) and EUSES v 2.1. In addition to the modelled exposure estimates, monitoring data has been collected on a systematic basis that provides a useful comparison between modelled and actual exposures.

Additional Advice:

The risk management measures presented here are based on the exposure estimates using indicated tools. In the case it is necessary to deviate from these risk management measures, you should perform your own analytical determination of the exposure levels under the operational conditions at your site in order to demonstrate that your existing control measures are sufficient to achieve the IOELV's communicated in this safety data sheet. In this case, you have implemented alternative risk management measures which provide at least an equally effective level of protection. To ensure continuous protection of workers, exposure monitoring should be based on appropriate systematic analytical determination of exposure levels with adequate interpretation of the data.

To better understand whether or not you have to prepare a downstream user's Chemical Safety Assessment (CSA) and Chemical Safety Report (CSR) please consult the ECHA Guidance for downstream users, and in particular the section regarding compliance with the exposure scenario.

11. Title of Exposure scenario:	
Short title: Industrial use (SU 3). Control of polymerisation processes Intermediate (PC 19) Manufacture of plastics products, including compounding and conversion (SU 12)	
Environment: Industrial use of reactive processing aids	ERC 6b
Worker	
Closed system. No contact to substance.	PROC 1

For further information on the use descriptor system refer to ECHA document "Guidance on information requirements and chemical safety assessment Chapter R12: Use descriptor system."

Physical form

Refer to Section 9 of the SDS for physical properties

Maximum Amount Used for this Exposure Scenario

The annual amount used per site covered by this scenario is up to 100 tonnes per year

Composition

Refer to Section 3 of the SDS for information on the composition

Duration and Frequency of Use

This scenario covers daily exposure of up to 8h/day (5 days a week/ 220 days per year).

Operational Conditions - General

This Exposure Scenario refers to closed systems. In closed systems exposure is negligible.

Risk Management Measures - Occupational

In these systems, workers exposure to carbon monoxide should be limited by physical containment of the substance within the system.

Workers should be trained in relevant procedures.

Containment plus good work practice should ensure negligible operator exposure.

Good general ventilation at workplace assumed.

Risk Management Measures – Environment

Locally measured concentrations of carbon monoxide have been estimated. The maximum estimated concentrations are of a similar level to global background levels. Therefore there is no need for concern for air emissions.

No exposure to the soil or water has been considered as exposure is not expected.

Waste Related Measures

Not applicable as substance is a gas. Cylinders used for transport of carbon monoxide can be reused.

Predicted Exposure:

Risk Management Measures	Maximum Estimated Operator Exposure Concentration (mg/m ³)	
	Short-term	Long-term
None	0.0234	0.0117

Indicative Occupational Exposure Limit Values:

Short-term (15 minutes) : 100 ppm (117 mg/m³)

Long-term (8 hours) : 20 ppm (23 mg/m³)

	Short-term	Long-term
Risk Characterisation Ratio	0.0002	0.0005

Calculation method

Assessment was performed using the ECETOC TRA model and EUSES v 2.1

In addition to the modelled exposure estimates, monitoring data has been collected on a systematic basis that provides a useful comparison between modelled and actual exposures

Additional Advice:

The risk management measures presented here are based on the exposure estimates using indicated tools. In the case it is necessary to deviate from these risk management measures, you should perform your own analytical determination of the exposure levels under the operational conditions at your site in order to demonstrate that your existing control measures are sufficient to achieve the IOELV's communicated in this safety data sheet. In this case, you have implemented alternative risk management measures which provide at least an equally effective level of protection. To ensure continuous protection of workers, exposure monitoring should be based on appropriate systematic analytical determination of exposure levels with adequate interpretation of the data.

To better understand whether or not you have to prepare a downstream user's Chemical Safety Assessment (CSA) and Chemical Safety Report (CSR) please consult the ECHA Guidance for downstream users, and in particular the section regarding compliance with the exposure scenario.