



CHEMICAL SAFETY REPORT

Substance Name: [calcium chloride](#)

EC Number: 233-140-8

CAS Number: 10043-52-4

Registrant's Identity: Macco Organiques, s.r.o.



Table of Contents

Part A	16
1. SUMMARY OF RISK MANAGEMENT MEASURES	17
2. DECLARATION THAT RISK MANAGEMENT MEASURES ARE IMPLEMENTED	18
3. DECLARATION THAT RISK MANAGEMENT MEASURES ARE COMMUNICATED	19
Part B	20
1. IDENTITY OF THE SUBSTANCE AND PHYSICAL AND CHEMICAL PROPERTIES	21
1.1. Name and other identifiers of the substance	21
1.2. Composition of the substance	21
1.3. Information on linked categories	24
1.4. Physicochemical properties	24
2. MANUFACTURE AND USES	29
2.1. Manufacture	29
2.2. Identified uses	31
3. CLASSIFICATION AND LABELLING	36
3.1. Classification and labelling according to CLP / GHS	36
4. ENVIRONMENTAL FATE PROPERTIES	39
4.1. Degradation	39
4.1.1. Abiotic degradation	39
4.1.1.1. Hydrolysis	39
4.1.1.2. Phototransformation/photolysis	39
4.1.1.2.1. Phototransformation in air	39
4.1.1.2.2. Phototransformation in water	39
4.1.1.2.3. Phototransformation in soil	39
4.1.2. Biodegradation	39
4.1.2.1. Biodegradation in water	39
4.1.2.1.1. Screening tests	39
4.1.2.1.2. Simulation tests (water and sediments)	40
4.1.2.1.3. Summary and discussion of biodegradation in water and sediment	40
4.1.2.2. Biodegradation in soil	40
4.1.3. Summary and discussion of degradation	40
4.2. Environmental distribution	40
4.2.1. Adsorption/desorption	40
4.2.2. Volatilisation	40
4.2.3. Distribution modelling	41
4.2.4. Summary and discussion of environmental distribution	41
4.3. Bioaccumulation	41
4.3.1. Aquatic bioaccumulation	41
4.3.2. Terrestrial bioaccumulation	41
4.3.3. Summary and discussion of bioaccumulation	41
4.4. Secondary poisoning	41
5. HUMAN HEALTH HAZARD ASSESSMENT	42
5.1. Toxicokinetics (absorption, metabolism, distribution and elimination)	42
5.1.1. Non-human information	42
5.1.2. Human information	42
5.1.3. Summary and discussion of toxicokinetics	42
5.2. Acute toxicity	43
5.2.1. Non-human information	43
5.2.1.1. Acute toxicity: oral	43
5.2.1.2. Acute toxicity: inhalation	45
5.2.1.3. Acute toxicity: dermal	45
5.2.1.4. Acute toxicity: other routes	46
5.2.2. Human information	46
5.2.3. Summary and discussion of acute toxicity	46
5.3. Irritation	47



5.3.1. Skin	47
5.3.1.1. Non-human information	47
5.3.1.2. Human information	50
5.3.2. Eye	50
5.3.2.1. Non-human information	50
5.3.2.2. Human information	56
5.3.3. Respiratory tract	56
5.3.3.1. Non-human information	56
5.3.3.2. Human information	56
5.3.4. Summary and discussion of irritation	56
5.4. Corrosivity	58
5.4.1. Non-human information	58
5.4.2. Human information	59
5.4.3. Summary and discussion of corrosion	59
5.5. Sensitisation	59
5.5.1. Skin	59
5.5.1.1. Non-human information	59
5.5.1.2. Human information	60
5.5.2. Respiratory system	60
5.5.2.1. Non-human information	60
5.5.2.2. Human information	60
5.5.3. Summary and discussion of sensitisation	60
5.6. Repeated dose toxicity	60
5.6.1. Non-human information	60
5.6.1.1. Repeated dose toxicity: oral	60
5.6.1.2. Repeated dose toxicity: inhalation	63
5.6.1.3. Repeated dose toxicity: dermal	63
5.6.1.4. Repeated dose toxicity: other routes	64
5.6.2. Human information	64
5.6.3. Summary and discussion of repeated dose toxicity	64
5.7. Mutagenicity	65
5.7.1. Non-human information	65
5.7.1.1. In vitro data	65
5.7.1.2. In vivo data	66
5.7.2. Human information	66
5.7.3. Summary and discussion of mutagenicity	66
5.8. Carcinogenicity	67
5.8.1. Non-human information	67
5.8.1.1. Carcinogenicity: oral	67
5.8.1.2. Carcinogenicity: inhalation	67
5.8.1.3. Carcinogenicity: dermal	67
5.8.1.4. Carcinogenicity: other routes	67
5.8.2. Human information	67
5.8.3. Summary and discussion of carcinogenicity	67
5.9. Toxicity for reproduction	68
5.9.1. Effects on fertility	68
5.9.1.1. Non-human information	68
5.9.1.2. Human information	69
5.9.2. Developmental toxicity	69
5.9.2.1. Non-human information	69
5.9.2.2. Human information	70
5.9.3. Summary and discussion of reproductive toxicity	70
5.10. Other effects	71
5.10.1. Non-human information	72
5.10.1.1. Neurotoxicity	72
5.10.1.2. Immunotoxicity	72
5.10.1.3. Specific investigations: other studies	72
5.10.1.4. Additional toxicological effects	72
5.10.2. Human information	72
5.10.3. Summary and discussion of other effects	72



5.11. Derivation of DNEL(s) and other hazard conclusions	72
5.11.1. Overview of typical dose descriptors for all endpoints	72
5.11.2. Selection of the DNEL(s) or other hazard conclusions for critical health effects	73
6. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICOCHEMICAL PROPERTIES	85
6.1. Explosivity	85
6.2. Flammability	85
6.3. Oxidising potential	86
7. ENVIRONMENTAL HAZARD ASSESSMENT	88
7.1. Aquatic compartment (including sediment)	88
7.1.1. Fish	88
7.1.1.1. Short-term toxicity to fish	88
7.1.1.2. Long-term toxicity to fish	89
7.1.2. Aquatic invertebrates	90
7.1.2.1. Short-term toxicity to aquatic invertebrates	90
7.1.2.2. Long-term toxicity to aquatic invertebrates	98
7.1.3. Algae and aquatic plants	99
7.1.4. Sediment organisms	101
7.1.5. Other aquatic organisms	101
7.2. Terrestrial compartment	102
7.2.1. Toxicity to soil macro-organisms	104
7.2.2. Toxicity to terrestrial plants	104
7.2.3. Toxicity to soil micro-organisms	105
7.2.4. Toxicity to other terrestrial organisms	106
7.3. Atmospheric compartment	106
7.4. Microbiological activity in sewage treatment systems	106
7.5. Non compartment specific effects relevant for the food chain (secondary poisoning)	106
7.5.1. Toxicity to birds	106
7.5.2. Toxicity to mammals	106
7.6. PNEC derivation and other hazard conclusions	107
7.6.1. PNEC derivation and other hazard conclusions	107
8. PBT AND vPvB ASSESSMENT	109
8.1. Assessment of PBT/vPvB Properties	109
8.1.1. PBT/vPvB criteria and justification	109
8.1.2. Summary and overall conclusions on PBT or vPvB properties	109
8.2. Emission characterisation	109
9. EXPOSURE ASSESSMENT (and related risk characterisation)	110
9.0. Introduction	110
9.0.1. Overview on uses	110
9.0.2. Assessment entity groups	110
9.0.3. Introduction to the assessment for the environment	110
9.0.3.1. Tonnage	110
9.0.3.2. Scope and type of assessment for the environment	111
9.0.3.3. Fate and distribution parameters	111
9.0.3.4. Comments on assessment approach for the environment	112
9.0.3.5. Scope and type of assessment for man via environment	112
9.0.4. Introduction to the assessment for workers	112
9.0.4.1. Scope and type of assessment for workers	112
9.0.4.2. Comments on assessment approach for workers	113
9.0.5. Introduction to the assessment for consumers	114
9.0.5.1. Scope and type of assessment for consumers	114
9.0.5.2. Comments on assessment approach for consumers	115
9.1. Exposure scenario 1: Manufacture - Manufacture	116
9.1.1. Env CS 1: Manufacturing of substances (ERC 1)	117
9.1.1.1. Conditions of use	117
9.1.1.2. Releases	118
9.1.1.3. Exposure and risks for the environment and man via the environment	118
9.1.2. Worker CS 2: Chemical production in closed process without likelihood of exposure or in containment conditions or processes with equivalent containment condition (PROC 1)	119
9.1.2.1. Conditions of use	119



9.1.2.2. Exposure and risks for workers	119
9.1.3. Worker CS 3: Chemical production in closed continuous process with occasional controlled exposure or processes with equivalent containment condition (PROC 2)	120
9.1.3.1. Conditions of use	120
9.1.3.2. Exposure and risks for workers	120
9.1.4. Worker CS 4: Manufacture in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC 3)	121
9.1.4.1. Conditions of use	121
9.1.4.2. Exposure and risks for workers	121
9.1.5. Worker CS 5: Chemical production where opportunity for exposure arises (PROC 4)	122
9.1.5.1. Conditions of use	122
9.1.5.2. Exposure and risks for workers	122
9.1.6. Worker CS 6: Transfer of a substance or mixture during process sampling at dedicated facilities (PROC 8b, PROC 26)	123
9.1.6.1. Conditions of use	123
9.1.6.2. Exposure and risks for workers	123
9.1.7. Worker CS 7: Transfer of a substance or mixture during process sampling at non-dedicated facilities (PROC 8a, PROC 26)	124
9.1.7.1. Conditions of use	124
9.1.7.2. Exposure and risks for workers	124
9.1.8. Worker CS 8: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9, PROC 26)	124
9.1.8.1. Conditions of use	125
9.1.8.2. Exposure and risks for workers	125
9.1.9. Worker CS 9: Tableting, compression, extrusion, pelettisation, granulation (PROC 14)	125
9.1.9.1. Conditions of use	125
9.1.9.2. Exposure and risks for workers	126
9.1.10. Worker CS 10: Use as laboratory reagent (PROC 15, PROC 26)	126
9.1.10.1. Conditions of use	126
9.1.10.2. Exposure and risks for workers	127
9.1.11. Worker CS 11: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC 8a, PROC 26)	127
9.1.11.1. Conditions of use	127
9.1.11.2. Exposure and risks for workers	128
9.1.12. Worker CS 12: Transfer of substance or mixture (charging/discharging) at dedicated-facilities (PROC 8b, PROC 26)	128
9.1.12.1. Conditions of use	128
9.1.12.2. Exposure and risks for workers	129
9.1.13. Worker CS 13: Equipment cleaning and maintenance at non-dedicated facility (PROC 8a, PROC 28)	129
9.1.13.1. Conditions of use	129
9.1.13.2. Exposure and risks for workers	130
9.1.14. Worker CS 14: Handling of solid inorganic substances at ambient temperature (PROC 26)	130
9.1.14.1. Conditions of use	130
9.1.14.2. Exposure and risks for workers	131
9.1.15. Worker CS 15: Manual maintenance (cleaning and repair) of machinery at non-dedicated facility (PROC 28)	131
9.1.15.1. Conditions of use	131
9.1.15.2. Exposure and risks for workers	132
9.2. Exposure scenario 2: Formulation or re-packing - Formulation or re-packing; Distribution of substance	133
9.2.1. Env CS 1: Formulation into mixture (ERC 2)	134
9.2.1.1. Conditions of use	134
9.2.1.2. Releases	134
9.2.1.3. Exposure and risks for the environment and man via the environment	134
9.2.2. Worker CS 2: Chemical production in closed process without likelihood of exposure or in containment conditions. (PROC 1)	135



9.2.2.1. Conditions of use	135
9.2.2.2. Exposure and risks for workers	135
9.2.3. Worker CS 3: Chemical production in closed continuous process with occasional controlled exposure. (PROC 2)	135
9.2.3.1. Conditions of use	136
9.2.3.2. Exposure and risks for workers	136
9.2.4. Worker CS 4: Formulation in closed batch processes with occasional controlled exposure. (PROC 3)	136
9.2.4.1. Conditions of use	136
9.2.4.2. Exposure and risks for workers	137
9.2.5. Worker CS 5: Chemical production where opportunity for exposure arises (PROC 4)	137
9.2.5.1. Conditions of use	137
9.2.5.2. Exposure and risks for workers	138
9.2.6. Worker CS 6: Mixing or blending in batch processes (PROC 5)	138
9.2.6.1. Conditions of use	138
9.2.6.2. Exposure and risks for workers	139
9.2.7. Worker CS 7: Transfer of a substance or mixture during process sampling at dedicated facilities (PROC 8b, PROC 26)	139
9.2.7.1. Conditions of use	139
9.2.7.2. Exposure and risks for workers	140
9.2.8. Worker CS 8: Transfer of a substance or mixture during process sampling at non-dedicated facilities (PROC 8a, PROC 26)	140
9.2.8.1. Conditions of use	140
9.2.8.2. Exposure and risks for workers	141
9.2.9. Worker CS 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9, PROC 26)	141
9.2.9.1. Conditions of use	141
9.2.9.2. Exposure and risks for workers	142
9.2.10. Worker CS 10: Use as laboratory reagent (PROC 15, PROC 26)	142
9.2.10.1. Conditions of use	142
9.2.10.2. Exposure and risks for workers	143
9.2.11. Worker CS 11: Tableting, compression, extrusion, pelettisation, granulation (PROC 14)	143
9.2.11.1. Conditions of use	143
9.2.11.2. Exposure and risks for workers	143
9.2.12. Worker CS 12: Transfer of substance or mixture (charging/discharging) at non-dedicated-facilities (PROC 8a, PROC 26)	144
9.2.12.1. Conditions of use	144
9.2.12.2. Exposure and risks for workers	144
9.2.13. Worker CS 13: Transfer of substance or mixture (charging/discharging) at dedicated-facilities (PROC 8b, PROC 26)	145
9.2.13.1. Conditions of use	145
9.2.13.2. Exposure and risks for workers	145
9.2.14. Worker CS 14: Equipment cleaning and maintenance at non-dedicated facility (PROC 8a, PROC 28)	146
9.2.14.1. Conditions of use	146
9.2.14.2. Exposure and risks for workers	146
9.2.15. Worker CS 15: Manual maintenance (cleaning and repair) of machinery (PROC 28)	147
9.2.15.1. Conditions of use	147
9.2.15.2. Exposure and risks for workers	148
9.3. Exposure scenario 3: Use at industrial sites - Use at industrial site (e.g. Industrial Indoor use as Chemical Intermediate and Process aid, Industrial Outdoor use)	149
9.3.1. Env CS 1: Use of non-reactive processing aid at industrial site (no inclusion into or onto article) (ERC 4)	154
9.3.1.1. Conditions of use	154
9.3.1.2. Releases	154
9.3.1.3. Exposure and risks for the environment and man via the environment	155
9.3.2. Env CS 2: Use as an intermediate (ERC 6a)	155



9.3.2.1. Conditions of use	155
9.3.2.2. Releases	155
9.3.2.3. Exposure and risks for the environment and man via the environment	156
9.3.3. Worker CS 3: Chemical production in closed process without likelihood of exposure or in containment conditions or processes with equivalent containment conditions (PROC 1)	156
9.3.3.1. Conditions of use	156
9.3.3.2. Exposure and risks for workers	157
9.3.4. Worker CS 4: Chemical production in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC 2)	157
9.3.4.1. Conditions of use	157
9.3.4.2. Exposure and risks for workers	157
9.3.5. Worker CS 5: Manufacture or formulation in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC 3)	158
9.3.5.1. Conditions of use	158
9.3.5.2. Exposure and risks for workers	158
9.3.6. Worker CS 6: Chemical production where opportunity for exposure arises (PROC 4)	159
9.3.6.1. Conditions of use	159
9.3.6.2. Exposure and risks for workers	159
9.3.7. Worker CS 7: Mixing or blending in batch processes (PROC 5)	160
9.3.7.1. Conditions of use	160
9.3.7.2. Exposure and risks for workers	160
9.3.8. Worker CS 8: Calendering operations (PROC 6)	160
9.3.8.1. Conditions of use	160
9.3.8.2. Exposure and risks for workers	161
9.3.9. Worker CS 9: Indoor use; Industrial spraying; Solid in solution (PROC 7)	161
9.3.9.1. Conditions of use	161
9.3.9.2. Exposure and risks for workers	162
9.3.10. Worker CS 10: Outdoor use; Industrial spraying (PROC 7)	162
9.3.10.1. Conditions of use	163
9.3.10.2. Exposure and risks for workers	163
9.3.11. Worker CS 11: Outdoor use; Industrial spraying (PROC 7)	164
9.3.11.1. Conditions of use	164
9.3.11.2. Exposure and risks for workers	164
9.3.12. Worker CS 12: Transfer of a substance or mixture during process sampling at non-dedicated facilities with a local exhaust ventilation (PROC 8a, PROC 26)	165
9.3.12.1. Conditions of use	165
9.3.12.2. Exposure and risks for workers	165
9.3.13. Worker CS 13: Transfer of a substance or mixture during process sampling at non-dedicated facilities without a local exhaust ventilation (PROC 8a, PROC 26)	166
9.3.13.1. Conditions of use	166
9.3.13.2. Exposure and risks for workers	166
9.3.14. Worker CS 14: Transfer of a substance or mixture during process sampling at dedicated facilities with a local exhaust ventilation (PROC 8b, PROC 26)	167
9.3.14.1. Conditions of use	167
9.3.14.2. Exposure and risks for workers	167
9.3.15. Worker CS 15: Transfer of a substance or mixture during process sampling at dedicated facilities without a local exhaust ventilation (PROC 8b, PROC 26)	168
9.3.15.1. Conditions of use	168
9.3.15.2. Exposure and risks for workers	168
9.3.16. Worker CS 16: Transfer of substance or mixture (charging/discharging) at non-dedicated facilities with a local exhaust ventilation. (PROC 8a, PROC 26)	168
9.3.16.1. Conditions of use	169
9.3.16.2. Exposure and risks for workers	169
9.3.17. Worker CS 17: Transfer of substance or mixture (charging/discharging) at non-dedicated facilities without a local exhaust ventilation. (PROC 8a, PROC 26)	169
9.3.17.1. Conditions of use	170
9.3.17.2. Exposure and risks for workers	170



9.3.18. Worker CS 18: Transfer of substance or mixture (charging/discharging) at dedicated facilities with a local exhaust ventilation. (PROC 8b, PROC 26)	170
9.3.18.1. Conditions of use	171
9.3.18.2. Exposure and risks for workers	171
9.3.19. Worker CS 19: Transfer of substance or mixture (charging/discharging) at dedicated facilities without a local exhaust ventilation. (PROC 8b, PROC 26)	171
9.3.19.1. Conditions of use	172
9.3.19.2. Exposure and risks for workers	172
9.3.20. Worker CS 20: Equipment cleaning and maintenance at non-dedicated facility (PROC 8a, PROC 28)	172
9.3.20.1. Conditions of use	172
9.3.20.2. Exposure and risks for workers	173
9.3.21. Worker CS 21: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) at facilities with a local exhaust ventilation (PROC 9, PROC 26, PROC 27b)	173
9.3.21.1. Conditions of use	174
9.3.21.2. Exposure and risks for workers	174
9.3.22. Worker CS 22: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) at facilities without a local exhaust ventilation (PROC 9, PROC 26)	174
9.3.22.1. Conditions of use	175
9.3.22.2. Exposure and risks for workers	175
9.3.23. Worker CS 23: Roller application or brushing (PROC 10)	175
9.3.23.1. Conditions of use	175
9.3.23.2. Exposure and risks for workers	176
9.3.24. Worker CS 24: Treatment of articles by dipping and pouring (PROC 13)	176
9.3.24.1. Conditions of use	176
9.3.24.2. Exposure and risks for workers	177
9.3.25. Worker CS 25: Tableting, compression, extrusion, pelettisation, granulation (PROC 14)	177
9.3.25.1. Conditions of use	177
9.3.25.2. Exposure and risks for workers	178
9.3.26. Worker CS 26: Use as laboratory reagent (PROC 15, PROC 26, PROC 27b)	178
9.3.26.1. Conditions of use	178
9.3.26.2. Exposure and risks for workers	179
9.3.27. Worker CS 27: Manufacturing and processing of minerals and/or metals at substantially elevated temperature (PROC 22, PROC 27a)	179
9.3.27.1. Conditions of use	179
9.3.27.2. Exposure and risks for workers	180
9.3.28. Worker CS 28: Open processing and transfer operations at substantially elevated temperature (PROC 23, PROC 27a)	180
9.3.28.1. Conditions of use	180
9.3.28.2. Exposure and risks for workers	181
9.3.29. Worker CS 29: Manual maintenance (cleaning and repair) of machinery at non-dedicated facilities (PROC 28)	181
9.3.29.1. Conditions of use	181
9.3.29.2. Exposure and risks for workers	182
9.4. Exposure scenario 4: Widespread use by professional workers - Professional use; Indoor use	183
9.4.1. Env CS 1: Indoor use; Professional use (ERC 8a)	184
9.4.1.1. Conditions of use	184
9.4.1.2. Releases	184
9.4.1.3. Exposure and risks for the environment and man via the environment	184
9.4.2. Worker CS 2: Chemical production in closed process without likelihood of exposure or in containment conditions or processes with equivalent containment conditions (PROC 1)	184
9.4.2.1. Conditions of use	185
9.4.2.2. Exposure and risks for workers	185
9.4.3. Worker CS 3: Chemical production in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC 2)	185



9.4.3.1. Conditions of use	185
9.4.3.2. Exposure and risks for workers	186
9.4.4. Worker CS 4: Manufacture or formulation in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC 3)	186
9.4.4.1. Conditions of use	186
9.4.4.2. Exposure and risks for workers	187
9.4.5. Worker CS 5: Chemical production where opportunity for exposure arises (PROC 4)	187
9.4.5.1. Conditions of use	187
9.4.5.2. Exposure and risks for workers	188
9.4.6. Worker CS 6: Mixing or blending in batch processes (PROC 5)	188
9.4.6.1. Conditions of use	188
9.4.6.2. Exposure and risks for workers	189
9.4.7. Worker CS 7: Transfer of substance or mixture (charging/discharging) at non-dedicated facilities (PROC 8a, PROC 26)	189
9.4.7.1. Conditions of use	189
9.4.7.2. Exposure and risks for workers	190
9.4.8. Worker CS 8: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC 8b, PROC 26)	190
9.4.8.1. Conditions of use	190
9.4.8.2. Exposure and risks for workers	191
9.4.9. Worker CS 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9, PROC 26)	191
9.4.9.1. Conditions of use	191
9.4.9.2. Exposure and risks for workers	192
9.4.10. Worker CS 10: Roller application or brushing (PROC 10)	192
9.4.10.1. Conditions of use	192
9.4.10.2. Exposure and risks for workers	192
9.4.11. Worker CS 11: Indoor use; Non-industrial spraying; Solid in solution (PROC 11)	193
9.4.11.1. Conditions of use	193
9.4.11.2. Exposure and risks for workers	193
9.4.12. Worker CS 12: Use as laboratory reagent (PROC 15, PROC 26)	194
9.4.12.1. Conditions of use	194
9.4.12.2. Exposure and risks for workers	194
9.4.13. Worker CS 13: Manual activities involving hand contact (PROC 19)	195
9.4.13.1. Conditions of use	195
9.4.13.2. Exposure and risks for workers	195
9.4.14. Worker CS 14: Use of functional fluids in small devices (PROC 20)	196
9.4.14.1. Conditions of use	196
9.4.14.2. Exposure and risks for workers	196
9.4.15. Worker CS 15: Equipment cleaning and maintenance at non-dedicated facility (PROC 8a, PROC 28)	196
9.4.15.1. Conditions of use	196
9.4.15.2. Exposure and risks for workers	197
9.4.16. Worker CS 16: Manual maintenance (cleaning and repair) of machinery at non-dedicated facility (PROC 28)	197
9.4.16.1. Conditions of use	198
9.4.16.2. Exposure and risks for workers	199
9.5. Exposure scenario 5: Widespread use by professional workers - Professional use; Outdoor use	200
9.5.1. Env CS 1: Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor) (ERC 8d)	208
9.5.1.1. Conditions of use	208
9.5.1.2. Releases	208
9.5.1.3. Exposure and risks for the environment and man via the environment	209
9.5.2. Worker CS 2: Chemical production in closed process without likelihood of exposure or in containment conditions. (PROC 1)	209
9.5.2.1. Conditions of use	209



9.5.2.2. Exposure and risks for workers	209
9.5.3. Worker CS 3: Chemical production in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC 2)	210
9.5.3.1. Conditions of use	210
9.5.3.2. Exposure and risks for workers	210
9.5.4. Worker CS 4: Manufacture or formulation in closed batch processes with occasional controlled exposure or processes with equivalent containment conditions (PROC 3)	211
9.5.4.1. Conditions of use	211
9.5.4.2. Exposure and risks for workers	211
9.5.5. Worker CS 5: Chemical production where opportunity for exposure arises (PROC 4)	212
9.5.5.1. Conditions of use	212
9.5.5.2. Exposure and risks for workers	212
9.5.6. Worker CS 6: Mixing or blending in batch processes (PROC 5)	213
9.5.6.1. Conditions of use	213
9.5.6.2. Exposure and risks for workers	213
9.5.7. Worker CS 7: Transfer of substance or mixture (charging/discharging) at non-dedicated facilities (PROC 8a, PROC 26)	213
9.5.7.1. Conditions of use	214
9.5.7.2. Exposure and risks for workers	214
9.5.8. Worker CS 8: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC 8b, PROC 26)	214
9.5.8.1. Conditions of use	214
9.5.8.2. Exposure and risks for workers	215
9.5.9. Worker CS 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9, PROC 26)	215
9.5.9.1. Conditions of use	215
9.5.9.2. Exposure and risks for workers	216
9.5.10. Worker CS 10: Roller application or brushing (PROC 10)	216
9.5.10.1. Conditions of use	216
9.5.10.2. Exposure and risks for workers	217
9.5.11. Worker CS 11: Outdoor use; Non-industrial spraying (PROC 11)	217
9.5.11.1. Conditions of use	217
9.5.11.2. Exposure and risks for workers	218
9.5.12. Worker CS 12: Outdoor use; Non-industrial spraying (PROC 11)	218
9.5.12.1. Conditions of use	218
9.5.12.2. Exposure and risks for workers	219
9.5.13. Worker CS 13: Use as laboratory reagent (PROC 15, PROC 26)	219
9.5.13.1. Conditions of use	219
9.5.13.2. Exposure and risks for workers	220
9.5.14. Worker CS 14: Mixing operations; Manual activities involving hand contact (PROC 19)	220
9.5.14.1. Conditions of use	220
9.5.14.2. Exposure and risks for workers	221
9.5.15. Worker CS 15: Equipment cleaning and maintenance at non-dedicated facility (PROC 8a)	221
9.5.15.1. Conditions of use	221
9.5.15.2. Exposure and risks for workers	222
9.5.16. Worker CS 16: Use of functional fluids in small devices (PROC 20)	222
9.5.16.1. Conditions of use	222
9.5.16.2. Exposure and risks for workers	223
9.6. Exposure scenario 6: Consumer use - Consumer use; Indoor or outdoor use	224
9.6.1. Env CS 1: Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor) (ERC 8a)	224
9.6.1.1. Conditions of use	224
9.6.1.2. Releases	224
9.6.1.3. Exposure and risks for the environment and man via the environment	225
9.6.2. Env CS 2: Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor) (ERC 8d)	225



9.6.2.1. Conditions of use	225
9.6.2.2. Releases	225
9.6.2.3. Exposure and risks for the environment and man via the environment	225
9.6.3. Cons CS 3: Dust suppressant; No spraying (PC 0)	226
9.6.3.1. Conditions of use	226
9.6.3.2. Exposure and risks for consumers	226
9.6.4. Cons CS 4: Dust suppressant; Spraying (PC 0)	227
9.6.4.1. Conditions of use	227
9.6.4.2. Exposure and risks for consumers	227
9.6.5. Cons CS 5: Humidity adsorbants (PC 0)	228
9.6.5.1. Conditions of use	228
9.6.5.2. Exposure and risks for consumers	229
9.6.6. Cons CS 6: Cement/concrete/mortar (PC 0)	229
9.6.6.1. Conditions of use	229
9.6.6.2. Exposure and risks for consumers	230
9.6.7. Cons CS 7: Adsorbents (PC 2)	230
9.6.7.1. Conditions of use	230
9.6.7.2. Exposure and risks for consumers	231
9.6.8. Cons CS 8: Anti-freeze and de-icing products; No spraying (PC 4)	231
9.6.8.1. Conditions of use	231
9.6.8.2. Exposure and risks for consumers	232
9.6.9. Cons CS 9: Anti-freeze and de-icing products; Spraying (PC 4)	232
9.6.9.1. Conditions of use	232
9.6.9.2. Exposure and risks for consumers	233
9.6.10. Cons CS 10: Fertilizers; No spraying (PC 12)	233
9.6.10.1. Conditions of use	233
9.6.10.2. Exposure and risks for consumers	234
9.6.11. Cons CS 11: Fertilizers; Spraying (PC 12)	234
9.6.11.1. Conditions of use	234
9.6.11.2. Exposure and risks for consumers	235
9.6.12. Cons CS 12: Heat transfer fluids (PC 16)	235
9.6.12.1. Conditions of use	235
9.6.12.2. Exposure and risks for consumers	236
9.6.13. Cons CS 13: Plant protection products; No spraying (PC 27)	236
9.6.13.1. Conditions of use	236
9.6.13.2. Exposure and risks for consumers	237
9.6.14. Cons CS 14: Plant protection products; Spraying (PC 27)	238
9.6.14.1. Conditions of use	238
9.6.14.2. Exposure and risks for consumers	238
9.6.15. Cons CS 15: Water treatment chemicals (PC 37)	238
9.6.15.1. Conditions of use	238
9.6.15.2. Exposure and risks for consumers	239
9.6.16. Cons CS 16: Washing and cleaning products; No spraying (PC 35)	240
9.6.16.1. Conditions of use	240
9.6.16.2. Exposure and risks for consumers	240
9.6.17. Cons CS 17: Washing and cleaning products; Spraying (PC 35)	241
9.6.17.1. Conditions of use	241
9.6.17.2. Exposure and risks for consumers	241
10. RISK CHARACTERISATION RELATED TO COMBINED EXPOSURE	243
10.1. Human health	243
10.1.1. Workers	243
10.1.2. Consumer	243
10.2. Environment (combined for all emission sources)	243
10.2.1. All uses (regional scale)	243
10.2.1.1. Total releases	243
10.2.2. Regional assessment	243
10.2.3. Local exposure due to all widespread uses	243
Annexes	245
1. Annex: References	246
2. Annex: Information on Test Material	250



3. Annex: Mode of action / Human relevance Framework	255
--	-----



List of Tables

1.1. Substance identity	21
1.2. Constituents (calcium chloride)	22
1.3. Impurities (calcium chloride)	22
1.4. Physicochemical properties	24
2.1. Manufacture	29
2.2. Formulation	31
2.3. Uses at industrial sites	31
2.4. Uses by professional workers	33
2.5. Consumer uses	35
3.1. Classification and labelling according to CLP / GHS for physicochemical properties	36
3.2. Classification and labelling according to CLP / GHS for health hazards	37
3.3. Classification and labelling according to CLP / GHS for environmental hazards	38
5.1. Studies on absorption, metabolism, distribution and elimination	42
5.2. Studies on acute toxicity after oral administration	43
5.3. Studies on acute toxicity after dermal administration	46
5.4. Exposure-related observations on acute toxicity in humans	46
5.5. Studies on skin irritation	48
5.6. Exposure-related observations on skin irritation in humans	50
5.7. Studies on eye irritation	50
5.8. Studies on repeated dose toxicity after oral administration	61
5.9. In vitro genotoxicity studies:	65
5.10. Studies on developmental toxicity	69
5.11. Available dose-descriptor(s) per endpoint as a result of its hazard assessment	72
5.12. Hazard conclusions for workers	73
5.13. Hazard conclusions for the general population	80
6.1. Information on oxidising potential	86
7.1. Short-term effects on fish	88
7.2. Long-term effects on fish	89
7.3. Short-term effects on aquatic invertebrates	90
7.4. Long-term effects on aquatic invertebrates	98
7.5. Effects on algae and aquatic plants	99
7.6. Effects on other aquatic organisms	101
7.7. Effects on terrestrial plants	104
7.8. Hazard assessment conclusion for the environment	107
9.1. Tonnage for assessment	110
9.2. Substance key phys-chem and fate properties	111
9.3. Type of risk characterisation required for man via the environment	112
9.4. Type of risk characterisation required for workers	112
9.5. Type of risk characterisation required for consumers	114
9.6. Local releases to the environment	118
9.7. Exposure concentrations and risks for the environment and man via the environment	119
9.8. Exposure concentrations and risks for workers	119
9.9. Exposure concentrations and risks for workers	120
9.10. Exposure concentrations and risks for workers	121
9.11. Exposure concentrations and risks for workers	122
9.12. Exposure concentrations and risks for workers	123
9.13. Exposure concentrations and risks for workers	124
9.14. Exposure concentrations and risks for workers	125
9.15. Exposure concentrations and risks for workers	126
9.16. Exposure concentrations and risks for workers	127
9.17. Exposure concentrations and risks for workers	128
9.18. Exposure concentrations and risks for workers	129
9.19. Exposure concentrations and risks for workers	130
9.20. Exposure concentrations and risks for workers	131
9.21. Exposure concentrations and risks for workers	132



9.22. Local releases to the environment	134
9.23. Exposure concentrations and risks for the environment and man via the environment	134
9.24. Exposure concentrations and risks for workers	135
9.25. Exposure concentrations and risks for workers	136
9.26. Exposure concentrations and risks for workers	137
9.27. Exposure concentrations and risks for workers	138
9.28. Exposure concentrations and risks for workers	139
9.29. Exposure concentrations and risks for workers	140
9.30. Exposure concentrations and risks for workers	141
9.31. Exposure concentrations and risks for workers	142
9.32. Exposure concentrations and risks for workers	143
9.33. Exposure concentrations and risks for workers	143
9.34. Exposure concentrations and risks for workers	144
9.35. Exposure concentrations and risks for workers	145
9.36. Exposure concentrations and risks for workers	146
9.37. Exposure concentrations and risks for workers	148
9.38. Local releases to the environment	154
9.39. Exposure concentrations and risks for the environment and man via the environment	155
9.40. Local releases to the environment	156
9.41. Exposure concentrations and risks for the environment and man via the environment	156
9.42. Exposure concentrations and risks for workers	157
9.43. Exposure concentrations and risks for workers	157
9.44. Exposure concentrations and risks for workers	158
9.45. Exposure concentrations and risks for workers	159
9.46. Exposure concentrations and risks for workers	160
9.47. Exposure concentrations and risks for workers	161
9.48. Exposure concentrations and risks for workers	162
9.49. Exposure concentrations and risks for workers	163
9.50. Exposure concentrations and risks for workers	164
9.51. Exposure concentrations and risks for workers	165
9.52. Exposure concentrations and risks for workers	166
9.53. Exposure concentrations and risks for workers	167
9.54. Exposure concentrations and risks for workers	168
9.55. Exposure concentrations and risks for workers	169
9.56. Exposure concentrations and risks for workers	170
9.57. Exposure concentrations and risks for workers	171
9.58. Exposure concentrations and risks for workers	172
9.59. Exposure concentrations and risks for workers	173
9.60. Exposure concentrations and risks for workers	174
9.61. Exposure concentrations and risks for workers	175
9.62. Exposure concentrations and risks for workers	176
9.63. Exposure concentrations and risks for workers	177
9.64. Exposure concentrations and risks for workers	178
9.65. Exposure concentrations and risks for workers	179
9.66. Exposure concentrations and risks for workers	180
9.67. Exposure concentrations and risks for workers	181
9.68. Exposure concentrations and risks for workers	182
9.69. Local releases to the environment	184
9.70. Exposure concentrations and risks for the environment and man via the environment	184
9.71. Exposure concentrations and risks for workers	185
9.72. Exposure concentrations and risks for workers	186
9.73. Exposure concentrations and risks for workers	187
9.74. Exposure concentrations and risks for workers	188
9.75. Exposure concentrations and risks for workers	189
9.76. Exposure concentrations and risks for workers	190
9.77. Exposure concentrations and risks for workers	191
9.78. Exposure concentrations and risks for workers	192
9.79. Exposure concentrations and risks for workers	192
9.80. Exposure concentrations and risks for workers	193
9.81. Exposure concentrations and risks for workers	194



9.82. Exposure concentrations and risks for workers	195
9.83. Exposure concentrations and risks for workers	196
9.84. Exposure concentrations and risks for workers	197
9.85. Exposure concentrations and risks for workers	199
9.86. Local releases to the environment	208
9.87. Exposure concentrations and risks for the environment and man via the environment	209
9.88. Exposure concentrations and risks for workers	210
9.89. Exposure concentrations and risks for workers	210
9.90. Exposure concentrations and risks for workers	211
9.91. Exposure concentrations and risks for workers	212
9.92. Exposure concentrations and risks for workers	213
9.93. Exposure concentrations and risks for workers	214
9.94. Exposure concentrations and risks for workers	215
9.95. Exposure concentrations and risks for workers	216
9.96. Exposure concentrations and risks for workers	217
9.97. Exposure concentrations and risks for workers	218
9.98. Exposure concentrations and risks for workers	219
9.99. Exposure concentrations and risks for workers	220
9.100. Exposure concentrations and risks for workers	221
9.101. Exposure concentrations and risks for workers	222
9.102. Exposure concentrations and risks for workers	223
9.103. Local releases to the environment	225
9.104. Exposure concentrations and risks for the environment and man via the environment	225
9.105. Local releases to the environment	225
9.106. Exposure concentrations and risks for the environment and man via the environment	226
9.107. Exposure concentrations and risks for consumers	227
9.108. Exposure concentrations and risks for consumers	227
9.109. Exposure concentrations and risks for consumers	229
9.110. Exposure concentrations and risks for consumers	230
9.111. Exposure concentrations and risks for consumers	231
9.112. Exposure concentrations and risks for consumers	232
9.113. Exposure concentrations and risks for consumers	233
9.114. Exposure concentrations and risks for consumers	234
9.115. Exposure concentrations and risks for consumers	235
9.116. Exposure concentrations and risks for consumers	236
9.117. Exposure concentrations and risks for consumers	237
9.118. Exposure concentrations and risks for consumers	238
9.119. Exposure concentrations and risks for consumers	239
9.120. Exposure concentrations and risks for consumers	240
9.121. Exposure concentrations and risks for consumers	241
10.1. Total releases to the environment per year from all life cycle stages	243
10.2. Predicted regional exposure concentrations (Regional PEC) and risks for the environment	243
10.3. Predicted exposure concentrations and risks for the environment and man via the environment due to all widespread uses	244



Part A



1. SUMMARY OF RISK MANAGEMENT MEASURES

The RMMs depend on the applicable exposure scenarios and the defined uses presented in chapter 3.5 of IUCLID. It is hence difficult to summarize them as such in this section. Reference is made to section 9 of Part B of the CSR for a full overview.

The above part A element applies to: CSR (all uses)



2. DECLARATION THAT RISK MANAGEMENT MEASURES ARE IMPLEMENTED

The Registrant declares that the risk management measures outlined in the relevant exposure scenarios for the Registrant's own uses are implemented by the Registrant.

The above part A element applies to: CSR (all uses)



3. DECLARATION THAT RISK MANAGEMENT MEASURES ARE COMMUNICATED

The Registrant declares that the relevant risk management measures as defined in the exposure scenarios generated for the supported uses of the registered substance are communicated to the distributors and downstream users by means of the Safety Data Sheet, and more specifically the Annex to the Safety Data Sheet.

The above part A element applies to: CSR (all uses)



Part B



1. IDENTITY OF THE SUBSTANCE AND PHYSICAL AND CHEMICAL PROPERTIES

1.1. Name and other identifiers of the substance

The substance [calcium chloride](#) is a mono-constituent substance (inorganic) having the following characteristics and physical-chemical properties (see the IUCLID dataset for further details).

Table 1.1. Substance identity

IUPAC name:	calcium dichloride
Synonyms:	Synonyms Calcium chloride (CaCl ₂)
EC number:	233-140-8
EC name:	calcium chloride
CAS number (EC inventory):	10043-52-4
CAS number:	10043-52-4
Molecular formula:	CaCl ₂
Molecular weight:	110.984

Figure 1.1. 10043-52-4-V2.jpeg



1.2. Composition of the substance

Overall information on composition:

Composition	Related composition(s)
calcium chloride (boundary composition of the substance)	

Name: calcium chloride

(boundary composition of the substance)

State/form: solid: bulk

Degree of purity: >87.7 - <=100 % (w/w)

Description: According to the REACH Guidance for identification and naming of substances under REACH, hydrates and water free (anhydrous) forms of compounds shall be regarded as the same substance. Therefore this dossier includes information on anhydrous substance, as well as four hydrate forms of calcium chloride (mono-, di-, tetra and hexahydrate). The majority of information included in this dossier is considered to be



applicable to all forms, unless stated otherwise. Various forms of calcium chloride are manufactured and imported in the EU: - calcium chloride anhydrous (CAS 10043-52-4) - calcium chloride monohydrate (CAS 22691-02-7) - calcium chloride dihydrate (CAS 10035-04-8) - calcium chloride tetrahydrate (CAS 25094-02-4) - calcium chloride hexahydrate (CAS 7774-34-7) Minimum purity is above 87.7%. Ranges of impurities are as reported in the boundary composition. No use of additives is known.

Table 1.2. Constituents (calcium chloride)

Constituent	Typical concentration	Concentration range	Remarks
calcium chloride EC no.: 233-140-8		≥ 87.7 - ≤ 100 % (w/w)	

Table 1.3. Impurities (calcium chloride)

Constituent	Typical concentration	Concentration range	Remarks
sodium chloride EC no.: 231-598-3		≥ 0 - ≤ 7.4 % (w/w)	
calcium hydroxide EC no.: 215-137-3	% (w/w)	≥ 0 - ≤ 0.5 % (w/w)	This substance is classified as Skin Irrit. 2, Eye Dam. 1 and STOT SE 3 based on the information in the REACH Registration dossier. The concentration of this substance in combination with any other impurity classified for Eye Damage 1 should not exceed $> 3\%$.
potassium chloride EC no.: 231-211-8		≥ 0 - ≤ 3.5 % (w/w)	
calcium sulphate EC no.: 231-900-3		≥ 0 - ≤ 0.8 % (w/w)	
Magnesium chloride EC no.: 232-094-6		≥ 0 - ≤ 2.5 % (w/w)	
calcium bromide EC no.: 232-164-6		≥ 0 - ≤ 2.6 % (w/w)	This substance is classified as Eye Dam. 1 based on the information in the REACH Registration dossier. The concentration of this substance in combination with any other impurity classified for Eye Damage 1 should not exceed $> 3\%$.

**Name: Calcium chloride (anhydrous)**

(legal entity composition of the substance)

State/form: solid: bulk

Degree of purity: >97 - <100 % (w/w)

Table 1.2a: Constituents (calcium chloride)

Constituent	Typical concentration	Concentration range	Remarks
calcium chloride EC no.: 233-140-8		>=97 - <=100 % (w/w)	

Table 1.2b: Impurities (calcium chloride)

Constituent	Typical concentration	Concentration range	Remarks
sodium chloride EC no.: 231-598-3	ca. 1% (w/w)	>=0 - <=2 % (w/w)	
Magnesium chloride EC no.: 232-094-6	< 1% (w/w)	>=0 - <=1 % (w/w)	

Name: Calcium chloride dihydrate

(legal entity composition of the substance)

State/form: solid: bulk

Degree of purity: >99 - <=100 % (w/w)

Description: Methods of manufacture of substance - Acid-limestone production This process is based on the direct reaction of HCl with limestone according to the following equation: $\text{CaCO}_3 + 2 \text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$ This may occur as a deliberate direct process or indirectly when the limestone is used in HCl acid fume abatement technology. The quality and strength of the solution produced will depend on the purity of the raw materials and the concentration of the acid used. Purification steps (e.g. addition of lime slurry) allow precipitating impurities like iron and other metals, which are then separated by filtration. Liquor produced via this route may be used in the production of flakes, prills or crystals.

Table 1.2c: Constituents (Calcium chloride dihydrate)

Constituent	Typical concentration	Concentration range	Remarks
Calcium chloride dihydrate EC no.:	ca.100 % (w/w)	>99 - <=100 % (w/w)	

Justification for reporting set of similar nanoforms:

Shape

No information available on Shape from IUCLID

Particle size distribution and range

No information available on Particle size distribution and range from IUCLID

Crystallinity

No information available on Crystallinity in IUCLID

Specific surface area

No information available on Specific surface area from IUCLID

Surface functionalisation / treatment

No information available Surface functionalisation / treatment from IUCLID



1.3. Information on linked categories

1.4. Physicochemical properties

Table 1.4. Physicochemical properties

Property	Value used for CSA / Discussion	Description of key information
Physical state	solid at 20°C and 101.3 kPa	
Melting / freezing point	782°C at 101.3 kPa Published in peer-reviewed handbook, adequate for assessment.	782 °C or 1055 K
Boiling point	Published in peer-reviewed handbooks, adequate for assessment.	In accordance with column 2 of REACH Annex VII, the boiling point study does not need to be conducted, as the substance has a melting point > 300 °C. However, data are available showing that calcium chloride has a boiling point > 1600 °C.
Relative density	2.15 at 20°C Published in peer-reviewed handbooks, acceptable for assessment.	2.15 g/cm ³ at 25 °C, 2.15 g/cm ³ at 15°C
Granulometry	Standard method determinations (laser diffraction by wet dispersion or sieving); adequate for assessment.	Tests on particle size distribution were performed on 4 samples of calcium chloride (powder of anhydrous CaCl ₂ , crystalline CaCl ₂ ·2H ₂ O, calcium chloride flakes and calcium chloride prills). These samples are considered to be typical examples of standard calcium chloride products manufactured by industry. The first two samples were measured by wet laser diffraction, the latter two by sieving. The following results were obtained: - Sample 1 (Calcium Chloride 94-97% Powder): D10 = 8.2 µm (RSD = 35.0%); D50 = 93.2 µm (RSD = 12.3%), D90 = 304.2 µm (RSD = 2.5%) (measurements were performed in triplicate). - Sample 2 (calcium chloride dihydrate, crystalline): D10 = 118.7 µm, D50 = 243.4 µm, D90 = 434.0 µm. - Sample 3 (calcium chloride flakes): 4.30% < 0.5 mm, 8.90% < 1.0 mm; 25.88% < 2.0 mm; 92.23% < 4 mm;



		99.97% < 6.3 mm - Sample 4 (calcium chloride prills): 0.36% > 4 mm; 21.07% fall in the range 2.8-4 mm; 36.43% fall in the range 2-28.mm; 42.14% < 2 mm.
Vapour pressure	0.05Pa at 800°C This information is used for risk assessment purposes (Chesar) only. It is also to be considered as a worst case value as this vapour pressure is applicable at considerably higher temperatures (800°C).	
Partition coefficient n-octanol/water (log value)		Partition coefficient of Calcium chloride does not need to be determined as the substance is inorganic. However, as this value it is needed to carry out the man via environment risk assessment using the Chesar tool, a value has been estimated using the QSAR model KOWWIN. Therefore, the Partition coefficient has been set to 0.05.
Water solubility	745000mg/L at 20°C Published in peer-reviewed handbook, adequate for assessment.	745 g/L at 20 °C 1590 g/L at 100 °C
Flammability	non flammable	The substance is non-flammable.
Explosive properties	non explosive	The substance is non-explosive.
Oxidising properties	no	The substance is non-oxidising

Data waiving**Information requirement:** Boiling point



Reason: study scientifically not necessary / other information available

Justification: the study does not need to be conducted because the substance is a solid which melts above 300°C [study scientifically not necessary / other information available] ; Data are available showing that calcium chloride has a boiling point >1600 °C

Information requirement: Vapour pressure

Reason: other justification

Justification: the study does not need to be conducted because the melting point is above 300°C [study scientifically not necessary / other information available]

Information requirement: Partition coefficient n-octanol/water (log value)

Reason: study technically not feasible

Justification: the study does not need to be conducted because the substance is inorganic [study technically not feasible]

Information requirement: Surface tension

Reason: study scientifically not necessary / other information available

Justification: the study does not need to be conducted because based on structure, surface activity is not expected or cannot be predicted [study scientifically not necessary / other information available]

Information requirement: Flash point

Reason: study technically not feasible

Justification: the study does not need to be conducted because the substance is inorganic [study technically not feasible] - Flammability essentially reflects the ability of the substance to react with oxygen in air at elevated temperatures in a strong exothermic reaction. In CaCl₂ the metal cation is already present in the highest possible oxidation state and thus cannot be further oxidized by oxygen. Chloride anion cannot be oxidized by oxygen due to its high electronegativity, which is only slightly lower than that of oxygen itself (3.16 vs. 3.44). Thus, as a reaction with oxygen is not possible, calcium chloride can be considered non-flammable. Based on the experience in handling the substance, the substance does not exhibit water reactivity or pyrophoric properties.

Information requirement: Self-ignition temperature

Reason: study scientifically not necessary / other information available

Justification: A waiver is proposed based on the fact that the substance cannot react with oxygen in the air. - In accordance with Section 1 of REACH Annex XI and Chapter 7.1.12 of REACH Guidance on information requirements and chemical safety assessment, the study is scientifically unjustified. The self-ignition temperature of a substance is defined as a minimum temperature at which the substance will ignite at predefined conditions. Ignition implies that the substance will interact with oxygen in strong exothermic reaction. However, as the metal ion is already present in the highest possible oxidation state and chloride cannot be oxidized by oxygen at normal conditions due to its high electronegativity, the interaction with oxygen is not possible, thus the substance is essentially non-flammable. Therefore the performance of the test on auto ignition temperature is considered to be not necessary.

Information requirement: Flammability

Reason: study scientifically not necessary / other information available

Justification: - - In accordance with Section 1 of REACH Annex XI and Chapter 7.1.10.3 of REACH Guidance on information requirements and chemical safety assessment the study is scientifically unjustified, as the substance is commonly known to be a stable inorganic salt. Flammability essentially reflects the ability of the substance to react with oxygen in air at elevated temperatures in a strong exothermic reaction. In CaCl₂ the metal cation is already present in the highest possible oxidation state and thus cannot be further oxidized by oxygen. Chloride anion cannot be oxidized by oxygen due to its high electronegativity, which is only slightly lower than that of oxygen itself (3.16 vs. 3.44). Thus, as a reaction with oxygen is not possible, calcium chloride can be considered non-flammable. Based on the experience in handling the substance, the substance does not exhibit water reactivity or pyrophoric properties.

Information requirement: Explosive properties



Reason: study scientifically not necessary / other information available

Justification: the study does not need to be conducted because there are no chemical groups present in the molecule which are associated with explosive properties [study scientifically not necessary / other information available] - In accordance with section 1 of REACH Annex XI, the study does not appear scientifically necessary. Potential explosive properties are indicated by the presence of certain reactive groups in the molecule and/or by the oxygen balance. No reactive groups are present. Considering the molecular structure of the substance, explosive properties are not expected.

Information requirement: Oxidising properties

Reason: study scientifically not necessary / other information available

Justification: the study does not need to be conducted because there are no chemical groups present in the molecule which are associated with oxidising properties and hence, the classification procedure does not need to be applied [study scientifically not necessary / other information available] - In accordance with Column 2 of REACH Annex VII, the study does not need to be conducted, as the substance is expected to be incapable of reacting exothermically with combustible materials based on its chemical structure, e.g. on the oxidation state of the constituting element

Information requirement: Stability in organic solvents and identity of relevant degradation products

Reason: other justification

Justification: In accordance with column 2 of REACH Annex IX (section 7.15), a stability study is not needed, as the substance is inorganic.

Information requirement: Dissociation constant

Reason: other justification

Justification: In accordance with column 2 of REACH Annex IX (section 7.16), a dissociation constant is not needed as the substance is immediately dissociated to ions in water (half-life less than 12 hours).

Information requirement: Viscosity

Reason: study scientifically not necessary / other information available

Justification: In accordance with Section 2 of REACH Annex XI, the test does not need to be conducted due to the properties of the substance: calcium chloride is a solid, while determination of the viscosity only applies to liquids.

Discussion of physicochemical properties

Key Information:

Solid calcium chloride occurs as white hard fragments (flakes), granules, prills, crystals or powder that is hygroscopic, deliquescent and soluble in water. The substance exists both in its anhydrous form and several crystallohydrates (mono-, di-, tetra- and hexahydrate). The commercial substance could have small impurities of iron that gives light nuance coloration to the end product depending on the state of oxidation of iron itself (off-white, yellow, pink).

The anhydrous substance has a melting point of 782°C (Lide, CRC Handbook of Chemistry and Physics, 1994) and a relative density of 2.15 at 15 and 25 °C (Lide, CRC Handbook of Chemistry and Physics, 1994; and Budavari, The Merck Index, 1989). In accordance with Column 2 of REACH Annex VII, the study on boiling point does not need to be conducted, as the substance has a melting point > 300 °C. However, data are available showing that calcium chloride has a boiling point > 1600 °C. Calcium chloride is very well soluble in water (745 g/L at 20 °C). Based on its chemical structure and overall experience in manufacture and handling, the substance is considered to be non-explosive, non-flammable and non-oxidizing. In accordance with Column 2 of REACH Annexes VII-X and/or Sections 1 and/or 2 of Annex XI of REACH and/or REACH Guidance on information requirements and chemical safety assessment, no studies are required on vapour pressure, partition coefficient, surface tension, flash point, auto flammability, stability in organic solvents, dissociation constant and viscosity.



Tests on particle size distribution were performed on 4 samples of calcium chloride (powder of anhydrous CaCl_2 , crystalline $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$, calcium chloride flakes and calcium chloride prills). These samples are considered to be typical examples of standard calcium chloride products manufactured by industry. The first two samples were measured by wet laser diffraction, the latter two by sieving. The following results were obtained:

- Sample 1 (Calcium Chloride 94-97% Powder): $D_{10} = 8.2 \mu\text{m}$ (RSD = 35.0%); $D_{50} = 93.2 \mu\text{m}$ (RSD = 12.3%), $D_{90} = 304.2 \mu\text{m}$ (RSD = 2.5%) (measurements were performed in triplicate) (Particle Analytical ApS, 2010)
- Sample 2 (calcium chloride dihydrate, crystalline): $D_{10} = 118.7 \mu\text{m}$, $D_{50} = 243.4 \mu\text{m}$, $D_{90} = 434.0 \mu\text{m}$ (Particle Analytical ApS, 2010)
- Sample 3 (calcium chloride flakes): 4.30% < 0.5 mm, 8.90% < 1.0 mm; 25.88% < 2.0 mm; 92.23% < 4 mm; 99.97% < 6.3 mm
- Sample 4 (calcium chloride prills): 0.36% > 4 mm; 21.07% fall in the range 2.8-4 mm; 36.43% fall in the range 2-28 mm; 42.14% < 2 mm



2. MANUFACTURE AND USES

Cumulative tonnages:

- Cumulative tonnage for uses at industrial sites: ≤ 80000 tonnes/year
- Cumulative tonnage for widespread uses by professional workers: ≤ 200000 tonnes/year
- Cumulative tonnage for consumer uses: ≤ 100000 tonnes/year
- Cumulative tonnage for service life: ≤ 0 tonnes/year

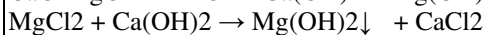
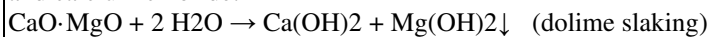
2.1. Manufacture

Table 2.1. Manufacture

	Manufacture
M-1	<p>Manufacture</p> <p><u>Further description of manufacturing process:</u></p> <p>Manufacture of Calcium Chloride, includes recycling/ recovery, material transfers, storage, maintenance and loading (including marine vessel/barge, road/rail car and bulk container), sampling and associated laboratory activities.</p> <p>Calcium chloride can be produced in various contexts.</p> <p>1) Co-product of soda ash manufacture</p> <p>The Solvay ammonia soda process is covered by the global equation: $\text{CaCO}_3 + 2\text{NaCl} \rightarrow \text{Na}_2\text{CO}_3 + \text{CaCl}_2$ High purity limestone is decomposed to produce calcium oxide and carbon dioxide, the CO₂ being used to carbonate ammoniated brine to precipitate sodium bicarbonate. The bicarbonate is filtered and decomposed by heating to produce sodium carbonate (soda ash) and the liberated CO₂ is returned to the carbonation stage. However, the filtrate is predominantly ammonium chloride solution and is sent for ammonia recovery. The calcium oxide from the limekilns is normally hydrated to 'a milk of lime' slurry (calcium hydroxide) and this reacts with the ammonium chloride rich filtrate to liberate ammonia which is then steam distilled. This leaves behind a calcium chloride solution containing suspended inert material derived from impurities in the limestone, brine and coke ash and some insoluble reaction products obtained during the distillation phase. The overall distillation reaction is: $\text{NH}_4\text{Cl} + \text{Ca}(\text{OH})_2 \rightarrow \text{NH}_3 + \text{H}_2\text{O} + \text{CaCl}_2$ The liquid stream from the distillers, after the removal of solid matter, is the source material for calcium chloride production, in which a number of purification and concentration steps is used. Various grades of calcium chloride are produced:</p> <ul style="list-style-type: none"> - concentrated solutions obtained by partial evaporation (typical concentrations of about 35% to 40% CaCl₂); during the process the precipitation of various impurities (sodium chloride, sulphates, carbonates) leads to a purification of CaCl₂ solution - solid CaCl₂ obtained by further evaporation steps (typical concentrations of 77% to 100% CaCl₂ depending on the hydration degree); the dry product is sent to a flaking machine to produce flakes which are dried. <p>2) Co-product of magnesium salts production</p> <p>Calcium chloride is a co-product of magnesia (MgO) production from the raw materials magnesium chloride and dolime. Dolime is calcium-magnesium oxide (MgO·CaO) derived from the burning of dolomite limestone MgCO₃·CaCO₃. Magnesium salts occur naturally within the halite deposits of the Zechstein Salt Basin of Europe, their occurrence being dependent on the local conditions under which the halite was deposited. Typically, these magnesium chlorides evaporated later in the evaporative process and therefore tend to appear on top of, or on the edges of, other halite deposits (sodium and potassium chlorides). However, the solubility of magnesium chloride is much greater than sodium chloride and in saturated conditions, very little sodium chloride is dissolved in the saturated magnesium chloride brine. After solution mining of the halite deposit to produce a magnesium chloride brine, the first step is to remove any sulphate ions by the addition of calcium chloride: $\text{MgSO}_4 + \text{CaCl}_2 + 2 \text{H}_2\text{O} \rightarrow \text{CaSO}_4 \cdot 2 \text{H}_2\text{O} + \text{MgCl}_2$ This is essentially brine purification.</p>



The other raw material for this magnesia production process is, i.e. burnt dolomite ($\text{CaO} \cdot \text{MgO}$) so-called 'dolime'. Dolime introduces a second source of magnesium oxide and considerably increases the yield of the magnesium oxide production. The dolime is slaked with water, which gives an initial precipitation of magnesium hydroxide, and the calcium hydroxide component is then reacted with the purified magnesium chloride brine to produce further magnesium hydroxide and calcium chloride:



To complete the process, the magnesium hydroxide is washed and calcined to drive off water and produce magnesium oxide.

The by-product calcium chloride (brine of 14-16 wt-% concentration) is further concentrated for commercial use.

3) Acid-limestone production

This process is based on the direct reaction of HCl with limestone according to the following equation:



This may occur as a deliberate direct process or indirectly when the limestone is used in HCl acid fume abatement technology.

The quality and strength of the solution produced will depend on the purity of the raw materials and the concentration of the acid used.

Purification steps (e.g. addition of lime slurry) allow precipitating impurities like iron and other metals, which are then separated by filtration.

Liquor produced via this route may be used in the production of flakes, prills or crystals.

4) CaCl_2 production from natural brines

Calcium chloride occurs 'naturally' in a few locations of the world, usually in association with other chlorides including sodium, potassium and magnesium as halite deposits in geological evaporation basins. The halite deposits may also contain iodides and bromides, which are also commercially worked. By careful control of the solution mining processes, it is possible to achieve differential extraction of individual chlorides although calcium and magnesium chloride are inseparable at this stage. In the US mixed magnesium/calcium chloride is produced as 32 to 45 % mixed chloride solutions by initial evaporation of the extracted solution, which normally contains about 25 % total chloride. There are no known naturally occurring deposits of calcium chloride within the EEA.

Contributing activity/technique for the environment :

- **Manufacturing of substances (ERC1)**

Contributing activity/technique for the workers :

- **Chemical production in closed process without likelihood of exposure or in containment conditions or processes with equivalent containment condition (PROC 1)**
- **Chemical production in closed continuous process with occasional controlled exposure or processes with equivalent containment condition (PROC 2)**
- **Manufacture in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC 3)**
- **Chemical production where opportunity for exposure arises (PROC 4)**
- **Transfer of a substance or mixture during process sampling at dedicated facilities (PROC 8b ; PROC 26)**
- **Transfer of a substance or mixture during process sampling at non-dedicated facilities (PROC 8a ; PROC 26)**
- **Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9 ; PROC 26)**
- **Tabletting, compression, extrusion, pelettisation, granulation (PROC 14)**
- **Use as laboratory reagent (PROC 15 ; PROC 26)**
- **Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC 8a ; PROC 26)**
- **Transfer of substance or mixture (charging/discharging) at dedicated-facilities (PROC 8b ; PROC 26)**
- **Equipment cleaning and maintenance at non-dedicated facility (PROC 8a ; PROC28)**
- **Handling of solid inorganic substances at ambient temperature (PROC 26)**



	<p>- Manual maintenance (cleaning and repair) of machinery at non-dedicated facility (PROC28)</p> <p>use registered according to REACH Article 10; total tonnage manufactured/imported >=10tonnes/year per registrant</p> <p>Tonnage of substance for that use: <=200000 tonnes/year</p> <p>Related assessment: use assessed in an own CSR</p>
--	---

2.2. Identified uses

Table 2.2. Formulation

	Formulation
F-1	<p>Formulation or re-packing; Distribution of substance</p> <p><u>Further description of the use:</u></p> <p>Formulation and distribution , packing and re-packing (including drums and small packs) of the Calcium Chloride and its mixtures in batch or continuous operations, including storage, materials transfers, mixing, large and small scale packing, loading (including marine vessel/barge, rail/road car and IBC loading), maintenance and associated laboratory activities. e.g. production of adsorbents, cosmetics, metals, fertilizers, plant protection, cement, haemodialysis solution and general distributor activities with Calcium Chloride.</p> <p>Contributing activity/technique for the environment :</p> <ul style="list-style-type: none"> - Formulation into mixture (ERC2) <p>Contributing activity/technique for the workers :</p> <ul style="list-style-type: none"> - Chemical production in closed process without likelihood of exposure or in containment conditions. (PROC 1) - Chemical production in closed continuous process with occasional controlled exposure. (PROC 2) - Formulation in closed batch processes with occasional controlled exposure. (PROC 3) - Chemical production where opportunity for exposure arises (PROC 4) - Mixing or blending in batch processes (PROC 5) - Transfer of a substance or mixture during process sampling at dedicated facilities (PROC 8b ; PROC 26) - Transfer of a substance or mixture during process sampling at non-dedicated facilities (PROC 8a ; PROC 26) - Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9 ; PROC 26) - Use as laboratory reagent (PROC 15 ; PROC 26) - Tabletting, compression, extrusion, pelettisation, granulation (PROC 14) - Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC 8a ; PROC 26) - Transfer of substance or mixture (charging/discharging) at dedicated-facilities (PROC 8b ; PROC 26) - Equipment cleaning and maintenance at non-dedicated facility (PROC 8a ; PROC28) - Manual maintenance (cleaning and repair) of machinery (PROC28) <p>Technical function of the substance: absorbent ; antifreeze agent ; dust suppressant ; food flavouring and nutrient ; intermediate (precursor) ; stabilising agent ; Other: laboratory chemical</p> <p>use registered according to REACH Article 10; total tonnage manufactured/imported >=10tonnes/year per registrant</p> <p>Tonnage of substance for that use: <=120000 tonnes/year</p> <p>Substance supplied to that use:</p> <p>Related assessment: use assessed in an own CSR</p>

Table 2.3. Uses at industrial sites

Uses at industrial sites



IW-1	<p>Use at industrial site (e.g. Industrial Indoor use as Chemical Intermediate and Process aid, Industrial Outdoor use)</p> <p><u>Further description of the use:</u></p> <p>Calcium Chloride can be used for different industrial applications. Within this industrial scenario, 3 applications are specifically covered: use as intermediate, use as processing aid and industrial outdoor use. This is however a non-exhaustive list and other industrial uses can be covered within this use of the operational conditions are applicable as described here.</p> <p>1) Use of Calcium Chloride as chemical intermediate. This means that Calcium Chloride is consumed in or used for chemical processing in order to be transformed into another substance(s). This use includes recycling/ recovery, material transfers, storage, maintenance and loading (including marine vessel/barge, road/rail car and bulk container), sampling and associated laboratory activities.</p> <p>2) Use of Calcium Chloride as processing aid. This means Calcium Chloride, or products containing Calcium Chloride are used upon manufacturing without becoming part of the product or without being consumed/transformed to be part of the product. This relates for example to the use as a process chemical or extraction agent and included includes recycling/recovery, material transfers, storage, maintenance and loading (including marine vessel/barge, road/rail car and bulk container), sampling and associated laboratory activities. For example, functions as adsorbent, coagulant, emulsion breaker, alginates, extraction agent, completion fluid, heat transfer fluid, water treatment chemical, industrial dehumidification or use within paper industry for example as antistatic apply to this use.</p> <p>3) Industrial outdoor use of Calcium Chloride. This covers the end use of Calcium Chloride either pure or in formulation by spreading, spraying and pouring, including storage, materials transfers, mixing, loading and maintenance. For example, the use of dust suppression - and de-icing/anti-freeze mixtures is relevant for this use.</p> <p>Contributing activity/technique for the environment :</p> <ul style="list-style-type: none">- Use of non-reactive processing aid at industrial site (no inclusion into or onto article) (ERC4)- Use as an intermediate (ERC6a) <p>Contributing activity/technique for the workers :</p> <ul style="list-style-type: none">- Chemical production in closed process without likelihood of exposure or in containment conditions or processes with equivalent containment conditions (PROC 1)- Chemical production in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC 2)- Manufacture or formulation in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC 3)- Chemical production where opportunity for exposure arises (PROC 4)- Mixing or blending in batch processes (PROC 5)- Calendering operations (PROC 6)- Indoor use; Industrial spraying; Solid in solution (PROC 7)- Outdoor use; Industrial spraying (PROC 7)- Outdoor use; Industrial spraying (PROC 7)- Transfer of a substance or mixture during process sampling at non-dedicated facilities with a local exhaust ventilation (PROC 8a ; PROC 26)- Transfer of a substance or mixture during process sampling at non-dedicated facilities without a local exhaust ventilation (PROC 8a ; PROC 26)- Transfer of a substance or mixture during process sampling at dedicated facilities with a local exhaust ventilation (PROC 8b ; PROC 26)- Transfer of a substance or mixture during process sampling at dedicated facilities without a local exhaust ventilation (PROC 8b ; PROC 26)- Transfer of substance or mixture (charging/discharging) at non-dedicated facilities with a local exhaust ventilation. (PROC 8a ; PROC 26)- Transfer of substance or mixture (charging/discharging) at non-dedicated facilities without a local exhaust ventilation. (PROC 8a ; PROC 26)- Transfer of substance or mixture (charging/discharging) at dedicated facilities with a
------	--



	<p>local exhaust ventilation. (PROC 8b ; PROC 26)</p> <ul style="list-style-type: none"> - Transfer of substance or mixture (charging/discharging) at dedicated facilities without a local exhaust ventilation. (PROC 8b ; PROC 26) - Equipment cleaning and maintenance at non-dedicated facility (PROC 8a ; PROC28) - Transfer of substance or mixture into small containers (dedicated filling line, including weighing) at facilities with a local exhaust ventilation (PROC 9 ; PROC 26 ; PROC 27b) - Transfer of substance or mixture into small containers (dedicated filling line, including weighing) at facilities without a local exhaust ventilation (PROC 9 ; PROC 26) - Roller application or brushing (PROC 10) - Treatment of articles by dipping and pouring (PROC 13) - Tableting, compression, extrusion, pelettisation, granulation (PROC 14) - Use as laboratory reagent (PROC 15 ; PROC 26 ; PROC 27b) - Manufacturing and processing of minerals and/or metals at substantially elevated temperature (PROC 22 ; PROC 27a) - Open processing and transfer operations at substantially elevated temperature (PROC 23 ; PROC 27a) - Manual maintenance (cleaning and repair) of machinery at non-dedicated facilities (PROC28) <p>Sector of end use: SU 1: Agriculture, forestry and fishing ; SU 2a: Mining (without offshore industries) ; SU 2b: Offshore industries ; SU 4: Manufacture of food products ; SU 5: Manufacture of textiles, leather, fur ; SU 6b: Manufacture of pulp, paper and paper products ; SU 8: Manufacture of bulk, large scale chemicals (including petroleum products) ; SU 9: Manufacture of fine chemicals ; SU 11: Manufacture of rubber products ; SU 12: Manufacture of plastics products, including compounding and conversion ; SU 13: Manufacture of other non-metallic mineral products, e.g. plasters, cement ; SU 14: Manufacture of basic metals, including alloys ; SU 15: Manufacture of fabricated metal products, except machinery and equipment ; SU 16: Manufacture of computer, electronic and optical products, electrical equipment ; SU 17: General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment</p> <p>Technical function of the substance: absorbent ; antifreeze agent ; demulsifier ; density modifier ; dust suppressant ; flocculating agent ; food flavouring and nutrient ; gelling modifier ; heat transferring agent ; humectant ; intermediate (precursor) ; pH regulating agent ; stabilising agent ; vapour pressure modifier ; viscosity modifier ; other: laboratory chemical</p> <p>use registered according to REACH Article 10; total tonnage manufactured/imported >=10tonnes/year per registrant</p> <p>Tonnage of substance for that use: <=80000 tonnes/year</p> <p>Substance supplied to that use:</p> <p>Subsequent service life relevant for that use: no</p> <p>Related assessment: use assessed in an own CSR</p>
--	--

Table 2.4. Uses by professional workers

	Uses by professional workers
PW-1	<p>Professional use; Indoor use</p> <p><u>Further description of the use:</u></p> <p>Professional indoor use of Calcium Chloride. Covers the end use of Calcium Chloride either pure or in formulation including pouring/unloading from drums or containers; and exposures during mixing/diluting in the preparatory phase and by spraying, brushing, dipping, wiping automated and by hand. For example, the use of, washing and cleaning products or use as heat transfer fluid.</p> <p>Contributing activity/technique for the environment :</p> <ul style="list-style-type: none"> - Indoor use; Professional use (ERC8a) <p>Contributing activity/technique for the workers :</p> <ul style="list-style-type: none"> - Chemical production in closed process without likelihood of exposure or in containment conditions or processes with equivalent containment conditions (PROC 1) - Chemical production in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC 2) - Manufacture or formulation in closed batch processes with occasional controlled



	<p>exposure or processes with equivalent containment condition (PROC 3)</p> <ul style="list-style-type: none"> - Chemical production where opportunity for exposure arises (PROC 4) - Mixing or blending in batch processes (PROC 5) - Transfer of substance or mixture (charging/discharging) at non-dedicated facilities (PROC 8a ; PROC 26) - Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC 8b ; PROC 26) - Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9 ; PROC 26) - Roller application or brushing (PROC 10) - Indoor use; Non-industrial spraying; Solid in solution (PROC 11) - Use as laboratory reagent (PROC 15 ; PROC 26) - Manual activities involving hand contact (PROC 19) - Use of functional fluids in small devices (PROC 20) - Equipment cleaning and maintenance at non-dedicated facility (PROC 8a ; PROC28) - Manual maintenance (cleaning and repair) of machinery at non-dedicated facility (PROC28) <p>Sector of end use: SU 1: Agriculture, forestry and fishing ; SU 13: Manufacture of other non-metallic mineral products, e.g. plasters, cement ; SU 19: Building and construction work ; SU 20: Health services ; SU 0: Other:</p> <p>Technical function of the substance: absorbent ; antifreeze agent ; density modifier ; dust suppressant ; fertilisers (soil amendments) ; food flavouring and nutrient ; heat transferring agent ; intermediate (precursor) ; stabilising agent ; other: laboratory chemical</p> <p>use registered according to REACH Article 10; total tonnage manufactured/imported >=10tonnes/year per registrant</p> <p>Tonnage of substance for that use: <=100000 tonnes/year</p> <p>Subsequent service life relevant for that use: no</p> <p>Related assessment: use assessed in an own CSR</p>
PW-2	<p>Professional use; Outdoor use</p> <p><u>Further description of the use:</u></p> <p>Professional outdoor use of Calcium Chloride. Covers the end use of Calcium chloride either pure or in formulation including pouring/unloading from drums or containers; and exposures during mixing/diluting in the preparatory phase and by spraying, brushing, dipping, spreading automated and by hand. Including storage, equipment clean-downs and disposal. For example, the use of agrochemicals, dust suppression- and de-icing- mixtures and the use of cement.</p> <p>Contributing activity/technique for the environment :</p> <ul style="list-style-type: none"> - Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor) (ERC8d) <p>Contributing activity/technique for the workers :</p> <ul style="list-style-type: none"> - Chemical production in closed process without likelihood of exposure or in containment conditions. (PROC 1) - Chemical production in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC 2) - Manufacture or formulation in closed batch processes with occasional controlled exposure or processes with equivalent containment conditions (PROC 3) - Chemical production where opportunity for exposure arises (PROC 4) - Mixing or blending in batch processes (PROC 5) - Transfer of substance or mixture (charging/discharging) at non-dedicated facilities (PROC 8a ; PROC 26) - Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC 8b ; PROC 26) - Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9 ; PROC 26) - Roller application or brushing (PROC 10) - Outdoor use; Non-industrial spraying (PROC 11) - Outdoor use; Non-industrial spraying (PROC 11)



	<ul style="list-style-type: none"> - Use as laboratory reagent (PROC 15 ; PROC 26) - Mixing operations; Manual activities involving hand contact (PROC 19) - Equipment cleaning and maintenance at non-dedicated facility (PROC 8a) - Use of functional fluids in small devices (PROC 20) <p>Sector of end use: SU 1: Agriculture, forestry and fishing ; SU 5: Manufacture of textiles, leather, fur ; SU 13: Manufacture of other non-metallic mineral products, e.g. plasters, cement ; SU 19: Building and construction work ; SU 20: Health services ; SU 0: Other: C23.5 - Manufacture of cement, lime and plaster, C23.6 - Manufacture of articles of concrete, cement and plaster</p> <p>Technical function of the substance: antifreeze agent ; density modifier ; dust suppressant ; fertilisers (soil amendments) ; food flavouring and nutrient ; heat transferring agent ; intermediate (precursor) ; stabilising agent ; Other: laboratory chemical</p> <p>use registered according to REACH Article 10; total tonnage manufactured/imported >=10tonnes/year per registrant</p> <p>Tonnage of substance for that use: <=100000 tonnes/year</p> <p>Subsequent service life relevant for that use: no</p> <p>Related assessment: use assessed in an own CSR</p>
--	---

Table 2.5. Consumer uses

	Consumer uses
C-1	<p>Consumer use; Indoor or outdoor use</p> <p><u>Further description of the use:</u></p> <p>Calcium Chloride and Calcium Chloride containing products are frequently used by consumers. For example as domestic dehumidifier, as anti-freeze/de-icer, for dust binding, in clays and putties, in cement, in agrochemical/fertilizers, in washing and cleaning agents and for water treatment (e.g. aquariums).</p> <p>Contributing activity/technique for the environment:</p> <ul style="list-style-type: none"> - Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor) (ERC8a) - Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor) (ERC8d) <p>Contributing activity/technique for consumers:</p> <ul style="list-style-type: none"> - Dust suppressant; No spraying (PC 0) - Dust suppressant; Spraying (PC 0) - Humidity adsorbents (PC 0) - Cement/concrete/mortar (PC 0) - Adsorbents (PC 2) - Anti-freeze and de-icing products; No spraying (PC 4) - Anti-freeze and de-icing products; Spraying (PC 4) - Fertilizers; No spraying (PC 12) - Fertilizers; Spraying (PC 12) - Heat transfer fluids (PC 16) - Plant protection products; No spraying (PC 27) - Plant protection products; Spraying (PC 27) - Water treatment chemicals (PC 37) - Washing and cleaning products; No spraying (PC 35) - Washing and cleaning products; Spraying (PC 35) <p>Technical function of the substance: absorbent ; antifreeze agent ; dust suppressant ; fertilisers (soil amendments) ; food flavouring and nutrient ; intermediate (precursor) ; stabilising agent</p> <p>use registered according to REACH Article 10; total tonnage manufactured/imported >=10tonnes/year per registrant</p> <p>Tonnage of substance for that use: <=100000 tonnes/year</p> <p>Subsequent service life relevant for that use: no</p> <p>Related assessment: use assessed in an own CSR</p>



3. CLASSIFICATION AND LABELLING

3.1. Classification and labelling according to CLP / GHS

Substance: [Calcium chloride](#)

Implementation: EU

Remarks:

Calcium chloride is manufactured in several forms (as anhydrous substance, mono-, di-, tetra- and hexahydrate). According to the REACH Guidance for identification and naming of substances under REACH, hydrates and water free (anhydrous) forms of compounds shall be regarded as the same substance. The reported classification and labelling are considered to be applicable for all forms of calcium chloride, unless stated otherwise.

Calcium chloride is included in Annex VI of EU Classification, Labelling and Packaging of Substances and Mixtures (CLP) Regulation (EC) No. 1272/2008 and is classified as Eye Irrit. 2 (Hazard statement: H319: Causes serious eye irritation). However, based on the results of the available studies, anhydrous calcium chloride needs to be classified as Eye Irrit. 1 (Hazard statement: H318: Causes serious eye damage). For calcium chloride hydrates, classification as Eye Irrit. 2 (Hazard statement: H319: Causes serious eye irritation) is still considered applicable. Nevertheless, in accordance with Article 4, point 3 of EU Classification, Labeling and Packaging of Substances and Mixtures (CLP) Regulation (EC) No. 1272/2008, if a substance is subject to harmonised classification and labelling in accordance with Title V through an entry in Part 3 of Annex VI, that substance shall be classified in accordance with that entry, and a classification of that substance in accordance with Title II shall not be performed for the hazard classes or differentiations covered by that entry. Based on this, classification of calcium chloride as Eye Irritant Category 2, H319 is used by the registrant in this dossier.

Related composition: Boundary composition

Table 3.1. Classification and labelling according to CLP / GHS for physicochemical properties

Hazard class	Hazard category	Hazard statement	Reason for no classification
Explosives:			data conclusive but not sufficient for classification
Desensitised explosives:			data conclusive but not sufficient for classification
Flammable gases and chemically unstable gases:			data conclusive but not sufficient for classification
Aerosols:			data conclusive but not sufficient for classification
Chemicals under Pressure:			hazard class not assessed
Oxidising gases:			data conclusive but not sufficient for classification
Gases under pressure:			data conclusive but not sufficient for classification
Flammable liquids:			data conclusive but not sufficient for classification
Flammable solids:			data conclusive but not sufficient for classification
Self-reactive substances and			data conclusive but not sufficient for classification



mixtures:			
Pyrophoric liquids:			data conclusive but not sufficient for classification
Pyrophoric solids:			data conclusive but not sufficient for classification
Self-heating substances and mixtures:			data conclusive but not sufficient for classification
Substances and mixtures which in contact with water emit flammable gases:			data conclusive but not sufficient for classification
Oxidising liquids:			data conclusive but not sufficient for classification
Oxidising solids:			data conclusive but not sufficient for classification
Organic peroxides:			data conclusive but not sufficient for classification
Corrosive to metals:			data conclusive but not sufficient for classification

Table 3.2. Classification and labelling according to CLP / GHS for health hazards

Hazard class	Hazard category	Hazard statement	Reason for no classification
Acute toxicity - oral:			data conclusive but not sufficient for classification
Acute toxicity - dermal:			data conclusive but not sufficient for classification
Acute toxicity - inhalation:			data conclusive but not sufficient for classification
Skin corrosion / irritation:			data conclusive but not sufficient for classification
Serious damage / eye irritation:	Eye Irrit. 2	H319: Causes serious eye irritation.	
Respiratory sensitisation:			data conclusive but not sufficient for classification
Skin sensitisation:			data conclusive but not sufficient for classification
Aspiration hazard:			data conclusive but not sufficient for classification
Reproductive Toxicity:			data conclusive but not sufficient for classification
Reproductive Toxicity: Effects on or via lactation:			data conclusive but not sufficient for classification
Germ cell mutagenicity:			data conclusive but not sufficient for classification
Carcinogenicity:			data conclusive but not sufficient for classification



Specific target organ toxicity – single exposure:			data conclusive but not sufficient for classification
Specific target organ toxicity – repeated exposure:			data conclusive but not sufficient for classification

Table 3.3. Classification and labelling according to CLP / GHS for environmental hazards

Hazard class	Hazard category	Hazard statement	Reason for no classification
Hazards to the aquatic environment (acute/short-term):			data conclusive but not sufficient for classification
Hazards to the aquatic environment (chronic/long-term):			data conclusive but not sufficient for classification
M-Factor acute:			
M-Factor chronic:			
Hazardous to the ozone layer:			data conclusive but not sufficient for classification

Labelling

Signal word: Warning

Hazard pictogram:

GHS07: exclamation mark

Hazard statements:

H319: Causes serious eye irritation.



4. ENVIRONMENTAL FATE PROPERTIES

General discussion of environmental fate and pathways:

Key Information:

Calcium chloride is an inorganic substance which is not expected to undergo photolysis or biodegradation.

Calcium chloride is an inorganic substance for which standard computer models can not be applied to estimate the distribution of this substance in the environment because the programs are designed for organic chemicals and not for inorganic salts.

Calcium chloride is soluble in water and its vapour pressure is negligible. This fact indicates that calcium chloride released into the environment is distributed into the water compartment in the form of calcium and chloride ions. Calcium chloride is not expected to be absorbed in soil due to its dissociation properties and high water solubility but may rather behave as free ions or may form stable inorganic or organic salts with other counter ions, leading to different fates between calcium and chloride ions in soil and water compartments in the environment. As for the behaviour of calcium in soil, the calcium ion may bind to soil particulate or may form stable inorganic salts with sulphate and carbonate ions. The chloride ion is mobile in soil and eventually drains into surface water because it is readily dissolved in water.

4.1. Degradation

4.1.1. Abiotic degradation

4.1.1.1. Hydrolysis

No relevant information available.

Data waiving

Information requirement: Hydrolysis

Reason: study scientifically not necessary / other information available

Justification: In accordance with section 1 of REACH Annex XI, the study does not need to be conducted as in water; calcium chloride is easily dissociated into calcium and chloride ions.

4.1.1.2. Phototransformation/photolysis

4.1.1.2.1. Phototransformation in air

No relevant information available.

4.1.1.2.2. Phototransformation in water

No relevant information available.

4.1.1.2.3. Phototransformation in soil

No relevant information available.

4.1.2. Biodegradation

4.1.2.1. Biodegradation in water

4.1.2.1.1. Screening tests

No relevant information available.



Data waiving

Information requirement: Biodegradation in water: screening test

Reason: study technically not feasible

Justification: the study does not need to be conducted because the substance is inorganic [study technically not feasible]

4.1.2.1.2. Simulation tests (water and sediments)

No relevant information available.

Data waiving

Information requirement: Simulation testing for biodegradation in water and sediment

Reason: study technically not feasible

Justification: In accordance with column 2 of REACH Annex IX, the simulation test on ultimate degradation in surface water does not need to be conducted as the substance is inorganic.

Information requirement: Simulation testing for biodegradation in water and sediment

Reason: other justification

Justification: In accordance with column 2 of REACH Annex IX, the sediment simulation test does not need to be conducted as the substance is inorganic.

4.1.2.1.3. Summary and discussion of biodegradation in water and sediment

No relevant information available.

4.1.2.2. Biodegradation in soil

No relevant information available.

Data waiving

Information requirement: Soil simulation testing

Reason: study technically not feasible

Justification: In accordance with column 2 of REACH Annex IX, the soil simulation test does not need to be conducted as the substance is inorganic.

4.1.3. Summary and discussion of degradation

4.2. Environmental distribution

4.2.1. Adsorption/desorption

No relevant information available.

Data waiving

Information requirement: Adsorption/desorption

Reason: study scientifically not necessary / other information available

Justification: See remarks field. - In accordance with section 1 of REACH Annex XI, the study does not need to be conducted as in water; calcium chloride is dissociated into calcium and chloride ions and chloride ions will not adsorb on particulate matter. The calcium ion may bind to soil particulate or may form stable inorganic salts with sulphate and carbonate ions, but calcium is naturally present in soil.

4.2.2. Volatilisation



No relevant information available.

4.2.3. Distribution modelling

No relevant information available.

4.2.4. Summary and discussion of environmental distribution

4.3. Bioaccumulation

4.3.1. Aquatic bioaccumulation

No relevant information available.

Data waiving

Information requirement: Aquatic bioaccumulation

Reason: study scientifically not necessary / other information available

Justification: In accordance with section 1 of REACH Annex XI, the study does not need to be conducted as in water, calcium chloride is easily dissociated into calcium and chloride ions and both ions are essential constituents of the body of all animals.

4.3.2. Terrestrial bioaccumulation

No relevant information available.

4.3.3. Summary and discussion of bioaccumulation

Key Information:

Calcium chloride is easily dissociated into calcium and chloride ions and both ions are essential constituents of the body of all animals hence if a high amount would be taken up this is regulated by the body. Bioaccumulation of calcium chloride is consequently not expected.

4.4. Secondary poisoning

Based on the available information, there is no indication of a bioaccumulation potential and, hence, secondary poisoning is not considered relevant (see CSR chapter 7.5 “PNEC derivation and other hazard conclusions”).



5. HUMAN HEALTH HAZARD ASSESSMENT

5.1. Toxicokinetics (absorption, metabolism, distribution and elimination)

5.1.1. Non-human information

The results are summarised in the following table:

Table 5.1. Studies on absorption, metabolism, distribution and elimination

Method	Results	Remarks
Basic toxicokinetics study basic toxicokinetics, other in vitro study (basic toxicokinetics, other Exposure regime:	<p>Main ADME results:</p> <p>Absorption, distribution and excretion : Calcium chloride is easily dissociated into calcium and chloride ions in water. The absorption, the distribution and the excretion of the ions in animals are regulated separately.</p> <p>Main functions of calcium : Calcium is essential for the formation of skeletons and the regulation of neural transmission, muscle contraction and coagulation of the blood.</p> <p>Main functions of chloride : Chloride is required for regulating intracellular osmotic pressure and buffering.</p> <p>Toxicokinetic parameters: Absorption: Distribution: Excretion: Metabolites identified: Details on metabolites:</p>	<p>2 (reliable with restrictions) supporting study</p> <p>Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II).</p> <p>Reference Ganong, W.F. 2001 Gomei, T. (chief ed.) 1998 Marcus, R. 2001 Standing Committee on the Scientific Evaluation of Dietary Reference Intakes 1999</p>
Justification for type of information: Weight of evidence from the available toxicokinetic data; considered as acceptable by the OECD SIDS (2003).		

5.1.2. Human information

No relevant information available.

5.1.3. Summary and discussion of toxicokinetics

The following information is taken into account for any hazard / risk assessment:

Key Information:

Calcium chloride is easily dissociated into calcium and chloride ions in water. The absorption, the distribution and the excretion of the ions in animals are regulated separately. Calcium and chloride are essential constituents of the body of all animal species. Calcium is essential for the formation of skeletons and the regulation of neural transmission, muscle contraction and coagulation of the blood. Chloride is required for regulating intracellular osmotic pressure and buffering.



5.2. Acute toxicity

5.2.1. Non-human information

5.2.1.1. Acute toxicity: oral

The results of studies on acute toxicity after oral administration are summarised in the following table:

Table 5.2. Studies on acute toxicity after oral administration

Method	Results	Remarks
rat [common species] (Crj: CD(SD) [rat]) male/female oral: gavage according to guideline OECD Guideline 401 (Acute Oral Toxicity) [before 2002]	LD50: 2120 mg/kg bw (male) LD50: 2361 mg/kg bw (female) LD50: 2301 mg/kg bw (male/female)	2 (reliable with restrictions) key study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Toxicol Laboratories Limited 1987
rat [common species] (Wistar [rat]) male equivalent or similar to guideline OECD Guideline 401 (Acute Oral Toxicity) [before 2002]	LD50: 3798 mg/kg bw (male)	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Akatsuka, K., Hashimoto, T. and Takeuchi, K. 1977
rat [common species] (Wistar [rat]) female equivalent or similar to guideline OECD Guideline 401 (Acute Oral Toxicity) [before 2002]	LD50: 4179 mg/kg bw (female)	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II).



		Reference Akatsuka, K., Hashimoto, T. and Takeuchi, K. 1977
rabbit [other species] (New Zealand White [rabbit]) male oral: capsule equivalent or similar to guideline OECD Guideline 401 (Acute Oral Toxicity) [before 2002]	LD50: 500 - 1000 mg/kg bw (male)	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Koopman, T.S.M. and Pot, T.E. 1986
rabbit [other species] (New Zealand White [rabbit]) male oral: capsule equivalent or similar to guideline OECD Guideline 401 (Acute Oral Toxicity) [before 2002]	LD50: 1000 mg/kg bw (male)	2 (reliable with restrictions) supporting study experimental study Test material 10035-04-8 / 10035-04-8, (full information in Annex II). Reference Koopman, T.S.M. and Pot, T.E. 1986
rabbit [other species] (New Zealand White [rabbit]) male equivalent or similar to guideline OECD Guideline 401 (Acute Oral Toxicity) [before 2002]	LD50: 1000 mg/kg bw (male)	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Koopman, T.S.M. and Pot, T.E. 1986
rabbit [other species] (New Zealand White [rabbit]) male equivalent or similar to guideline OECD Guideline 401 (Acute Oral Toxicity) [before 2002]	LD50: 1000 mg/kg bw (male)	1 (reliable without restriction) supporting study experimental study Test material



		calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Koopman, T.S.M. and Pot, T.E. 1986
mouse [other species] (ICR [mouse]) male equivalent or similar to guideline OECD Guideline 401 (Acute Oral Toxicity) [before 2002]	LD50: 2045 mg/kg bw (male)	2 (reliable with restrictions) supporting study experimental study Test material Information not provided in IUCLID Reference Akatsuka, K., Hashimoto, T. and Takeuchi, K. 1977
mouse [other species] (ICR [mouse]) female oral: gavage equivalent or similar to guideline OECD Guideline 401 (Acute Oral Toxicity) [before 2002]	LD50: 1940 mg/kg bw (female)	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Akatsuka, K., Hashimoto, T. and Takeuchi, K. 1977

5.2.1.2. Acute toxicity: inhalation

No relevant information available.

Data waiving

Information requirement: Acute toxicity after inhalation exposure

Reason: other justification

Justification: In accordance with column 2 of REACH Annex VIII, the study does not need to be conducted, as reliable information on acute toxicity by two other routes of exposure, oral and dermal, is available.

5.2.1.3. Acute toxicity: dermal

The results of studies on acute toxicity after dermal administration are summarised in the following table:

**Table 5.3. Studies on acute toxicity after dermal administration**

Method	Results	Remarks
rabbit [common species] (New Zealand White [rabbit]) male/female Coverage (dermal absorption study): Vehicle: water Method: other	LD50: >5000 mg/kg bw (male/female)	2 (reliable with restrictions) key study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Carreon, R.E., Yano, B.L. and New, M.A. 1981

5.2.1.4. Acute toxicity: other routes

No relevant information available.

5.2.2. Human information

The exposure-related observations in humans are summarised in the following table:

Table 5.4. Exposure-related observations on acute toxicity in humans

Method	Results	Remarks
Study type: tuberculosis patients treatment tuberculosis patients Subjects: - Number of subjects exposed: 65 - Sex: 51 males, 14 females - Age: below 30: 17, from 31 to 50: 39, over 50: 9 - Race: unknown - Demographic information: unknown - Known diseases: tuberculosis Endpoint addressed: acute toxicity: inhalation Sixty five tuberculosis patients (51 males, 14 females; age from below 30 till over 50) were treated with aerosol inhalations of 2-5% aqueous solution of calcium chloride. The number of inhalations varied from below 10 (24 patients), till over 30 (2 patients). Clinical signs are reported.	Outcome of incidence: Several patients reported irritation of mucos membranes of pharinx and throat and unpleasant sensation in mouth already after the first inhalations. However, the frequency of such cases was described as minor by the authors. Overall calcium chloride inhalations were said to have beneficiary effects on disease symptoms (improved quality of spatum, decreased amounts of spatum, improved ease of spatum expellance, decreased frequency of coughing).	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Vinnikov PL, Slepova RI, Sataev IF 1962

5.2.3. Summary and discussion of acute toxicity

The following information is taken into account for any hazard / risk assessment:

**Key Information:**

The combined oral LD50 for male and female rats, determined in a GLP-compliant guideline study, was 2301 mg/kg bw. The dermal LD50 for rabbits was above 5000 mg/kg bw. No reliable animal data on acute inhalation toxicity are available; however, human data suggest that calcium chloride is not acutely toxic by inhalation. A non-reliable acute toxicity study with rats reported signs of respiratory tract irritation at 40 and 160 mg/m3.

Value used for CSA:

Acute oral toxicity:

(LD50) 2301 mg/kg bw

Acute dermal toxicity:

(LD50) 5000 mg/kg bw

Acute inhalation toxicity:

Additional information:

The acute toxicity of calcium chloride is low. The combined oral LD50 value in the GLP-compliant study with rat was 2301 mg/kg bw (Toxicological Laboratories Limited, 1987). The dermal LD50 value in the study with rabbits was above 2000 mg/kg bw (Carreon et al., 1981a). No reliable animal data are available on the acute inhalation toxicity; however, in accordance with Column 2 of REACH Annex VIII, the study does not need to be conducted, as sufficient data are available on two other routes of exposure, oral and dermal. In the acute inhalation toxicity study with rats of low reliability, signs of irritation of the respiratory tract were described at both exposure levels (40 and 160 mg/m3), suggesting that inhalation of calcium chloride can cause an irritation of the respiratory tract. As no deaths were observed, LC50 was established to exceed 160 mg/m3.

In addition, Vinnikov et al. (1962) reported treating tuberculosis patients with aerosol inhalations of 2 -5% aqueous calcium chloride. The number of inhalations varied from below 10 (24 patients), till over 30 (2 patients). Several patients reported irritation of mucos membranes of pharinx and throat and unpleasant sensation in mouth already after the first inhalations. However, the frequency of such cases was described as minor by the authors. Overall calcium chloride inhalations were said to have beneficiary effects on disease symptoms (improved quality of spatum, decreased amounts of spatum, improved ease of spatum expellance, decreased frequency of coughing). These data are considered to prove that calcium chloride is not acutely toxic by inhalation.

Justification for classification or non classification:

The combined oral LD50 value in the GLP-compliant study with rat was 2301 mg/kg bw. The dermal LD50 value in the study with rabbits was above 5000 mg/kg bw. These values are above the cut-off limit of 2000 mg/kg bw, established by the CLP Regulation (EC) No. 1272/2008. Therefore classification for acute toxicity is not warranted.

Discussion of human information:

See "Summary and discussion of human information" in chapter 5 HUMAN HEALTH HAZARD ASSESSMENT

5.3. Irritation

5.3.1. Skin

5.3.1.1. Non-human information

The results of studies on skin irritation are summarised in the following table:



Table 5.5. Studies on skin irritation

Method	Results	Remarks
rabbit [common species] () Coverage: occlusive according to guideline OECD Guideline 404 (Acute Dermal Irritation / Corrosion)	GHS criteria not met overall irritation score 0 (no effects seen) erythema score 0 (Time point: 24/48/72 h) 0 (Time point: 24/48/72 h) 0 (Time point: 24/48/72 h) edema score 0 (Time point: 24/48/72 h) 0 (Time point: 24/48/72 h) 0 (Time point: 24/48/72 h)	1 (reliable without restriction) key study experimental study Test material anhydrous calcium chloride, Form: solid: crystalline (full information in Annex II). Reference Koopman, T.S.M. and Pot, T.E. 1986
rabbit [common species] () Coverage: occlusive according to guideline OECD Guideline 404 (Acute Dermal Irritation / Corrosion)	GHS criteria not met overall irritation score 0 (no effects seen)	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride dihydrate, (full information in Annex II). Reference Koopman, T.S.M. and Pot, T.E. 1986
rabbit [common species] () Coverage: occlusive according to guideline OECD Guideline 404 (Acute Dermal Irritation / Corrosion)	GHS criteria not met overall irritation score >0 - <1 (Time point: 24 hours- 72 hours) Reversibility: fully reversible (one animal with irritation)	2 (reliable with restrictions) supporting study experimental study Test material calcium chloride hexahydrate, (full information in Annex II). Reference Koopman, T.S.M. and Pot, T.E. 1986
rabbit [common species] () Coverage: occlusive according to guideline OECD Guideline 404 (Acute Dermal Irritation / Corrosion)	GHS criteria not met overall irritation score 0 (no effects seen)	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride /



		10043-52-4 / 233-140-8, (full information in Annex II). Reference Koopman, T.S.M. and Pot, T.E. 1986
rabbit [common species] () Coverage: occlusive Method: other: US Federal Register 38: 187, Part 1500, Section 41, 1973.	moderately irritating (Draize) primary dermal irritation index (PDII) 1.4 of max. 8 (Time point: 24 h)	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Carreon, R.E., Yano, B.L. and New, M.A. 1981
rabbit [common species] () Coverage: occlusive Method: other: US Federal Hazardous Labeling Act. procedures recommended by the FDA CFR, Part 191, Chapter 1, Title 21, January 1, 1970.	moderately irritating (Draize) erythema score (slight erythema) (moderate to severe erythema) edema score (moderate edema)	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Norris, J.M. 1971
rabbit [common species] () Coverage: occlusive Method: other	moderately irritating (Draize) overall irritation score (Time point: 4 h) (slight or moderate erythema, edema and slight necrosis)	2 (reliable with restrictions) supporting study experimental study Test material calcium difluoride / 7789-75-5 / 232-188-7, (full information in Annex II). Reference Norris, J.M. 1971



rabbit [common species] () Coverage: occlusive Method: other: US Federal Hazardous Labeling Act. procedures recommended by the FDA CFR, Part 191, Chapter 1, Title 21, January 1, 1970.	moderately irritating (Draize) overall irritation score (Very slight or slight erythema was observed on the intact skin of 5 of 6 rabbits with the remaining rabbit displaying moderate necrosis, no edema by 2 rabbits, very slight to slight edema by 3 rabbits and moderate edema by the remaining rabbit)	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Norris, J.M. 1971
---	---	--

Studies with results indicating corrosivity to the skin are summarised in section 5.4 Corrosivity.

Data waiving

Information requirement: Skin Irritation

Reason: study scientifically not necessary / other information available

Justification: an in vitro skin irritation study does not need to be conducted because adequate data from an in vivo skin irritation study are available [study scientifically not necessary / other information available]

5.3.1.2. Human information

The exposure-related observations in humans are summarised in the following table:

Table 5.6. Exposure-related observations on skin irritation in humans

Method	Results	Remarks
Study type: poisoning incident general Subjects: A 24y old healthy man. Endpoint addressed: skin irritation / corrosion no guideline followed	A skin biopsy shows partial calcification of individual thick and thin collagen fibers in the papillary and upper reticular dermis associated with a sparse infiltrate of neutrophils, lymphocytes and mononuclear histiocytes. There are foci of transepidermal eliminatin (TE) of calcified fibers with adjacent epidermal hyperplasia and orthokeratosis and parakeratosis. A Von Kossa stain highlights calcification of individual fibers, and a trichrome stain confirms the fibers are collagen. A Verhoeff-van Gieson stain shows no significant abnormality of elastic fibers. Outcome of incidence:	4 (not assignable) supporting study accidental exposure Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Patel, R. et al. 2010

5.3.2. Eye

5.3.2.1. Non-human information

The results of studies on eye irritation are summarised in the following table:

Table 5.7. Studies on eye irritation

Method	Results	Remarks
--------	---------	---------



rabbit () Vehicle: according to guideline OECD Guideline 405 (Acute Eye Irritation / Corrosion)	<p>highly irritating</p> <p>cornea opacity score</p> <p>(animal #1) 2 of max. 4 (Time point: 24/48/72 h) not reversible</p> <p>cornea opacity score</p> <p>(animal #2) 2 of max. 4 (Time point: 24/48/72 h) not reversible</p> <p>cornea opacity score</p> <p>(animal #3) 2 of max. 4 (Time point: 24/48/72 h) not fully reversible within: 21 days</p> <p>cornea opacity score</p> <p>(mean) 2 of max. 4 (Time point: 24/48/72 h) not fully reversible within: 21 days</p> <p>iris score</p> <p>(animal #1) 1 of max. 2 (Time point: 24/48/72 h) 0 score after 21 days</p> <p>iris score</p> <p>(animal #2) 1 of max. 2 (Time point: 24/48/72 h) not reversible</p> <p>iris score</p> <p>(animal #3) 1 of max. 2 (Time point: 24/48/72 h) 0 score after 21 days</p> <p>iris score</p> <p>(mean) 1 of max. 2 (Time point: 24/48/72 h) not fully reversible within: 21 days</p> <p>conjunctivae score</p> <p>(animal #1) 2 of max. 2 (Time point: 24/48/72 h) not fully reversible within: 21 days</p> <p>conjunctivae score</p> <p>(animal #2) 2 of max. 3 (Time point: 24/48/72 h) not fully reversible within: 21 days</p> <p>conjunctivae score</p> <p>(animal #3) 1.67 of max. 2 (Time point: 24/48/72 h) score 0 after 21 days</p> <p>conjunctivae score</p> <p>(mean) 1.9 of max. 3 (Time point: 24/48/72 h) not fully reversible within: 21 days</p> <p>chemosis score</p> <p>(animal #1) 2.33 of max. 3 (Time point: 24/48/72 h) not fully reversible within: 21 days</p> <p>chemosis score</p> <p>(animal #2) 2 of max. 3</p>	<p>1 (reliable without restriction) key study experimental study</p> <p>Test material calcium dichloride / 10043-52-4 / 233-140-8, Form: solid: crystalline (full information in Annex II).</p> <p>Reference Koopman, T.S.M. and Pot, T.E. 1986</p>
---	--	---



	<p>(Time point: 24/48/72 h) not reversible chemosis score (animal #3) 2.33 of max. 3 (Time point: 24/48/72 h) score) after 21 days chemosis score (mean) 2.2 of max. 4 (Time point: 24/48/72 h)</p>	
<p>rabbit () Vehicle: according to guideline OECD Guideline 405 (Acute Eye Irritation / Corrosion)</p>	<p>irritating cornea opacity score (animal #1) 1 of max. 1 (Time point: 24/48/72 h) score 0 after 14 days cornea opacity score (animal #2) 0 of max. 0 (Time point: 24/48/72 h) not damage cornea opacity score (animal #3) 2 of max. 2 (Time point: 24/48/72 h) not fully reversible within: 21 days cornea opacity score (mean) 1 of max. 4 (Time point: 24/48/72 h) not fully reversible within: 21 days in one animal iris score (animal #1) 0 of max. 0 (Time point: 24/48/72 h) 0 score after 14 days iris score (animal #2) 0 of max. 0 (Time point: 24/48/72 h) not damage iris score (animal #3) 1 of max. 2 (Time point: 24/48/72 h) 0 score after 21 days iris score (mean) 0.33 of max. 2 (Time point: 24/48/72 h) not fully reversible within: 14 days conjunctivae score (animal #1) 2.33 of max. 3 (Time point: 24/48/72 h) not fully reversible within: 14 days conjunctivae score (animal #2) 0.33 of max. 2 (Time point: 24/48/72 h) not fully reversible within: 21 days conjunctivae score (animal #3) 2 of max. 2 (Time point: 24/48/72 h)</p>	<p>1 (reliable without restriction) key study experimental study</p> <p>Test material calcium chloride dihydrate, Form: solid: flakes (full information in Annex II).</p> <p>Reference Koopman, T.S.M. and Pot, T.E. 1986</p>



	<p>not reversible conjunctivae score (mean) 1.54 of max. 3 (Time point: 24/48/72 h) not fully reversible within: 21 days in one animal chemosis score (animal #1) 2.33 of max. 3 (Time point: 24/48/72 h) not fully reversible within: 14 days chemosis score (animal #2) 1 of max. 2 (Time point: 24/48/72 h) 0 score after 21 days chemosis score (animal #3) 1.67 of max. 2 (Time point: 24/48/72 h) score 0 after 21 days chemosis score (mean) 1.65 of max. 4 (Time point: 24/48/72 h) fully reversible within: 14 days</p>	
<p>rabbit () Vehicle: according to guideline OECD Guideline 405 (Acute Eye Irritation / Corrosion)</p>	<p>moderately irritating cornea opacity score (animal #1) 1 of max. 1 (Time point: 24/48/72 h) fully reversible within: 7 days cornea opacity score (animal #2) 0.33 of max. 1 (Time point: 24/48/72 h) fully reversible within: 72h cornea opacity score (animal #3) 1.33 of max. 2 (Time point: 24/48/72 h) fully reversible within: 21 days cornea opacity score (mean) 1 of max. 4 (Time point: 24/48/72 h) fully reversible within: 7 days iris score (animal #1) 0 of max. 0 (Time point: 24/48/72 h) 0 score after 7 days iris score (animal #2) 0 of max. 0 (Time point: 24/48/72 h) 0 score after 7 days iris score (animal #3) 0 of max. 0 (Time point: 24/48/72 h) 0 score after 21 days iris score (mean) 0 of max. 2 (Time point: 24/48/72 h)</p>	<p>1 (reliable without restriction) key study experimental study</p> <p>Test material Calcium chloride hexahydrate, Form: solid: crystalline (full information in Annex II).</p> <p>Reference Koopman, T.S.M. and Pot, T.E. 1986</p>



	<p>conjunctivae score</p> <p>(animal #1) 1 of max. 2 (Time point: 24/48/72 h) 0 score after 7 days</p> <p>conjunctivae score</p> <p>(animal #2) 0.33 of max. 1 (Time point: 24/48/72 h) 0 score after 72h</p> <p>conjunctivae score</p> <p>(animal #3) 0.67 of max. 1 (Time point: 24/48/72 h) 0 score after 21 days</p> <p>conjunctivae score</p> <p>(mean) 0.67 of max. 3 (Time point: 24/48/72 h) fully reversible within: 14 days</p> <p>chemosis score</p> <p>(animal #1) 1.33 of max. 2 (Time point: 24/48/72 h) 0 score after 7 days</p> <p>chemosis score</p> <p>(animal #2) 0.33 of max. 2 (Time point: 24/48/72 h) 0 score after 7 days</p> <p>chemosis score</p> <p>(animal #3) 0.67 of max. 2 (Time point: 24/48/72 h) score 0 after 21 days</p> <p>chemosis score</p> <p>(mean) 0.78 of max. 4 (Time point: 24/48/72 h) fully reversible within: 7 days</p>	
<p>rabbit ()</p> <p>Vehicle:</p> <p>according to guideline OECD Guideline 405 (Acute Eye Irritation / Corrosion)</p>	<p>moderately irritating</p> <p>cornea opacity score</p> <p>(mean) 1.22 of max. 4 (Time point: 24 + 48 + 72 hr) not fully reversible within: 21 days in 1 animal</p> <p>iris score</p> <p>(mean) 0.11 of max. 2 (Time point: 24 + 48 + 72 hr) fully reversible within: 72 hr</p> <p>conjunctivae score</p> <p>(mean) 1.11 of max. 3 (Time point: 24 + 48 + 72 hr) fully reversible within: 21 days</p> <p>chemosis score</p> <p>(mean) 1.22 of max. 4 (Time point: 24 + 48 + 72 hr) fully reversible within: 21 days</p> <p>cornea opacity score</p> <p>(animal #1) 2 of max. 2 (Time point: 24/48/72 h) not fully reversible within: after 21 days</p>	<p>2 (reliable with restrictions) key study experimental study</p> <p>Test material Calcium chloride, 33% aqueous solution, (full information in Annex II).</p> <p>Reference Koopman, T.S.M. and Pot, T.E. 1986</p>



	<p>cornea opacity score (animal #2) 2 of max. 2 (Time point: 24/48/72 h) not fully reversible within: 21 days</p> <p>cornea opacity score (animal #3) 0 of max. 0 (Time point: 24/48/72 h) 0 score after 72h</p> <p>iris score (animal #1) 0 of max. 1 (Time point: 24/48/72 h) fully reversible within: 24 h</p> <p>iris score (animal #2) 0.33 of max. 1 (Time point: 24/48/72 h) fully reversible within: 72 h</p> <p>iris score (animal #3) 0 of max. 0 (Time point: 24/48/72 h) 0 score after 72h</p> <p>conjunctivae score (animal #1) 1.33 of max. 2 (Time point: 24/48/72 h) fully reversible within: 21 days</p> <p>conjunctivae score (animal #2) 1.33 of max. 2 (Time point: 24/48/72 h) fully reversible within: 21 days</p> <p>conjunctivae score (animal #3) 0.33 of max. 1 (Time point: 24/48/72 h) fully reversible within: 72h</p> <p>chemosis score (animal #1) 2 of max. 2 (Time point: 24/48/72 h) fully reversible within: 21 days</p> <p>chemosis score (animal #2) 1.33 of max. 2 (Time point: 24/48/72 h) fully reversible within: 7 days</p> <p>chemosis score (animal #3) 1.33 of max. 2 (Time point: 24/48/72 h) fully reversible within: 48 h</p>	
<p>rabbit () Vehicle: Method: other: US Federal Hazardous Labeling Act. procedures recommended by the FDA CFR, Part 191, Chapter 1, Title 21, January 1, 1970.</p>	<p>moderately irritating</p>	<p>2 (reliable with restrictions) supporting study experimental study</p> <p>Test material calcium chloride dihydrate, (full information in Annex II).</p>



		Reference Norris, J.M. 1971
rabbit () Vehicle: Method: other: US Federal Hazardous Labeling Act. procedures recommended by the FDA CFR, Part 191, Chapter 1, Title 21, January 1, 1970.	moderately irritating	2 (reliable with restrictions) supporting study experimental study Test material calcium chloride, 38% aqueous solution, (full information in Annex II). Reference Norris, J.M. 1971

Data waiving**Information requirement: Eye Irritation**

Reason: study scientifically not necessary / other information available

Justification: an in vitro eye irritation study does not need to be conducted because adequate data from an in vivo eye irritation study are available [study scientifically not necessary / other information available]

5.3.2.2. Human information

No relevant information available.

5.3.3. Respiratory tract**5.3.3.1. Non-human information**

No relevant information available

5.3.3.2. Human information

No relevant information available.

5.3.4. Summary and discussion of irritation

The following information is taken into account for any hazard / risk assessment:

Key Information:

Based on the results of GLP-compliant guideline study, calcium chloride is found to be not irritating to skin. Anhydrous calcium chloride is severely irritating to rabbit eyes; however, irritating properties seem to diminish with a higher degree of hydration for calcium chloride hydrates. There is limited evidence that calcium chloride may cause respiratory tract irritation; however, this evidence is concluded to be not sufficient for classification and labelling.

Value used for CSA:

Skin irritation / corrosion: no adverse effect observed (not irritating) Eye irritation: adverse effect observed (irritating) Respiratory irritation: no adverse effect observed (not irritating)



Relevant studies: Koopman 1986/K1 KS/Skin irritation / corrosion

Relevant studies: Koopman 1986/K1 KS/Eye irritation.001

Relevant studies: Koopman 1986/K1 KS/Eye irritation.002

Relevant studies: Koopman 1986/K1 KS/Eye irritation.003

Relevant studies: Koopman 1986/K2 KS/Eye irritation

Additional information:

Skin irritation

Calcium chloride was found to be not irritating to rabbit skin in the GLP-compliant study, performed according to OECD Guideline 404 (Koopman et al., 1986e). No effects were noted in any of three rabbits at any observation time points (1, 24, 48 and 72 hours) following an application of the anhydrous substance under occlusive dressing for 4 hours.

Eye irritation

Good quality eye irritation studies are available with anhydrous calcium chloride, calcium chloride dihydrate, calcium chloride hexahydrate and 33% aqueous solution (Koopman et al., 1986i, 1986j, 1986k, 1986l), performed in accordance with OECD Guideline 405. In each study 100 mg of the material was instilled in an eye of three rabbits. No rinsing was performed. The results indicate that anhydrous calcium chloride is severely irritating to rabbit eyes. The cornea and conjunctiva were moderately to severely irritated in all rabbits from one hour till 14 days after treatment. Thereafter the eye of one rabbit recovered, but there was still a slight haze on the cornea, 21 days after treatment. In the two other rabbits the cornea and conjunctiva were still moderately irritated 21 days after treatment.

The irritating properties of calcium chloride seem to diminish with a higher degree of hydration, as can be seen from the results with di- and hexahydrate forms and 33% aqueous solution of calcium chloride. For calcium chloride dihydrate, the conjunctiva of one rabbit was moderately to severely irritated from one till 24 hours after treatment. Thereafter the irritation diminished and had disappeared at 14 days after treatment, although a slight lacrimation was still noted. The cornea of this rabbit was slightly opaque up to and including 72 hours. The conjunctiva of the second rabbit was moderately irritated at the one hour reading. Thereafter the irritation diminished, although the conjunctiva was still slightly damaged at the end of the observation period. In the third rabbit the cornea was moderately irritated from 24 till 72 hours. Thereafter the irritation diminished, but was still slight at the end of the experiment. The conjunctiva was moderately irritated from one till 72 hours. Thereafter the eye recovered, but the irritation was still present 21 days after application. The iris was slightly irritated from one hour up to 14 days after treatment.

In the study with calcium chloride hexahydrate, the conjunctiva of one rabbit was slightly irritated till 48 hours; the irritation had disappeared at 72 hours. The cornea was slightly irritated at 24 hours after treatment. In a second rabbit the conjunctiva was moderately irritated from one till 48 hours after treatment, thereafter the conjunctiva recovered. The cornea was slightly irritated from one till 72 hours. The irritation of cornea and conjunctiva had disappeared at 7 days after treatment. In the third rabbit the cornea was slightly irritated from 24 hours till 72 hours after treatment. The conjunctiva was slightly irritated from 1 hour till 14 days. At day 21 only some lacrimation was noted in this rabbit.

Finally, in the study with 33% aqueous solution of calcium chloride, the conjunctiva of one rabbit was slightly irritated from 1 till 48 hours after treatment. The irritation had disappeared at 48 hours, although some lacrimation was still noted. In a second rabbit the cornea and conjunctiva were moderately irritated till 48 hours. Thereafter the eye recovered and the irritation had disappeared 14 days after treatment. In the third rabbit the cornea and conjunctiva were moderately irritated till 72 hours. Thereafter, the cornea and conjunctiva recovered, but 21 days after treatment, the cornea was still slightly irritated.

Respiratory tract irritation

In the acute inhalation toxicity study of low reliability, signs of irritation of the respiratory tract were described at both exposure levels (40 and 160 mg/m³), suggesting that inhalation of calcium chloride can cause an irritation of the respiratory tract. In the study with tuberculosis patients who were treated with aerosol



inhalations of 2-5% aqueous solution of calcium chloride, with the number of inhalations varying from below 10 to over 30 (Vinnikov et al., 1962), irritation of mucous membranes of pharynx and throat and unpleasant sensation in mouth was reported by some patients. However, the frequency of such cases was described as minor by the authors. Overall calcium chloride inhalations were said to have beneficial effects on disease symptoms (improved quality of sputum, decreased amounts of sputum, improved ease of sputum expectoration, decreased frequency of coughing). In summary, the evidence that calcium chloride can cause respiratory tract irritation is considered to be inconclusive.

Justification for classification or non classification:

Based on the results of GLP-compliant guideline studies, calcium chloride does not need to be classified for skin irritation.

In the available eye irritation study with anhydrous calcium chloride, the observed signs of irritation were not fully reversible within 21 days of observation period. This suggests that anhydrous substance should be classified as Category 1, H318 (causes serious eye damage) according to EU Classification, Labeling and Packaging of Substances and Mixtures (CLP) Regulation (EC) No. 1272/2008.

For hydrated forms of calcium chloride classification as Category 2, H319 (causes serious eye irritation) is proposed based on the available studies. It should be noted that although (minor) signs of irritation were still present in some animals at the end of 21 days observation period in some cases, classification into a more severe category is considered to be not warranted based on following considerations:

- No examples of calcium chloride causing irreversible damage to eyes in humans have been reported, despite its long history of widespread use
- It is feasible that eye irritating properties of calcium chloride are directly related to its hygroscopic properties. Anhydrous calcium chloride is a highly hygroscopic substance, and its dissolution in water is a highly exothermic process (heat of dissolution 81.3 kJ/mol), while calcium chloride hydrates are significantly less hygroscopic and their dissolution in water is only slightly exothermic.
- Available studies have been performed in accordance with OECD Guideline 401 adopted in 1981, which stated that eyes can be rinsed 24 hours post-instillation. According to the modern version of the guideline, rinsing of eyes 1 hour post-instillation is allowed. It is thus feasible that more severe effects have been observed due to the longer presence of the test substance in a conjunctival sac.

In summary, classification in Category 1, H318 (causes serious eye damage) according to EU Classification, Labeling and Packaging of Substances and Mixtures (CLP) Regulation (EC) No. 1272/2008 is proposed for anhydrous calcium chloride. For calcium chloride hydrates, classification in Category 2, H319 (causes serious eye irritation) is proposed. However, calcium chloride is already classified as Category 2, H319 (causes serious eye irritation) on Annex VI of EU Classification, Labeling and Packaging of Substances and Mixtures (CLP) Regulation (EC) No. 1272/2008. In accordance with Article 4, point 3 of EU Classification, Labeling and Packaging of Substances and Mixtures (CLP) Regulation (EC) No. 1272/2008, if a substance is subject to harmonised classification and labelling in accordance with Title V through an entry in Part 3 of Annex VI, that substance shall be classified in accordance with that entry, and a classification of that substance in accordance with Title II shall not be performed for the hazard classes or differentiations covered by that entry. Based on this, classification of calcium chloride as Eye Irritant Category 2, H319 shall be followed by the registrant in this dossier.

No classification of calcium chloride as a respiratory tract irritant is proposed based on the available data.

5.4. Corrosivity

5.4.1. Non-human information

No relevant information available.



5.4.2. Human information

No relevant information available.

5.4.3. Summary and discussion of corrosion

Koopman 1986/K1 KS/Skin irritation / corrosion

The studies with results indicating corrosivity are discussed in section 5.3.4 Summary and discussion of irritation.

5.5. Sensitisation

5.5.1. Skin

5.5.1.1. Non-human information

No relevant information available.

Data waiving

Information requirement: Skin Sensitisation

Reason: study scientifically not necessary / other information available

Justification: see 'Remark' - As described in ECHA guidance R7a, section R.7.3.2, contact allergens are reactive substances of low molecular weight and having a lipophilicity that favours dermal penetration. It usually concerns organic substances or metal ions. The Adverse Outcome Pathway (AOP) describes some of the mechanisms of skin sensitization. The first key event in the AOP is the formation of a covalent bond between the substance and skin proteins. However, as calcium chloride is an ionic substance, it is not able to form covalent bonds, and the mechanism described in the AOP cannot occur. As calcium chloride dissociates into calcium and chloride, possible skin sensitization effects of calcium as a metal might further be considered. As mentioned in ECHA guidance R7a, the mechanisms of metals leading to induction of skin sensitization effects is not fully understood. For some metals the sensitizing effects may occur by interaction of the metal with the major histocompatibility complex (MHC), but for other metals the mechanisms are less well known. Therefore, ECHA guidance R7a prescribes that skin sensitization for metals should be evaluated on a case-by-case basis depending on the metal and amount of available information. When making this case-by-case assessment for calcium chloride, a first aspect to take into account is the fact that the ionic nature of calcium chloride makes it very hydrophilic in nature. As a consequence, calcium chloride lacks the necessary lipophilicity that is required to allow penetration of the substance through the stratum corneum. Calcium chloride will therefore not be absorbed through the skin in relevant amounts, and hence, dermal contact cannot lead to any systemic effects, including skin sensitization. Furthermore, it is noted that calcium ions are ubiquitous in living organisms, having important roles in the physiology of normal cell functioning. Calcium is essential for the formation of skeletons and the regulation of neural transmission, muscle contraction and coagulation of the blood. As a consequence, plasma calcium levels in humans are strongly regulated. The normal range of total (free + protein-bound) blood calcium level in humans is kept between 85 and 103 mg/L by homeostatic mechanisms. Free calcium ions are normally present in human blood in a concentration of 44 to 54 mg/L. Even if dermal contact with calcium chloride would result in the dermal uptake of calcium through the skin (which is unlikely due to its hydrophilicity), the calcium level in the blood will not change noticeably due to the calcium homeostasis. Calcium ions are known to form complexes with different types of proteins in the blood, and the so formed calcium-protein complexes have many different functions in biochemical processes. In T lymphocytes of the immune system, calcium is essential for gene expression regulation. In conclusion, additional testing on skin sensitizing properties of calcium chloride is deemed not scientifically meaningful, as (i) calcium chloride will not become systemically available upon dermal contact, (ii) calcium chloride is not able to form covalent bonds, (iii) calcium metal ion levels are regulated by homeostasis, (iv) calcium is essential in the correct gene expression of the immune system. Finally, it should be mentioned that sensitising effects of calcium chloride have never been reported, despite long-term historical and wide dispersive use. Furthermore, calcium chloride has been approved as a food additive in the European Union and therefore a sensitizing effects of calcium chloride is not expected.



5.5.1.2. Human information

No relevant information available.

5.5.2. Respiratory system

5.5.2.1. Non-human information

No relevant information available.

5.5.2.2. Human information

No relevant information available.

5.5.3. Summary and discussion of sensitisation

The following information is taken into account for any hazard / risk assessment:

Skin sensitisation

Key Information:

Calcium chloride is not sensitizing to skin.

Value used for CSA: no adverse effect observed (not sensitising)

Additional information:

Calcium chloride is considered not to have any sensitising properties, based on the physiological role of both its constituent ions, as well as the fact that sensitising effects of calcium chloride have never been reported, despite long-term historical and wide dispersive use (e.g. via food and medication).

The following information is taken into account for any hazard / risk assessment:

Respiratory sensitisation

Value used for CSA: no adverse effect observed (not sensitising)

Additional information:

Calcium chloride is considered not to have any sensitising properties, based on the physiological role of both its constituent ions, as well as the fact that sensitising effects of both ions have never been reported, despite long-term historical and wide dispersive use (e.g. via food and medication).

As a result, calcium chloride is assumed not sensitizing to the respiratory tract.

5.6. Repeated dose toxicity

5.6.1. Non-human information

5.6.1.1. Repeated dose toxicity: oral



The results of studies are summarised in the following table:

Table 5.8. Studies on repeated dose toxicity after oral administration

Method	Results	Remarks
rat [common rodent species] (Wistar [rat]) male short-term repeated dose toxicity: oral oral: feed 0g / 100g diet 0.5g / 100g diet 1g / 100g diet 1.5g / 100g diet Vehicle: unchanged (no vehicle) Exposure: 60 days (once daily) no guideline followed - Principle of test: Repeated dose toxicity test in male rats to assess the effect of calcium dichloride on the thyroid. - Short description of test conditions: The animals received diets with 0, 0.5, 1.0 or 1.5 g CaCl ₂ /100g diet for a period of 60 days. - Parameters analysed / observed: food consumption, body and thyroid weight, histological examination of the thyroid gland, thyroid peroxidase (TPO) assay, thyroid sodium potassium triphosphatase (Na ⁺ K ⁺ ATPase) assay, thyroidal 5'-deiodinase type I (DI) assay, protein estimation, serum total thyroxine (tT ₄), serum total triiodothyronine (tT ₃), serum free thyroxine (fT ₄), serum free triiodothyronine (fT ₃) and radioimmunoassay (RIA) of thyroid stimulating hormone (TSH).	(- Toxicological relevance of findings not clear. Observed effects: altered thyroid hormone profile and modifications of thyroid histoarchitecture.)	4 (not assignable) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Chandra, A.K., et al. 2012
rat [common rodent species] () not specified repeated dose toxicity: oral [deactivated phrase] oral: feed Doses / Concentrations: 20000 ppm Basis: Vehicle: Exposure: 12 months (daily) Rats received diet enriched with 20 mg CaCl ₂ per gram diet for a period of 1 year. Examinations included body weight and histopathological examination of the gastro-intestinal tract, urinary tract, liver, heart, brain and spleen.	NOAEL: >=20000 ppm (not specified) (no neoplastic lesions observed)	4 (not assignable) supporting study experimental study Test material Calcium chloride, (full information in Annex II). Reference Pamukcu, A.M., Yalciner, S. and Bryan, G.T. 1977
rat [common rodent species] () male/female repeated dose toxicity: oral [deactivated phrase] oral: feed	NOAEL: >=20000 ppm (male/female) (no bodyweight effects, no thyroid effects) NOAEL: >=1000 mg/kg bw/day	4 (not assignable) supporting study experimental study Test material



<p>Doses / Concentrations: 20000 ppm in basal diet or 10000 ppm in drinking water Basis:</p> <p>Vehicle:</p> <p>Exposure: 12 weeks (daily)</p> <p>Rats received either a diet enriched with 2% of calcium chloride or drinking water containing 1% of calcium chloride. Body weight and effects on thyroid gland were examined.</p>	<p>(nominal) (male/female) (no bodyweight effects, no thyroid effects)</p>	<p>Calcium chloride, (full information in Annex II).</p> <p>Reference</p> <p>Sharpless, G.R., Sabol, M., Anthony, E.K. and Argetsinger, H.L. 1942</p>
<p>rat [common rodent species] (not specified)</p> <p>not specified</p> <p>repeated dose toxicity: oral [deactivated phrase]</p> <p>oral: gavage</p> <p>Doses / Concentrations: 1.1, 2.8, 5.6 g/kg-bw Basis:</p> <p>Vehicle:</p> <p>Exposure: 70 days (6 days/week)</p> <p>Rats received solutions of calcium chloride via gavage for 6d / wk during 10 weeks. Received doses were 1.1 to 5.6 g CaCl₂/kg bw. Mortality and histopathological changes to heart, liver and kidney were assessed.</p>	<p>(Total mortality occurred within the first week in animals receiving 2.8 or 5.6 g CaCl₂/kg bw/d.)</p> <p>(No histological changes in heart, liver or kidney in animals that survived until study termination.)</p>	<p>4 (not assignable) supporting study experimental study</p> <p>Test material</p> <p>calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II).</p> <p>Reference</p> <p>Smith, E.R.B. 1942</p>
<p>rabbit [other species] (not specified)</p> <p>not specified</p> <p>repeated dose toxicity: oral [deactivated phrase]</p> <p>oral: gavage</p> <p>Doses / Concentrations: 1.5, 1.8, 2.2, 2.5 g/kg/day Basis:</p> <p>Vehicle:</p> <p>Exposure: 4 days (daily)</p> <p>Rabbits received solutions of calcium chloride via gavage for an unknown duration. Received doses were 1.5 to 5.5 g CaCl₂/kg bw. Mortality, urinalysis, blood analysis and histopathological changes to lung, myocardium, liver and kidney were assessed.</p>	<p>(Mortality observed in 2.2 and 2.5 g/kg bw/d dose groups.)</p> <p>(No effects observed in 1.5 and 1.8 g/kg bw/d dose groups.)</p>	<p>3 (not reliable) disregarded due to major methodological deficiencies experimental study</p> <p>Test material</p> <p>calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II).</p> <p>Reference</p> <p>Govan, A.D.T. and Parkes, J. 1949</p>
<p>rat [common rodent species] (Sprague-Dawley [rat])</p> <p>female</p> <p>short-term repeated dose toxicity: oral</p> <p>oral: gavage</p> <p>0mg/kg bw/day (nominal)</p> <p>20mg/kg bw/day (nominal)</p> <p>40mg/kg bw/day (nominal)</p>	<p>(- positive effects on bones and gonadal development, in combination with effects on plasma triglyceride levels and a decrease in body weight gain)</p>	<p>3 (not reliable) disregarded due to major methodological deficiencies experimental study</p> <p>Test material</p> <p>Calcium dichloride</p>



60mg/kg bw/day (nominal) Vehicle: water Exposure: 5 weeks (daily oral gavage) no guideline followed - Principle of test: Repeated dose toxicity test in female immature rats to assess the effect of calcium dichloride on blood parameters, gonadal development and bone structure. - Short description of test conditions: Immature female rats were dosed with 20, 40 or 60 mg/kg bw/d of calcium chloride dihydrate via oral gavage for 5 weeks. - Parameters analysed / observed: biochemical assay of blood samples, histological and morphological examination.		dihydrate, Form: solid: crystalline (full information in Annex II). Reference El-Merhie, N., Sabry, I., Balbaa, M. 2012
--	--	---

Data waiving

Information requirement: sub-chronic toxicity study (90 days) (oral)

Reason: other justification

Justification: See remarks field. - Calcium and chloride are essential nutrients for the physiology and homeostasis of humans. Calcium and chloride are both naturally present in food in significant quantities. For calcium the average requirement (AR) for adults ≥ 25 years was reported to be 750 mg/day (EFSA, 2015). The dietary reference value for chloride is 3.1 g/day for adults including pregnant and lactating women (EFSA, 2019b). In addition, it was reported that the use of calcium chloride as food additive (E 509) does not raise a safety concern at the reported use and use levels EFSA (2019a). It is therefore considered that additional oral repeated dose toxicity testing on calcium chloride is not necessary.

5.6.1.2. Repeated dose toxicity: inhalation

No relevant information available.

Data waiving

Information requirement: sub-chronic toxicity study (90 days) (inhalation)

Reason: other justification

Justification: See remarks field. - For inhalation exposure, a long-term DNEL for local effects of 5 mg/m³ was determined based on the occurrence of irritation of the respiratory tract upon exposure to calcium chloride. Should a worker be exposed to such a concentration for 8 hours, the total amount of inhaled calcium chloride can be calculated to be 50 mg CaCl₂ (assuming 10 m³ of inhaled air volume for a worker at light activity). When accounting for a complete uptake of the calcium chloride, this would result in a systemic availability of 18 mg of Ca²⁺ and 32 mg of Cl⁻. It is obvious from these findings that the doses that could become systemically available following inhalation exposure to calcium chloride are low as compared to the daily average requirement of 750 mg calcium per day and 3100 mg chloride per day. The same reasoning can be extrapolated to the general population. It is therefore considered that inhalation exposure does not contribute significantly to the systemic availability of calcium and chloride and, hence, repeated dose toxicity testing for this route of administration is not deemed of added value.

5.6.1.3. Repeated dose toxicity: dermal

No relevant information available.

Data waiving

Information requirement: sub-chronic toxicity study (90 days) (dermal)



Reason: other justification

Justification: See remarks field. - Similar as to the inhalation route, in order for the dermal route to contribute significantly to the systemic availability of calcium and chloride, unrealistically high amounts of calcium chloride should be applied to and absorbed through the skin. Repeated dose toxicity testing for this route of administration is therefore not deemed of added value. Overall, it can be concluded that calcium chloride has a low repeated dose toxicity and the conduct of a standard repeated dose toxicity study with animals has no added value in the context of the REACH regulation.

5.6.1.4. Repeated dose toxicity: other routes

No relevant information available.

5.6.2. Human information

No relevant information available.

5.6.3. Summary and discussion of repeated dose toxicity

The following information is taken into account for any hazard / risk assessment:

Value used for CSA (via oral route - systemic effects):

Value used for CSA (inhalation - systemic effects):

Value used for CSA (inhalation - local effects):

Value used for CSA (dermal - systemic effects):

Value used for CSA (dermal - local effects):

**Justification for classification or non classification:**

As both calcium and chloride are essential nutrients for humans and taking into account that the tolerable upper intake level for calcium is set at 2500 mg per day (equivalent to 6.9 g CaCl₂ per day, classification is not warranted in accordance with EU Classification, Labeling and Packaging of Substances and Mixtures (CLP) Regulation (EC) No. 1272/2008.

Detailed information on the Mode of Action is available in **Annex III**.

5.7. Mutagenicity**5.7.1. Non-human information****5.7.1.1. In vitro data**

The results of in vitro genotoxicity studies are summarised in the following table:

Table 5.9. In vitro genotoxicity studies:

Method	Results	Remarks
bacterial reverse mutation assay [in vitro gene mutation study in bacteria] (in vitro gene mutation study in bacteria - Type of genotoxicity: gene mutation) S. typhimurium, other: TA92, TA1535, TA100, TA1537, TA94, TA98 [bacteria] (with met. act.) Test concentrations: max 5.0 mg/plate Positive control substance(s): equivalent or similar to guideline OECD Guideline 471 (Bacterial Reverse Mutation Assay) [in vitro gene mutation study in bacteria]	Test results: negative for S. typhimurium, other: TA92, TA1535, TA100, TA1537, TA94, TA98 [bacteria]; met. act.: with genotoxicity: negative cytotoxicity: no cytotoxicity nor precipitates, but tested up to recommended limit concentrations vehicle controls valid: negative controls valid: positive controls valid:	2 (reliable with restrictions) key study experimental study Test material calcium chloride, (full information in Annex II). Reference Ishidate, M., Jr., Sofumi, T., Yoshikawa, K., Hayashi, M., Nohmi, T., Sawada, M. and Matsuoka, A. 1984
in vitro mammalian chromosome aberration test [chromosome aberration] (in vitro cytogenicity / chromosome aberration study in mammalian cells - Type of genotoxicity: chromosome aberration) Chinese hamster fibroblast cell line CHL (without met. act.) Test concentrations: max. 4 mg/plate Positive control substance(s): equivalent or similar to guideline OECD Guideline 473 (In Vitro Mammalian Chromosome Aberration Test) [in vitro cytogenicity / chromosome aberration study in mammalian cells]	Test results: negative for Chinese hamster lung fibroblasts (V79) [mammalian cell line]; met. act.: without genotoxicity: negative cytotoxicity: cytotoxicity vehicle controls valid: negative controls valid: positive controls valid: Remarks: all strains/cell types tested	2 (reliable with restrictions) key study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Ishidate, M., Jr., Sofumi, T., Yoshikawa, K., Hayashi, M., Nohmi, T., Sawada, M. and Matsuoka, A. 1984



bacterial reverse mutation assay [in vitro gene mutation study in bacteria] (in vitro gene mutation study in bacteria - Type of genotoxicity: gene mutation) Salmonella typhimurium TA97, TA102 (with and without met. act.) Test concentrations: 0.1 - 10 mg/plate Positive control substance(s): Method: other	Test results: negative for ; met. act.: with and without genotoxicity: negative cytotoxicity: vehicle controls valid: negative controls valid: positive controls valid: Remarks: other: Salmonella typhimurium TA97, TA102	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Fujita, H. and Sasaki, M. 1987
--	---	---

Data waiving

Information requirement: In vitro genotoxicity: (in vitro gene mutation study in mammalian cells)

Reason: study scientifically not necessary / other information available

Justification: see 'Remark' - In accordance with section 1 of REACH Annex XI, testing does not appear scientifically necessary; the performed in vitro genetic toxicity tests were negative. Furthermore, calcium chloride is naturally present in cells and the structure does not indicate a genotoxic potential. Therefore, calcium chloride is considered to be not genotoxic. Moreover, is the substance already present in the tissue culture media of the in vitro test systems for genetic toxicity testing, and needed for normal function of the cells in culture. Testing sodium bicarbonate in vitro will affect the cellular homeostasis due to osmolarity and/or pH of the culture medium which might give rise to aspecific effects.

5.7.1.2. In vivo data

No relevant information available.

5.7.2. Human information

No relevant information available.

5.7.3. Summary and discussion of mutagenicity

The following information is taken into account for any hazard / risk assessment (genetic toxicity in vitro):

Based on the results of two bacterial mutation assays and an in vitro chromosome aberration test in Chinese hamster lung fibroblasts, calcium chloride is considered not to have a genotoxic potential.

Value used for CSA (genetic toxicity in vitro): Genetic toxicity: no adverse effect observed (negative)

Justification for classification or non classification

Based on the negative results of the available in vitro tests, classification of calcium chloride is not warranted in accordance with EU Classification, Labeling and Packaging of Substances and Mixtures (CLP) Regulation (EC) No. 1272/2008.

Additional information:



Calcium chloride was negative in the bacterial mutation tests and the mammalian chromosome aberration test, showing no genotoxic potential for calcium chloride.

In addition, calcium chloride is already present in the tissue culture media of the in vitro test systems for genetic toxicity testing, and needed for normal function of the cells in culture.

Furthermore, the safety of the use of calcium chloride as a food additive was recently re-evaluated the EFSA Panel on Food Additives and Flavourings (Scientific opinion dated 6 June 2019, doi: 10.2903/j.efsa.2019.5751). The assessment confirmed that there is no concern with respect to genotoxicity.

Considering these aspects and taken into account that calcium chloride is a normal constituent of the body, no further genotoxicity testing is considered necessary.

Detailed information on the Mode of Action is available in **Annex III**.

5.8. Carcinogenicity

5.8.1. Non-human information

5.8.1.1. Carcinogenicity: oral

No relevant information available.

5.8.1.2. Carcinogenicity: inhalation

No relevant information available.

5.8.1.3. Carcinogenicity: dermal

No relevant information available.

5.8.1.4. Carcinogenicity: other routes

No relevant information available.

5.8.2. Human information

No relevant information available.

5.8.3. Summary and discussion of carcinogenicity

The following information is taken into account for any hazard / risk assessment:

Calcium chloride is not genotoxic in vivo. Calcium and chloride are both essential nutrients for humans and a daily intake of more than 1000 mg for each of the ions is recommended. As for healthy humans, the tolerable upper intake level for calcium is set at 2500 mg per day (equivalent to 6.9 g CaCl₂ per day) [1]. For chloride, the reference nutrient intake is set at 2500 mg/day (equivalent to 3.9 g CaCl₂ per day) [2].

The safety of the use of calcium chloride as a food additive was recently re-evaluated the EFSA Panel on Food Additives and Flavourings (Scientific opinion dated 6 June 2019, doi: 10.2903/j.efsa.2019.5751). The assessment confirmed that there is no concern with respect to carcinogenicity.

Based on this information, it is concluded that the substance is not carcinogenic and the performance of a carcinogenicity study for calcium chloride is not indicated.



Value used for CSA (route: oral):

Value used for CSA (route: dermal):

Value used for CSA (route: inhalation):

Detailed information on the Mode of Action is available in **Annex III**.

5.9. Toxicity for reproduction

5.9.1. Effects on fertility

5.9.1.1. Non-human information

No relevant information available.

Data waiving

Information requirement: Toxicity for reproduction / fertility

Reason: study scientifically not necessary / other information available

Justification: see 'Remark' - Calcium chloride is an inorganic salt that will dissolve into its ions upon contact with water. Also in the human body it will be present as calcium and chloride ions and not as the salt calcium chloride. Calcium and chloride ions are ubiquitous in living organisms, and both have important roles in the physiology of normal cell functioning. Calcium is essential for the formation of skeletons and the regulation of neural transmission, muscle contraction and coagulation of the blood. As a consequence, plasma calcium levels in humans are strongly regulated. The normal level of total (free + protein-bound) blood calcium level in humans is kept between 85 and 103 mg/L by homeostatic mechanisms. Free calcium ions are normally present in human blood in a concentration of 44 to 54 mg/L. The daily average requirement for calcium in the diet is 750 mg calcium per day. Chloride is an essential electrolyte. Membrane transport of chloride is important in many processes, e.g. to maintain proper blood volume, blood pressure and pH of the body fluids, and chloride also has a role in carbon dioxide transport, renal function and gastric fluids. The levels of chloride in the blood are regulated by the kidneys, and are typically kept in the range of 95 to 105 mmol/L, which corresponds to 3368 – 3722 mg/L. The daily average requirement for chloride in the diet is 3100 mg chloride per day. As both calcium and chloride are present in significant quantities in the blood, and their concentration is regulated homeostatically, it can be questioned whether exposure to calcium chloride via the dermal, inhalation or oral route can contribute significantly to the systemic concentrations of these ions in the blood. Dermal exposure -- The ionic nature of calcium chloride makes it very hydrophilic in nature. As a consequence, calcium chloride lacks the necessary lipophilicity that is required to allow penetration of the substance through the stratum corneum. Calcium chloride will therefore not be absorbed through the skin in relevant amounts, and hence, dermal contact cannot lead to any systemic effects. Inhalation exposure -- Being an inorganic salt, the vapour pressure of calcium chloride is very low (0.05 Pa @ 800°C). Hence, inhalation of calcium chloride can only occur via exposure to dust. In the hazard assessment, a long-term DNEL for local inhalation effects is set to 5 mg/m³. Should a worker be exposed to such a concentration for 8 hours, the total amount of inhaled calcium chloride can be calculated: 5 mg CaCl₂/m³ * 10 m³ of inhaled air volume for a worker at light activity = 50 mg CaCl₂. Assuming a complete uptake of the calcium chloride, this would result in a systemic availability of 18 mg of Ca²⁺ and 32 mg of Cl⁻. Likewise, for the general population exposure to 5 mg CaCl₂/m³ for 24h/d would result in 100 mg CaCl₂, or a systemic availability of 36 mg of Ca²⁺ and 64 mg of Cl⁻. It is obvious from these findings that the doses that could become systemically available following inhalation exposure to calcium chloride are low as compared to the daily average requirement of 750 mg calcium per day and 3100 mg chloride per



day. It is therefore considered that inhalation exposure does not contribute significantly to the systemic availability of calcium and chloride. Oral exposure -- Oral exposure is a route that is only relevant for the general population, as under conditions of good occupational hygiene, oral exposure in the workplace is avoided. As stated above, calcium and chloride are both essential nutrients, with a daily average requirement of 750 mg/d for calcium and 3100 mg/day for chloride. Both are naturally present in food in significant quantities. Moreover, calcium chloride is an approved food additive (E509) for which the reported uses do not raise a safety concern at the reported use levels EFSA (2019a). Oral exposure to calcium chloride from non-food uses therefore is considered to not contribute significantly to the systemic availability of calcium and chloride. As described in ECHA guidance A.1.2.1, the purpose of the (human health) chemical safety assessment is to assess the intrinsic hazards of a substance, including the determination of the appropriate hazard classification, and to characterize the hazards where possible by means of a derived no-effect-level (DNEL). Where a substance is found to have hazardous properties, the assessment should include an exposure and risk characterization addressing exposure of workers and the general population. The information requirements as stipulated in REACH Annexes VII to X are the main source of information that is used as input for the chemical safety assessment. When a new vertebrate animal study is required, the relevance and adequacy of the study outcome for the purpose of the risk assessment has to be taken into account. As stipulated in REACH Art. 25, testing on vertebrate animals shall be undertaken only as a last resort. Taking into account all available information on calcium chloride, it can be concluded that the generation of additional reproductive toxicity information will not contribute to the hazard or risk assessment, as none of the exposure routes relevant to workers or the general population would result in actual increased systemic levels of calcium and chloride. Furthermore, calcium chloride is naturally present in food in significant quantities and it has been approved as a food additive in the European Union and therefore it is not considered to be reprotoxic. As a consequence, additional testing is deemed not scientifically and ethically justified.

Toxicity to reproduction: other studies

No relevant information available.

5.9.1.2. Human information

No relevant information available.

5.9.2. Developmental toxicity

5.9.2.1. Non-human information

The results of studies on developmental toxicity are summarised in the following table:

Table 5.10. Studies on developmental toxicity

Method	Results	Remarks
rat (Wistar [rat]) oral: gavage (Doses / Concentrations: 1.76, 8.18, 38.0, 176 mg/kg/day Basis: Vehicle: Exposure: 6th to 15th day of pregnancy (daily) equivalent or similar to guideline OECD Guideline 414 (Prenatal Developmental Toxicity Study) Method: other	Maternal animals: NOAEL: >176 mg/kg bw/day Fetuses: Fetal abnormalities not specified localisation: NOAEL: >176 mg/kg bw/day Overall developmental toxicity: not specified Lowest effective dose / concentration: Relation to maternal toxicity:	1 (reliable without restriction) key study experimental study Test material calcium chloride, (full information in Annex II). Reference Food and Drug Research Laboratoires, Inc. 1974



mouse (CD-1 [mouse]) oral: gavage (Doses / Concentrations: 1.89, 8.78, 40.8, 189 mg/kg/day Basis: Vehicle: Exposure: 6th to 15th day of pregnancy (daily) equivalent or similar to guideline OECD Guideline 414 (Prenatal Developmental Toxicity Study)	Maternal animals: NOAEL: >189 mg/kg bw/day Fetuses: Fetal abnormalities not specified localisation: NOAEL: >189 mg/kg bw/day Overall developmental toxicity: not specified Lowest effective dose / concentration: Relation to maternal toxicity:	1 (reliable without restriction) key study experimental study Test material calcium chloride, (full information in Annex II). Reference Food and Drug Research Laboratoires, Inc. 1974
rabbit (Dutch [rabbit]) oral: gavage (Doses / Concentrations: 1.69, 7.85, 35.6, 169 mg/kg/day Basis: Vehicle: Exposure: 6th to 18th day of pregnancy (daily) equivalent or similar to guideline OECD Guideline 414 (Prenatal Developmental Toxicity Study)	Maternal animals: NOAEL: >169 mg/kg bw/day Fetuses: Fetal abnormalities not specified localisation: NOAEL: >169 mg/kg bw/day Overall developmental toxicity: not specified Lowest effective dose / concentration: Relation to maternal toxicity:	1 (reliable without restriction) key study experimental study Test material calcium chloride, (full information in Annex II). Reference Food and Drug Research Laboratoires, Inc. 1974

5.9.2.2. Human information

No relevant information available.

5.9.3. Summary and discussion of reproductive toxicity

Effects on fertility

The following information is taken into account for any hazard / risk assessment:

Calcium and chloride are essential nutrients for the physiology and homeostasis of humans. Calcium and chloride are both naturally present in food in significant quantities. For calcium the average requirement (AR) for adults ≥ 25 years was reported to be 750 mg/day (EFSA, 2015). The dietary reference value for chloride is 3.1 g/day for adults including pregnant and lactating women (EFSA, 2019b). In addition, it was reported that the use of calcium chloride as food additive (E 509) does not raise a safety concern at the reported use and use levels EFSA (2019a). It is therefore considered that additional reproductive toxicity testing on calcium chloride is not necessary.

Value used for CSA (route: oral):

Value used for CSA (route: dermal):



Value used for CSA (route: inhalation):

Developmental toxicity

The following information is taken into account for any hazard / risk assessment:

An oral developmental study was performed in 3 species (mouse, rat and rabbit). In all three species no maternal or teratogenic effects were noted, and NOAELs were above the highest dose given.

Effect on developmental toxicity - development (via oral route)

Value used for CSA (route: oral):
(NOAEL): 169mg/kg bw/day

Effect on developmental toxicity - development (via dermal route)

Value used for CSA (route: dermal):

Effect on developmental toxicity - development (via inhalation route)

Value used for CSA (route: inhalation):

Additional information:

It can be stated that the substance will neither reach the foetus nor reach male and female reproductive organs (as it does not become systemically available), which shows that there is no risk for developmental toxicity and no risk for toxicity to reproduction.

It is confirmed in three species that there is no concern with regard to developmental toxicity (at least up to 169 mg/kg/d for rabbits), which supports the general consideration that the substance will usually not reach the foetus. As such, it is considered not useful to perform a reproduction study.

Justification for classification or non classification:

Based on the results of the available developmental toxicity studies with three different species, and taking into account normal physiological roles of calcium and chloride ions, classification of calcium chloride for reproductive and developmental toxicity is not warranted in accordance with the EU Classification, Labeling and Packaging of Substances and Mixtures (CLP) Regulation (EC) No. 1272/2008.

Detailed information on the Mode of Action is available in **Annex III**.

5.10. Other effects



5.10.1. Non-human information

5.10.1.1. Neurotoxicity

No relevant information available.

5.10.1.2. Immunotoxicity

No relevant information available.

5.10.1.3. Specific investigations: other studies

No relevant information available.

5.10.1.4. Additional toxicological effects

No relevant information available.

5.10.2. Human information

No relevant information available.

5.10.3. Summary and discussion of other effects

5.11. Derivation of DNEL(s) and other hazard conclusions

5.11.1. Overview of typical dose descriptors for all endpoints

Table 5.11. Available dose-descriptor(s) per endpoint as a result of its hazard assessment

Endpoint	Route	Dose descriptor or qualitative effect characterisation; test type
Acute toxicity	oral	(LD50):
Acute toxicity	dermal	(LD50):
Irritation / Corrosivity	skin	no adverse effect observed (not irritating)
Irritation / Corrosivity	eye	adverse effect observed (irritating)
Irritation / Corrosivity	resp. tract	no adverse effect observed (not irritating)
Sensitisation	skin	no adverse effect observed (not sensitising)
Sensitisation	resp. tract	no adverse effect observed (not sensitising)
Mutagenicity	in vitro / in vivo	In vitro: no adverse effect observed (negative) In vivo:
Reproductive toxicity: developmental toxicity	oral	(NOAEL): 169mg/kg bw/day



5.11.2. Selection of the DNEL(s) or other hazard conclusions for critical health effects

Table 5.12. Hazard conclusions for workers

Route	Type of effect	Hazard conclusion	Most sensitive endpoint
Inhalation	Systemic effects - Long-term	no hazard identified	
Inhalation	Systemic effects - Acute	no hazard identified	
Inhalation	Local effects - Long-term	DNEL (Derived No Effect Level) 5mg/m ³	irritation (respiratory tract)
Inhalation	Local effects - Acute	DNEL (Derived No Effect Level) 10mg/m ³	irritation (respiratory tract)
Dermal	Systemic effects - Long-term	no hazard identified	
Dermal	Systemic effects - Acute	no hazard identified	
Dermal	Local effects - Long-term	no hazard identified	
Dermal	Local effects - Acute	no hazard identified	
Eyes	Local effects	medium hazard (no threshold derived)	

Inhalation Systemic effects - Long-term

Further explanation on hazard conclusions:

A long-term DNEL for local effects of 5 mg/m³ was determined based on the occurrence of irritation of the respiratory tract upon exposure to calcium chloride. Should a worker be exposed to such a concentration for 8 hours, the total amount of inhaled calcium chloride can be calculated: 5 mg CaCl₂/m³ * 10 m³ of inhaled air volume for a worker at light activity = 50 mg CaCl₂. Assuming a complete uptake of the calcium chloride, this would result in a systemic availability of 18 mg of Ca²⁺ and 32 mg of Cl⁻. It is obvious from these findings that the doses that could become systemically available following inhalation exposure to calcium chloride are low as compared to the daily average requirement of 750 mg calcium per day and 3100 mg chloride per day. It is therefore considered that inhalation exposure does not contribute significantly to the systemic availability of calcium and chloride and, hence, systemic DNELs for the inhalation route are not deemed required.

Inhalation Systemic effects - Acute

Further explanation on hazard conclusions:

None of the acute toxicity studies trigger the need for classification for acute hazards. Acute systemic



DNELs only need to be derived when there is a classification for acute toxicity, hence no acute DNELs have been derived. Additionally, based on the available data and taking into account the toxicokinetics and normal physiological role of calcium chloride, systemic effects are also not anticipated after repeated exposure.

Inhalation Local effects - Long-term

Overall Assessment Factor: 1

Further explanation on hazard conclusions:

The DNEL has been derived by the weight of evidence approach, considering the limit values for long-term exposure established by ACGIH for Ca²⁺ and Cl⁻ containing substances known to cause respiratory tract irritation.

Inhalation Local effects - Acute

Overall Assessment Factor: 1

Further explanation on hazard conclusions:

The DNEL has been derived by the weight of evidence approach, considering the limit values for short-term exposure established by ACGIH for Ca²⁺ and Cl⁻ containing substances known to cause respiratory tract irritation.

Dermal Systemic effects - Long-term

Further explanation on hazard conclusions:

Based on the available data and taking into account the toxicokinetics and the normal physiological role of calcium chloride, systemic effects are not anticipated after repeated dermal exposure. In order for the dermal route to contribute significantly to the systemic availability of calcium and chloride, unrealistically high amounts of calcium chloride should be applied to and absorbed through the skin. Therefore, a DNEL for systemic effects following dermal exposure is not deemed relevant.

Dermal Systemic effects - Acute

Further explanation on hazard conclusions:

The DNEL_{acute} only need to be derived if an acute toxicity hazard (leading to classification and labelling) has been identified and peak exposures are likely to occur. The available data do not trigger classification for acute systemic dermal toxicity, hence acute DNELs are not required.

Dermal Local effects - Long-term

Further explanation on hazard conclusions:

Calcium chloride is not irritating to skin; thus it is not expected to induce local effects by dermal exposure. As a result no local dermal DNEL is required.

Dermal Local effects - Acute



Further explanation on hazard conclusions:

Calcium chloride is not irritating to skin; thus it is not expected to induce local effects by dermal exposure. As a result no local dermal DNEL is required.

Discussion:

Derivation of DNELs for local and systemic effects by acute and prolonged exposure for calcium chloride for general population

According to the REACH guidance on information requirements and chemical safety assessment a leading DN(M) EL needs to be derived for every relevant human population and every relevant route, duration and frequency of exposure, if feasible.

After assessment of the toxicological properties of CaCl₂, it is concluded that systemic toxicity of CaCl₂ is low, but the substance is capable of inducing local effects, caused most probably due to its strong hygroscopic properties. Based on the results of reliable skin and eye irritation studies with rabbits, calcium chloride is not irritating to skin, but causes serious eye irritation. In the acute inhalation toxicity study of limited reliability, signs of irritation of the respiratory tract were described at both exposure levels (40 and 160 mg/m³), suggesting that inhalation of calcium chloride can cause an irritation of the respiratory tract.

Only limited data addressing repeated exposure to calcium chloride are available for assessment. Calcium and chloride are both essential nutrients for humans and a daily intake of more than 1000 mg for each of the ions is recommended. As for healthy humans, the tolerable upper intake level for calcium is set at 2500 mg per day (equivalent to 6.9 g CaCl₂ per day) [1]. For chloride, the reference nutrient intake is set at 2500 mg/day (equivalent to 3.9 g CaCl₂ per day) [2]. The estimated intake of calcium chloride in a form of food additives (160-345 mg/day) is considerably smaller than these values. Consistent with this, the establishment of an ADI for calcium chloride has not been deemed necessary by JECFA [3]. A recent re-evaluation of the use of calcium chloride as a food additive by the EFSA Panel on Food Additives and Flavourings [4] furthermore reconfirmed that calcium chloride does not raise a safety concern at the reported use and use levels.

Taking into account the physico-chemical properties, toxicokinetics and normal physiological role of calcium chloride systemic effects are not anticipated after repeated exposure.

Systemic effects: DNEL_{acute} and DNEL_{long term}

Despite the limitations of the available 12-month repeated dosing oral study with rats, it can be concluded that administration of calcium chloride did not induce any adverse systemic effects. Also no evidence of systemic effects was obtained in the available acute toxicity studies and developmental toxicity studies with rats, mice and rabbits.

Furthermore, no systemic effects are expected due to the normal physiological role of calcium and chloride as essential nutrients, and the self-regulatory systems of the body for both ions. This is confirmed by the available human data which report local irritating effects only. Therefore, a DNEL for systemic effects (both acute and long term) is not required, also taking into account the recommended daily intake of > 1000 mg/day.

Local effects: DNEL_{acute} and DNEL_{long term}

DNEL_{acute}

The effects noted in the acute toxicity tests were mainly local irritating effects, predominately at the port of entry. Acute oral toxicity of calcium chloride is low, as evidenced by the studies with rats administered single doses of calcium chloride dissolved in water or in 5% Arabic gum, resulting in LD₅₀ > 2000 mg/kg bw. However, in the acute toxicity studies with rabbits administered anhydrous substance in gelatin capsules at dose levels of 500-1000 mg/kg bw, haemorrhagic trachea and severe ulceration of the stomach were observed. These effects were regarded to be exaggerated by gavage administration. In acute dermal toxicity studies, skin



lesions/irritation was noted at or near the administration sites; however, it should be noted that the administered dose was much higher and the application duration much longer in comparison to the testing regime recommended by modern guidelines for skin irritation studies. In a non-reliable inhalation study with rats, irritation of the trachea was noted at test concentrations of 40 and 160 mg/m³.

A DNEL_{acute} should be established for substances if an acute hazard toxicity (leading to C&L) has been identified and a potential for high peak exposures exists.

Eye irritation

Calcium chloride is classified as an eye irritant. Three eye irritation studies with calcium chloride are available, performed with calcium chloride hexahydrate, 33% aqueous solution of calcium chloride, and anhydrous calcium chloride, respectively, demonstrating slight to severe eye irritating properties in rabbits.

In accordance with Chapter R.8, appendix R. 8-9 of the REACH Guidance on information requirements and chemical safety assessment, “DNELs for irritation/corrosion can only be derived if dose-response information is available. Acute, sub-acute or sub-chronic toxicity studies in animals by the dermal or inhalation route may be able to provide this information, provided that symptoms of irritation/corrosion are recorded and reported in relevant studies”. No LOAEL or NOAEL can be derived from the available eye irritation studies on different forms of calcium chloride, as these studies were designed to provide only qualitative information on the eye irritation potential of the substances (i.e. whether the substance is irritating or non-irritating). The exposure conditions used in these studies can also not be extrapolated to exposure situations that are relevant for potential human exposure. Furthermore, the observed difference in irritation potential between anhydrous calcium chloride and its hexahydrate is likely not to be the result of a concentration effect, but rather be caused by differences in the physical properties between the two substances, such as the extent of being hygroscopic.

Furthermore, Chapter R.8, appendix R. 8-9 of the Guidance states that “In acute, sub-acute and sub-chronic toxicity studies, the eyes of the animal are not intentionally exposed and the symptoms are not systematically reported. Therefore, normally there is no basis for quantitative assessment of the eye irritation/corrosion from these studies. In case signs of eye irritation/corrosion are observed in inhalation toxicity studies, and dose-response information is available, it may be possible to identify a NOAEC or a LOAEC and derive a DNEL. Also, if human data are available, a NOAEC or a LOAEC may be identified from these data.”

For calcium chloride, the single study via the inhalation route is an acute inhalation study with rats reported by Sukhanov et al. (1990). The reliability of this study is insufficient and there is no indication of clinical signs referring to potential eye irritation. Therefore, this study does not allow the derivation of a DNEL for eye irritation.

In summary, a (quantitative) DNEL for eye irritation for calcium chloride can not be derived due to the design of the eye irritation studies (i.e. providing only qualitative information on eye irritation potential) and the lack of inhalation studies that sufficiently document eye irritation effects in experimental animals. Therefore, as no DNEL can be derived, a qualitative approach to assessing and controlling the risks is appropriate. For the worker the use of goggles is considered to be an adequate risk management measure.

Skin irritation

Anhydrous calcium chloride has not been classified for skin irritation based on the results of the available OECD guideline study. In other studies only slight irritation was noted, however, in these cases the animals were either exposed to the hexahydrate form, or exposed for 24 hours. The rabbit acute dermal study (24 hour exposure) indicated an LD₅₀ of > 5000 mg/kg. Gross pathology revealed skin lesions (scab formation, skin



thickening, and inflammation) at or near the treatment site; however, as stated above, the dose applied and the exposure duration significantly exceeded the limits recommended by modern guidelines for skin irritation studies. As no other doses were administered a NOAEL for these local effects could not be determined. A few reports on human skin injuries as a result of incidental contact with calcium chloride are available. However, as no quantitative risk assessment is possible based on these data and calcium chloride is not classified as skin irritant, no DNEL for these effects shall be derived.

Respiratory tract irritation

In the limited acute inhalation toxicity study with rats, signs of irritation of the respiratory tract were described at both exposure levels (40 and 160 mg/m³). Because of the insufficient documentation of the study, a NOAEC for the DNEL derivation could not be established.

In addition, Vinnikov et al. reported the use of aerosol inhalation of 2-5% aqueous solution of calcium chloride in the treatment of tuberculosis patients. Although in some cases symptoms of mucos membrane of pharynx and throat, as well as an unpleasant sensation in the mouth, were reported, most patients did not experience any adverse effects, suggesting that the toxicity of calcium chloride by inhalation is very low.

In accordance with Chapter R.8 of REACH Guidance on information requirements and chemical safety assessment, a national OEL can be used in place of a DNEL if an evaluation of the scientific background for its setting has been performed. As discussed above, the systemic toxicity of calcium chloride is very low and no adverse systemic effects are expected to occur upon repeated exposure. In accordance with Chapter R.8 of REACH Guidance on information requirements and chemical safety assessment, in case of exposure to inert significantly soluble dusts a general limit of 10 mg/m³ (used in setting Occupational Exposure Limits in many countries) can be used as a DNEL. However, there are indications, although from a study with a limited reliability, that anhydrous calcium chloride can induce respiratory tract irritation. The irritant potency of anhydrous calcium chloride is expected to be mainly a physical effect, caused by its strong hygroscopic properties, leading to drying of mucus membranes. An Occupational exposure limit (OEL) for calcium chloride of 5 mg/m³ has been established by the Ministry of Labour, Ontario, Canada, 2002 [5]. No further OELs for calcium chloride have been established; however, ACGIH (2018) [6] has established a TLV-TWA and a STEL values for several substances containing Ca²⁺ and Cl⁻ ions with low systemic toxicity, based on their respiratory tract irritating properties, namely calcium sulfate, calcium hydroxide and ammonium chloride. Their physico-chemical properties, as well as scientific background for limit values derivation, are briefly discussed below. As the TLV-TWA for calcium hydroxide is partially based on the limit value established by ACGIH for sodium hydroxide based on the available data, the latter substance has been included in the overview for sake of comparison as well.

Calcium sulfate

Anhydrous calcium sulfate, similarly to calcium chloride, possesses the high affinity for water and will absorb 6.6% of its weight of water, forming the stable hemihydrate. In contrast to highly soluble calcium chloride (solubility of anhydrous form 745 g/L at 20 °C), anhydrous calcium sulfate is only very limitedly soluble in water (ca. 2.1 g/L at 30 °C). An available study with human volunteers indicated chemesthetic effects on the nose and throat at the 40 mg/m³ exposure level and above. Nasal secretion, nasal resistance and mucociliary transport were unaffected. A chronic study with guinea pigs with commercial calcined gypsum consisting of 70% hemihydrate, 15% calcite, 10% anhydrite, 2% of other carbonates (magnesium, aluminum and iron) showed no or slight lung effects at airborne levels of 448 million particles per cubic foot. Based on these concentration levels, a TLV-TWA of 10 mg/m³ has been recommended by ACGIH to protect against respiratory health effects, based on upper and lower respiratory tract irritation.

Calcium hydroxide



Calcium hydroxide is a relatively strong base and hence a moderately caustic irritant to all exposed surfaces of the body, including the eyes and respiratory tract. It is slightly soluble in water (1.85 g/L at 0 °C). The EU Commission Directive 2017/164 prescribes an 8h limit value of 1 mg/m³ and a short-term limit value of 4 mg/m³. This is considered to be sufficiently low to protect against undue irritation.

Ammonium chloride

Ammonium chloride is a somewhat hygroscopic, readily soluble in water (297 g/L at 0°C) material. According to the available data, the substance is a moderate skin and eye irritant. Although only limited information was available on its inhalation toxicity, a TLV-TWA of 10 mg/m³ and TLV-STEL of 20 mg/m³ was suggested by ACGIH. The recommended values should minimize the potential for ocular and respiratory tract irritation.

Sodium hydroxide

Sodium hydroxide has been included in this overview because it was partially used to establish the TLV-TWA value for calcium hydroxide by ACGIH (ACGIH, 2018). It is a hygroscopic alkaline material, which readily absorbs water from air. It is well soluble in water (420 g/L at 0°C). Depending upon the concentration, sodium hydroxide aerosol can be a severe irritant of the eyes, mucous membranes and skin; the caustic dust of sodium hydroxide is irritating to the upper respiratory tract. Rats that inhaled unmeasured concentrations of sodium hydroxide aerosols for 30 minutes/day suffered pulmonary damage after 2.5 months. In humans, there were two reports indicating noticeable irritation at concentrations of sodium hydroxide aerosol below 2 mg/m³. Accordingly, a TLV-Ceiling of 2 mg/m³ was recommended by ACGIH, based on a concentration that produces noticeable, but not excessive, ocular and upper respiratory tract irritation.

In summary, although only limited information on the induction of local effects upon inhalation exposure to calcium chloride is available, the overview of the available limit values established by ACGIH for substances with similar properties shows that the concentration levels below 5 mg/m³ are considered to be sufficient to ensure the protection against the respiratory tract irritation for workers (see Table 1). An exception is sodium hydroxide, for which a TLV-TWA value of 2 mg/m³ has been suggested by ACGIH. However, as sodium hydroxide is a very strong base, classified as corrosive on Annex VI of Regulation (EC) No 1272/2008 (CLP), the comparison of its properties with those of calcium chloride is not really appropriate. Overall, using the weight of evidence approach, a concentration of 5 mg/m³, which also coincides with the Canadian OEL for calcium chloride, is thought to be sufficient to ensure the protection against possible respiratory health effects by prolonged exposure, and shall be considered as a DNEL_{long-term} for local effects. For acute exposure, based on the ratio for proposed TLV-TWA and TLV-STEL values for ammonium chloride, a concentration of 10 mg/m³ is proposed, which shall be regarded as a DNEL_{acute} for local effects.

Table 1. Overview of the available TLV values established by ACGIH for Ca(OH)₂, CaSO₄, NaOH and NH₄Cl

Substance	TLV-TWA mg/m ³	TLV-STEL mg/m ³	TLV-Ceiling mg/m ³	Classification (local effects)
Ca(OH) ₂	4	1	-	Skin irrit. 2, Eye Damm. 1
CaSO ₄	10	-	-	/
NaOH	-	-	2	Skin corr. 1A
NH ₄ Cl	10	20	-	Eye Irrit. 2

DNELs anhydrous vs hydrate form of Calcium chloride



Risk assessment is based on the anhydrous form of Calcium Chloride anhydrous (CAS 10043-52-44), however other 4 forms of hydrate Calcium chloride are present in the market, namely:

- calcium chloride monohydrate (CAS 22691-02-7)
- calcium chloride dihydrate (CAS 10035-04-8)
- calcium chloride tetrahydrate (CAS 25094-02-4)
- calcium chloride hexahydrate (CAS 7774-34-7)

The anhydrous form was chosen as it would result in the most conservative assessment, as per section 9-10 of the CSR, thus covering also the associated risk to the exposure to the other hydrate forms (Tab.2). Nevertheless, for completeness of information, here are reported the DNELs for the hydrate forms that can be used for a specific risk assessment.

Table 2. DNELs for acute and chronic inhalation exposure

	MW CaCl ₂ g/mol	MW H ₂ O g/mol	sum MW	local acute DNEL mg/m ³	local chronic DNEL mg/m ³
calcium chloride anhydrous (CAS 10043-52-44)	110.98	0	110.98	10	5
calcium chloride monohydrate (CAS 22691-02- 7)	110.98	18	128.98	11.6	5.8
calcium chloride dihydrate (CAS 10035-04-8)	110.98	36	146.98	13.2	6.6
calcium chloride tetrahydrate (CAS 25094-02- 4)	110.98	72	182.98	16.5	8.2
calcium chloride hexahydrate (CAS 7774-34- 7)	110.98	108	218.98	19.7	9.9

[1] Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, 1999

[2] Department of Health, UK, 1991

[3] Joint FAO/WHO Expert Committee on Food Additives; 1974, 2001

[4] Scientific Opinion of the EFSA Panel on Food Additives and Flavourings (FAF), Adopted 6 June 2019: Re-evaluation of hydrochloric acid (E507), potassium chloride (E508), calcium chloride (E509) and magnesium chloride (E511) as food additives.

[5] Ministry of Labour, Ontario, Canada (2002) Updated and New OELs in Part 4 of Regulation 833, effective



September 30, 2000. Found at http://www.e-laws.gov.on.ca/html/regs/english/elaws_regs_900833_e.htm

[6] ACGIH (2018). TLVs and BEIs based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices. Signature Publications, Cincinnati, Ohio, USA (and references therein)

Table 5.13. Hazard conclusions for the general population

Route	Type of effect	Hazard conclusion	Most sensitive endpoint
Inhalation	Systemic effects - Long-term	no hazard identified	
Inhalation	Systemic effects - Acute	no hazard identified	
Inhalation	Local effects - Long-term	DNEL (Derived No Effect Level) 2.5mg/m ³	irritation (respiratory tract)
Inhalation	Local effects - Acute	DNEL (Derived No Effect Level) 5mg/m ³	irritation (respiratory tract)
Dermal	Systemic effects - Long-term	no hazard identified	
Dermal	Systemic effects - Acute	no hazard identified	
Dermal	Local effects - Long-term	no hazard identified	
Dermal	Local effects - Acute	no hazard identified	
Oral	Systemic effects - Long-term	no hazard identified	
Oral	Systemic effects - Acute	no hazard identified	
Eyes	Local effects	medium hazard (no threshold derived)	

Inhalation Systemic effects - Long-term

Further explanation on hazard conclusions:

A long-term DNEL for local effects of 5 mg/m³ was determined based on the occurrence of irritation of the respiratory tract upon exposure to calcium chloride. Should a worker be exposed to such a concentration for 8 hours, the total amount of inhaled calcium chloride can be calculated: 5 mg CaCl₂/m³ * 20 m³ of inhaled



air volume for a worker at light activity = 100 mg CaCl₂. Assuming a complete uptake of the calcium chloride, this would result in a systemic availability of 36 mg of Ca²⁺ and 64 mg of Cl⁻. It is obvious from these findings that the doses that could become systemically available following inhalation exposure to calcium chloride are low as compared to the daily average requirement of 750 mg calcium per day and 3100 mg chloride per day. It is therefore considered that inhalation exposure does not contribute significantly to the systemic availability of calcium and chloride and, hence, systemic DNELs for the inhalation route are not deemed required.

Inhalation Systemic effects - Acute

Further explanation on hazard conclusions:

None of the acute toxicity studies trigger the need for classification for acute hazards. Acute systemic DNELs only need to be derived when there is a classification for acute toxicity, hence no acute DNELs have been derived. Additionally, based on the available data and taking into account the toxicokinetics and normal physiological role of calcium chloride, systemic effects are also not anticipated after repeated exposure.

Also taking into account the recommended daily intake of 1000 mg/kg bw CaCl₂, no DNEL for systemic effects has been derived.

Inhalation Local effects - Long-term

Overall Assessment Factor: 2

Further explanation on hazard conclusions:

The DNEL has been derived by the weight of evidence approach, considering the limit values for short-term exposure established by ACGIH for Ca²⁺ and Cl⁻ containing substances known to cause respiratory tract irritation, and applying an additional default assessment factor of 2 for extrapolation from workers to general population.

Inhalation Local effects - Acute

Overall Assessment Factor: 2

Further explanation on hazard conclusions:

The DNEL has been derived by the weight of evidence approach, considering the limit values for short-term exposure established by ACGIH for Ca²⁺ and Cl⁻ containing substances known to cause respiratory tract irritation, and applying an additional default assessment factor of 2 for extrapolation from workers to general population.

Dermal Systemic effects - Long-term

Further explanation on hazard conclusions:

Based on the available data and taking into account the toxicokinetics and the normal physiological role of calcium chloride, systemic effects are not anticipated after repeated dermal exposure. In order for the dermal route to contribute significantly to the systemic availability of calcium and chloride, unrealistically high amounts of calcium chloride should be applied to and absorbed through the skin. Therefore, a DNEL for systemic effects following dermal exposure is not deemed relevant.

Dermal Systemic effects - Acute



Further explanation on hazard conclusions:

The DNEL_{acute} only need to be derived if an acute toxicity hazard (leading to classification and labelling) has been identified and peak exposures are likely to occur. The available data do not trigger classification for acute systemic dermal toxicity, hence acute DNELs are not required.

Dermal Local effects - Long-term

Further explanation on hazard conclusions:

Calcium chloride is not irritating to skin; thus it is not expected to induce local effects by dermal exposure.

Dermal Local effects - Acute

Further explanation on hazard conclusions:

Calcium chloride is not irritating to skin; thus it is not expected to induce local effects by dermal exposure.

Oral Systemic effects - Long-term

Further explanation on hazard conclusions:

Calcium and chloride are essential nutrients for the physiology and homeostasis of humans. Calcium and chloride are both naturally present in food in significant quantities. For calcium the average requirement (AR) for adults ≥ 25 years was reported to be 750 mg/day (EFSA, 2015). The dietary reference value for chloride is 3.1 g/day for adults including pregnant and lactating women (EFSA, 2019b).

In addition, it was reported that the use of calcium chloride as food additive (E 509) does not raise a safety concern at the reported use and use levels EFSA (2019a). It is therefore considered that a systemic DNEL for oral exposure of the general population is not necessary.

Oral Systemic effects - Acute

Further explanation on hazard conclusions:

The DNEL_{acute} needs only be derived if an acute toxicity hazard (leading to classification and labelling) has been identified and peak exposures are likely to occur. The available data do not trigger classification for acute systemic oral toxicity.

Discussion:

Derivation of DNELs for local and systemic effects by acute and prolonged exposure for calcium chloride for general population

According to the REACH guidance on information requirements and chemical safety assessment a leading DN(M) EL needs to be derived for every relevant human population and every relevant route, duration and frequency of exposure, if feasible.

**Systemic effects: DNELacute and DNELlong term**

After assessment of the toxicological properties of CaCl_2 , it has been concluded that the substance is not expected to cause adverse systemic effects by either acute or repeated exposure (see Discussion in the Section “DNEL derivation for workers”). Therefore no DNELs for systemic effects by either acute or prolonged exposure have been derived either for workers or for general population for any exposure route.

Local effects: DNELacute and DNELlong term**Dermal route of exposure**

Regarding the local effects, calcium chloride is not classified as irritating to skin; therefore no DNELs were derived for local dermal effects by either acute or prolonged exposure.

Inhalation route of exposure

Available data, albeit of poor quality, indicate that anhydrous calcium chloride may cause respiratory tract irritation due to its intense hygroscopic properties. However, available animal data are not sufficient to derive DNEL for either acute or repeated exposure based on them. Therefore DNELs for respiratory tract irritation by acute or long-term exposure to calcium chloride for workers have been derived by weight of evidence approach, comparing established by ACGIH limit values for occupational exposure for either Ca^{2+} or Cl^- containing substances, known to cause respiratory tract irritation. This resulted in the DNEL_{local} of 5 mg/m³ for long-term inhalation exposure and 10 mg/m³ for acute inhalation exposure for workers. As general population also includes elderly and juvenile citizens, a default assessment factor of 2 is recommended by Chapter R.8 of REACH Guidance on information requirements and chemical safety assessment for the extrapolation of the DNEL from workers to general population. Applying this assessment factor, DNEL_{local} of 2.5 mg/m³ and DNEL_{local} of 5 mg/m³ are derived for acute and prolonged inhalation exposure, respectively, for general population.

Oral route of exposure

In the available acute oral toxicity studies with rabbits, several irritating local effects were revealed at gross pathology, in particular haemorrhagic trachea and severe ulceration of the stomach. These effects are regarded to be exaggerated by gavage administration. Taking into account that calcium and chloride are both essential nutrients for humans and a daily intake of more than 1000 mg of each of these ions is recommended, no DNEL needs to be derived for oral route of exposure.

DNELs anhydrous vs hydrate form of Calcium chloride

Risk assessment is based on the anhydrous form of Calcium Chloride anhydrous (CAS 10043-52-44), however other 4 forms of hydrate Calcium chloride are present in the market, namely:

- calcium chloride monohydrate (CAS 22691-02-7)
- calcium chloride dihydrate (CAS 10035-04-8)
- calcium chloride tetrahydrate (CAS 25094-02-4)



· calcium chloride hexahydrate (CAS 7774-34-7)

The anhydrous form was chosen as it would result in the most conservative assessment, as per section 9-10 of the CSR, thus covering also the associated risk to the exposure to the other hydrate forms (Tab.1). Nevertheless, for completeness of information, here are reported the DNELs for the hydrate forms that can be used for a specific risk assessment.

Table 1. DNELs for acute and chronic inhalation exposure

	MW CaCl ₂ g/mol	MW H ₂ O g/mol	sum MW	local acute DNEL mg/m ³	local chronic DNEL mg/m ³
calcium chloride anhydrous (CAS 10043-52-44)	110.98	0	110.98	5	2.5
calcium chloride monohydrate (CAS 22691-02- 7)	110.98	18	128.98	5.8	2.9
calcium chloride dihydrate (CAS 10035-04-8)	110.98	36	146.98	6.6	3.3
calcium chloride tetrahydrate (CAS 25094-02- 4)	110.98	72	182.98	8.2	4.1
calcium chloride hexahydrate (CAS 7774-34- 7)	110.98	108	218.98	9.9	4.9



6. HUMAN HEALTH HAZARD ASSESSMENT OF PHYSICOCHEMICAL PROPERTIES

6.1. Explosivity

No relevant information available.

Data waiving: see CSR section 1.3 Physicochemical properties.

Discussion

The following information is taken into account for any hazard / risk assessment:

Key Information:

The substance is non-explosive.

Value used for CSA:

Explosiveness: non explosive

Classification according to GHS

Name: Calcium chloride

Related composition: calcium chloride (solid: bulk)

Classification: data conclusive but not sufficient for classification

Justification for classification or non-classification:

Based on the chemical structure of calcium chloride, classification of the substance as explosive is not warranted in accordance with EU Classification, Labelling and Packaging of Substances and Mixtures (CLP) Regulation (EC) No. 1272/2008.

6.2. Flammability

Flammability

No relevant information available.

Data waiving: see CSR section 1.3 Physicochemical properties.

Discussion

The following information is taken into account for any hazard / risk assessment:

Flammability

Key value for chemical safety assessment: Flammability: non flammable

The substance is non-flammable.

Flash Point

No relevant information available.

Data waiving: see CSR section 1.3 Physicochemical properties.

Classification according to GHS



Name: Calcium chloride

Related composition: calcium chloride (solid: bulk)

Classification (gas): data conclusive but not sufficient for classification

Classification (liquid): data conclusive but not sufficient for classification

Classification (solid): data conclusive but not sufficient for classification

Justification for classification or non-classification:

Based on the chemical structure of calcium chloride and experience in its manufacture and handling, classification of the substance as flammable is not warranted in accordance with CLP Regulation (EC) No. 1272/2008.

6.3. Oxidising potential

The available information on the oxidising potential is summarised in the following table:

Table 6.1. Information on oxidising potential

Method	Results	Remarks
oxidising solids No data	Test results: Oxidising solids: calcium chloride is not oxidising: calcium chloride is not oxidising:	2 (reliable with restrictions) supporting study not specified Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference CCOSH 2010

Data waiving: see CSR section 1.3 Physicochemical properties.

Discussion

The following information is taken into account for any hazard / risk assessment:

Key Information:

The substance is non-oxidising

Value used for CSA:

Oxidising properties: no

Classification according to GHS

Name: Calcium chloride

Related composition: calcium chloride (solid: bulk)



Classification (gas): data conclusive but not sufficient for classification
Classification (liquid): data conclusive but not sufficient for classification
Classification (solid): data conclusive but not sufficient for classification

Justification for classification or non-classification:

Based on the chemical structure of calcium chloride, classification of the substance as oxidising is not warranted in accordance with EU Classification, Labelling and Packaging of Substances and Mixtures (CLP) Regulation (EC) No. 1272/2008.



7. ENVIRONMENTAL HAZARD ASSESSMENT

7.1. Aquatic compartment (including sediment)

7.1.1. Fish

7.1.1.1. Short-term toxicity to fish

The results are summarised in the following table:

Table 7.1. Short-term effects on fish

Method	Results	Remarks
Pimephales promelas freshwater short-term toxicity to fish Method: other: EPA/600/4-90/027, EPA/600/6-91/003	LC50 (96h): 4630 mg/L based on: mortality (fish) LC50 (48h): >6560 mg/L based on: mortality (fish) LC50 (24h): >6660 mg/L based on: mortality (fish)	2 (reliable with restrictions) key study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Mount, D.R., Gulley, D.D., Hockett, J.R., Garrison, T.D. and Evans, J.M. 1997
Lepomis macrochirus freshwater short-term toxicity to fish Method: other: Doudroff et al., (1951)	(96h): 9500 - 11300 mg/L based on: mortality (fish)	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Cairns, J., Jr. and Scheier, A. 1959
Lepomis macrochirus freshwater short-term toxicity to fish Method: other	LC50 (96h): 10650 mg/L based on: mortality (fish)	2 (reliable with restrictions) supporting study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II).



		Reference Trama, F.B. 1954
Gambusia affinis freshwater short-term toxicity to fish Method: other: not mentioned	LC50 (96h): 13400 mg/L based on: mortality (fish) LC0 (96h): 10000 mg/L based on: mortality (fish)	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233- 140-8, (full information in Annex II). Reference Wallen, I.E., Greer, W.C. and Lasater, R. 1957

Discussion

The following information is taken into account for acute fish toxicity for the derivation of PNEC:

Key Information:

Eight studies on acute toxicity to fish have been reported, of which 4 were considered reliable with restrictions (K2). These are presented in the current summary. Four other studies were scored K3 and are not further discussed.

The key study (Mount et al. 1997, performed under EPA guideline) estimated the lowest 96-hour LC50 value of 4630 mg/L as result of exposing fathead minnow (Pimephales promelas). The other 3 K2 studies exposing bluegill sunfish (Lepomis macrochirus) (Cairns and Scheier (1959) and Trama (1954)) and mosquitofish (Gambusia affinis) (Wallen et al. 1957) resulted in 96-hour LC50 values between 9500 and 13400 mg/L.

Freshwater fish

Effect concentration: 4630 mg/L

Relevant studies: Mount 1997/K2 KS/Short-term fish

7.1.1.2. Long-term toxicity to fish

The results are summarised in the following table:

Table 7.2. Long-term effects on fish

Method	Results	Remarks
Oncorhynchus mykiss (previous name: Salmo gairdneri) freshwater fish early-life stage toxicity equivalent or similar to guideline OECD	NOEC (25d): 230 mg/L test mat. (dissolved fraction) (nominal) based on: length (- NOEC was extrapolated from the relative graph attached as illustration) NOEC (25d): 230 mg/L test mat. (dissolved	2 (reliable with restrictions) key study experimental study



Guideline 210 (Fish, Early-Life Stage Toxicity Test)	fraction) (nominal) based on: weight (-NOEC was extrapolated from the relative graph attached as illustration) LOEC (25d): 860 mg/L test mat. (dissolved fraction) (nominal) based on: length (-NOEC was extrapolated from the relative graph attached as illustration) LOEC (25d): 860 mg/L test mat. (dissolved fraction) (nominal) based on: weight (-NOEC was extrapolated from the relative graph attached as illustration)	Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference William D. Hintz Rick A. Relyea 2017
--	--	---

Discussion

The following information is taken into account for long-term fish toxicity for the derivation of PNEC:

Key Information:

A study was performed exposing alevins of rainbow trout, *Oncorhynchus mykiss*, to the test item for 25 d, comprehensive of 2 weeks of exposure after starting exogenous feeding. Test was conducted according to the OECD 210 guideline. Analytical concentrations of the test item were not measured but initial nominal concentrations were calculated based on the Cl ionic concentration. Results indicated a NOEC of 230 mg/L and a LOEC of 860 mg/L based on effects on length and weight.

Freshwater fish

Relevant studies: Hintz 2017/K2 KS/Long-term fish *O. mykiss*

7.1.2. Aquatic invertebrates

7.1.2.1. Short-term toxicity to aquatic invertebrates

The results are summarised in the following table:

Table 7.3. Short-term effects on aquatic invertebrates

Method	Results	Remarks
Daphnia magna freshwater static according to guideline OECD Guideline 202 (Daphnia sp. Acute Immobilisation Test)	LC50 (48h): 2400 mg/L based on: mobility NOEC (48h): 2000 mg/L based on: mobility	1 (reliable without restriction) key study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference



		de Groot, W.A. and Groeneveld, A.H.C. 1998
Daphnia magna static Method: other: EPA/600/4-90/027, EPA/600/6-91/003	LC50 (48h): 2770 mg/L based on: mobility	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Mount, D.R., Gulley, D.D., Hockett, J.R., Garrison, T.D. and Evans, J.M. 2009
Ceriodaphnia dubia freshwater static Method: other: EPA/600/4-90/027, EPA/600/6-91/003	LC50 (48h): 1830 mg/L based on: mobility	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference Mount, D.R., Gulley, D.D., Hockett, J.R., Garrison, T.D. and Evans, J.M. 2009
Daphnia magna static Method: other	(48h): 1062 mg/L based on: mobility	2 (reliable with restrictions) supporting study experimental study Test material 10035-04-8 / 10035-04-8, (full information in Annex II). Reference Khargarot, B.S. and Ray, P.K. 1989
other aquatic worm: Tubifex tubifex	EC50 (96h): 780 mg/L based on: mobility	2 (reliable with



freshwater semi-static Method: other	EC50 (48h): 1830 mg/L based on: mobility EC50 (24h): 2260 mg/L based on: mobility	restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233- 140-8, (full information in Annex II). Reference Khangarot, B.S. 1991
other aquatic crustacea: Cyclops abyssorum prealpinus freshwater static Method: other: not mentioned	LC50 (48h): 19400 mg/L based on: mortality	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233- 140-8, (full information in Annex II). Reference Baudouin, M.F. and Scoppa, P. 1974
other aquatic crustacea: Eudiaptomus padanus padanus freshwater static Method: other: not mentioned	LC50 (48h): 11100 mg/L based on: mortality	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233- 140-8, (full information in Annex II). Reference Baudouin, M.F. and Scoppa, P. 1974
other aquatic crustacea: Daphnia hyalina freshwater static Method: other: not mentioned	LC50 (48h): 8300 mg/L based on: mortality	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233- 140-8, (full information in



		Annex II). Reference Baudouin, M.F. and Scoppa, P. 1974
Caenorhabditis elegans freshwater static Method: other	LC50 (24h): 44400 mg/L based on: mortality	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233- 140-8, (full information in Annex II). Reference Tatara, C.P., Newman, M.C., McCloskey, J.T. and Williams, P.L. 1997
other aquatic crustacea: Nitocra spinipes freshwater static Method: other: not mentioned	LC50 (96h): 1600 mg/L based on: mortality	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233- 140-8, (full information in Annex II). Reference Bengtsson, B.-E. 1978
Daphnia magna freshwater static Method: other: not mentioned	LC50 (48h): 1285 mg/L based on: mortality	2 (reliable with restrictions) supporting study experimental study Test material 10035-04-8 / 10035- 04-8, (full information in Annex II). Reference Biesinger, K.E. and Christensen, G.M. 1972



<p>other aquatic crustacea: Gammarus sobaegensis freshwater - moderately hard synthetic water (US EPA 1994) static no guideline followed The bioassay was conducted in moderately hard synthetic water (US EPA 1994) by using high-grade calcium chloride (CAS number: 10043-52-4). Pilot test was conducted to determine suitable test range of concentrations and optimal temperatures. Individuals with similar body size (7–10 mm) were selected and used for the tests. 10 randomly selected individuals were tested in an insect-breeding dish (12-cm diameter, 8-cm height; SPL Life Science 310122, Korea) filled with 200 ml of test solution at 15 °C, under a photoperiod of 16 L:8D h and light intensity of 1,500 lx. A control and six test concentrations (0–6 g/L) were tested with at least three replicates. No food was supplied to the test organisms during the toxicity tests. Acute toxicity (50 % lethal concentration (LC50)) and behavioral toxicity (50 % effective concentration (EC50)) were determined after 48 h of exposure, by using death of individuals and behavioral abnormality as the endpoints. The criteria for death were immobility and/or lack of reaction to a mechanical stimulus; the criterion for behavioral abnormality was reduced swimming performance compared with that of the untreated control, based on whether stimulation with a glass rod or soft brush resulted in jumping behavior</p>	<p>EC50 (48h): 2.85 g/L test mat. (nominal) based on: behaviour - swimming (95% C.L. 2.53–3.07) LC50 (48h): 3.54 g/L test mat. (nominal) based on: mortality (95% C.L. 3.29–3.78) LC10 (48h): 2.1 g/L test mat. (nominal) based on: mortality (95% C.L. 1.68–2.41) LC90 (48h): 5.98 g/L test mat. (nominal) based on: mortality (95% C.L. 5.36–7.13) EC10 (48h): 1.94 g/L test mat. (nominal) based on: behaviour - swimming (95% C.L. 1.32–2.27) EC90 (48h): 4.17 g/L test mat. (nominal) based on: behaviour - swimming (95% C.L. 3.74–5.35)</p>	<p>2 (reliable with restrictions) supporting study experimental study</p> <p>Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II).</p> <p>Reference Min Jeong Baek; Tae Joong Yoon; Dong Gun Kim; Cha Young Lee; Kijong Cho; Yeon Jae Bae 2014</p>
<p>other aquatic crustacea: Glyptotendipes tokunagai Sasa (Diptera: Chironomidae) freshwater - moderately hard synthetic water (US EPA 1994) static no guideline followed The bioassay was conducted in moderately hard synthetic water (US EPA 1994) by using high-grade calcium chloride (CAS number: 10043-52-4). Pilot test was conducted to determine suitable test range of concentrations and optimal temperatures. Individuals with similar body size (10–12 mm) were selected and used for the tests. 10 randomly selected individuals were exposed to 40 ml of test solution in a 50-ml glass beaker at 25 °C, under a photoperiod of 16 L:8D h and light intensity of 1,500 lx. A control and six test concentrations (0–8 g/L) were</p>	<p>EC50 (48h): 3.45 g/L test mat. (nominal) based on: behaviour - swimming (95% C.L. 2.37–4.05) LC50 (48h): 3.84 g/L test mat. (nominal) based on: mortality (95% C.L. 2.94–4.47) LC10 (48h): 2.19 g/L test mat. (nominal) based on: mortality (95% C.L. 1.04–2.80) LC90 (48h): 6.71 g/L test mat. (nominal) based on: mortality (95% C.L. 5.80–8.87) EC10 (48h): 2 g/L test mat. (nominal) based on: behaviour - swimming (95% C.L. 0.80–2.73) EC90 (48h): 5.94 g/L test mat. (nominal) based on: behaviour - swimming (95% C.L. 5.11–8.21)</p>	<p>2 (reliable with restrictions) supporting study experimental study</p> <p>Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II).</p> <p>Reference Min Jeong Baek; Tae Joong Yoon; Dong Gun Kim; Cha Young Lee; Kijong Cho; Yeon Jae Bae 2014</p>



tested with at least three replicates. No food was supplied to the test organisms during the toxicity tests. Acute toxicity (50 % lethal concentration (LC50)) and behavioral toxicity (50 % effective concentration (EC50)) were determined after 48 h of exposure, by using death of individuals and behavioral abnormality as the endpoints. The criteria for death were immobility and/or lack of reaction to a mechanical stimulus; the criterion for behavioral abnormality was reduced swimming performance compared with that of the untreated control, based on observations of whether they quickly whipped their body into an alpha shape.		
<p>other aquatic crustacea: Cloeon dipterum (L.) (Ephemeroptera: Baetidae)</p> <p>freshwater - moderately hard synthetic water (US EPA 1994)</p> <p>static</p> <p>no guideline followed</p> <p>The bioassay was conducted in moderately hard synthetic water (US EPA 1994) by using high-grade calcium chloride (CAS number: 10043-52-4). Pilot test was conducted to determine suitable test range of concentrations and optimal temperatures. Individuals with similar body size (8–10 mm) were selected and used for the tests. 10 randomly selected individuals tested in an insect-breeding dish (12-cm di- ameter, 8-cm height; SPL Life Science 310122, Korea) filled with 200 ml of test solution at 20 °C, under a photoperiod of 16 L:8D h and light intensity of 1,500 lx. A control and six test concentrations (0–8 g/L) were tested with at least three replicates. No food was supplied to the test organisms during the toxicity tests. Acute toxicity (50 % lethal concentration (LC50)) and behavioral toxicity (50 % effective concentration (EC50)) were determined after 48 h of exposure, by using death of individuals and behavioral abnormality as the endpoints. The criteria for death were immobility and/or lack of reaction to a mechanical stimulus; the criterion for behavioral abnormality was reduced swimming performance compared with that of the untreated control, based on whether stimulation with a glass rod or soft brush resulted in jumping behavior.</p>	<p>EC50 (48h): 5.66 g/L test mat. (nominal) based on: behaviour - swimming (95% C.L. 5.22–6.20)</p> <p>LC50 (48h): 6.14 g/L test mat. (nominal) based on: mortality (95% C.L. 5.50–7.20)</p> <p>LC10 (48h): 3.83 g/L test mat. (nominal) based on: mortality (95% C.L. 2.82–4.42)</p> <p>LC90 (48h): 9.83 g/L test mat. (nominal) based on: mortality (95% C.L. 8.06–15.62)</p> <p>EC10 (48h): 3.58 g/L test mat. (nominal) based on: behaviour - swimming (95% C.L. 2.92–4.02)</p> <p>EC90 (48h): 8.95 g/L test mat. (nominal) based on: behaviour - swimming (95% C.L. 7.78–11.47)</p>	<p>2 (reliable with restrictions) supporting study experimental study</p> <p>Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II).</p> <p>Reference Min Jeong Baek; Tae Joong Yoon; Dong Gun Kim; Cha Young Lee; Kijong Cho; Yeon Jae Bae 2014</p>
other aquatic crustacea: Caridina denticulata denticulata De Haan (Decapoda: Atyidae)	<p>EC50 (48h): 17.97 g/L test mat. (nominal) based on: behaviour - swimming (95% C.L. 15.64–20.61)</p>	<p>2 (reliable with restrictions) supporting study</p>



<p>freshwater - moderately hard synthetic water (US EPA 1994) static no guideline followed The bioassay was conducted in moderately hard synthetic water (US EPA 1994) by using high-grade calcium chloride (CAS number: 10043-52-4). Pilot test was conducted to determine suitable test range of concentrations and optimal temperatures. Individuals with similar body size (28–32 mm) were selected and used for the tests. 10 randomly selected individuals were exposed to 1,000 ml of test solution in a plastic container (22-cm long × 15-cm wide × 13-cm high) at 15 °C, under a photoperiod of 16 L:8D h and light intensity of 1,500 lx. A control and six test concentrations (0–25 g/L) were tested with at least three replicates. No food was supplied to the test organisms during the toxicity tests. Acute toxicity (50 % lethal concentration (LC50)) and behavioral toxicity (50 % effective concentration (EC50)) were determined after 48 h of exposure, by using death of individuals and behavioral abnormality as the endpoints. The criteria for death were immobility and/or lack of reaction to a mechanical stimulus; the criterion for behavioral abnormality was reduced swimming performance compared with that of the untreated control, based on observations of abnormal swimming or lying sideways.</p>	<p>LC50 (48h): 18.88 g/L test mat. (nominal) based on: mortality (95% C.L. 16.35–20.19) LC10 (48h): 18.88 g/L test mat. (nominal) based on: mortality (95% C.L. 16.35–20.19) LC90 (48h): 28.79 g/L test mat. (nominal) based on: mortality (95% C.L. 24.45–49.34) EC10 (48h): 10.3 g/L test mat. (nominal) based on: behaviour - swimming (95% C.L. 5.41–12.78) EC90 (48h): 33.15 g/L test mat. (nominal) based on: behaviour - swimming (95% C.L. 25.31–59.40)</p>	<p>experimental study</p> <p>Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II).</p> <p>Reference Min Jeong Baek; Tae Joong Yoon; Dong Gun Kim; Cha Young Lee; Kijong Cho; Yeon Jae Bae 2014</p>
<p>other aquatic crustacea: Ecdyonurus levis Navas (Ephemeroptera: Heptageniidae) freshwater - moderately hard synthetic water (US EPA 1994) static no guideline followed The bioassay was conducted in moderately hard synthetic water (US EPA 1994) by using high-grade calcium chloride (CAS number: 10043-52-4). Pilot test was conducted to determine suitable test range of concentrations and optimal temperatures. Individuals with similar body size (18–20 mm) were selected and used for the tests. 10 randomly selected individuals tested in an insect-breeding dish (12-cm di- ameter, 8-cm height; SPL Life Science 310122, Korea) filled with 200 ml of test solution at 15 °C, under a photoperiod of 16 L:8D h and light intensity of 1,500 lx. A control and six test concentrations (0–12 g/L) were tested with at least three replicates. No food was</p>	<p>EC50 (48h): 5.89 g/L test mat. (nominal) based on: behaviour - swimming (95% C.L. 4.92–7.04) LC50 (48h): 6.32 g/L test mat. (nominal) based on: mortality (95% C.L. 5.28–7.51) LC10 (48h): 2.76 g/L test mat. (nominal) based on: mortality (95% C.L. 1.69–3.58) LC90 (48h): 14.45 g/L test mat. (nominal) based on: mortality (95% C.L. 11.24–23.02) EC10 (48h): 2.79 g/L test mat. (nominal) based on: behaviour - swimming (95% C.L. 1.71–3.59) EC90 (48h): 12.45 g/L test mat. (nominal) based on: behaviour - swimming (95% C.L. 9.72–20.17)</p>	<p>2 (reliable with restrictions) supporting study experimental study</p> <p>Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II).</p> <p>Reference Min Jeong Baek; Tae Joong Yoon; Dong Gun Kim; Cha Young Lee; Kijong Cho; Yeon Jae Bae 2014</p>



supplied to the test organisms during the toxicity tests. Acute toxicity (50 % lethal concentration (LC50)) and behavioral toxicity (50 % effective concentration (EC50)) were determined after 48 h of exposure, by using death of individuals and behavioral abnormality as the endpoints. The criteria for death were immobility and/or lack of reaction to a mechanical stimulus; the criterion for behavioral abnormality was reduced swimming performance compared with that of the untreated control, based on whether stimulation with a glass rod or soft brush resulted in jumping behavior.		
<p>other aquatic mollusc: <i>Corbicula fluminea</i> freshwater - During the test, the addition of the test item (salt) in the medium, increased the salinity of 12.2 ppt at the highest concentration tested semi-static</p> <p>equivalent or similar to guideline ASTM International. 2013. Standard guide for conducting laboratory toxicity tests with freshwater mussels. E 2455-06.</p> <p>- Principle of test: Mortality of clams was assessed exposing the organisms for 4- and 8-d to the test item - Parameters analysed / observed: mortality recorded every 24 with two methods. Method 1: Clams which did not respond or close their shell after being touched at each 24-h check were considered dead; method 2: due to the easily mistaken assessment of mortality, clams were placed into freshwater after being exposed for 4 or 8 d. Mortality was then reassessed based on whether they responded or closed when touched.</p>	<p>LC50 (4d): 3554 mg/L test mat. (dissolved fraction) - chloride (meas. (not specified)) based on: mortality (- not significant difference in mortality between the two assessing methods , so only a value is reported)</p> <p>LC50 (8d): 2235 mg/L test mat. (dissolved fraction) - chloride (meas. (not specified)) based on: mortality (- not significant difference in mortality between the two assessing methods , so only a value is reported)</p>	<p>2 (reliable with restrictions) supporting study experimental study</p> <p>Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II).</p> <p>Reference Kayla D. Coldsnow Rick A. Relyea 2018</p>

Discussion

The following information is taken into account for short-term toxicity to aquatic invertebrates for the derivation of PNEC:

Key Information:

Twelve reliable studies (K2) are available fulfilling overall 16 study records covering different species: 9 crustacean, 2 worms, 1 mollusc and 3 aquatic insects.

Only two studies conducted according to international or national guidelines exposing *Daphnia magna* (de Groot and Groeneveld 1998) and *Ceriodaphnia* sp. (Mount et al., 1997) for 48 h to the test item are available. Results indicated estimated EC50s of 2400 mg/L for *Daphnia magna* and 1830 mg/L for *Ceriodaphnia* sp. However, the lowest EC50 of 1062 mg/L for crustacean was found in another valid study (Khangarot and Ray 1989), which however was not conducted by a standard method and so deemed less reliable than the aforementioned studies. Two studies reporting the toxicity of the test material to worm, *Tubifex tubifex* at 96 h (Khangarot, 1991) and *Caenorhabditis elegans* at 24h (Tatara et al. 1997), showed respectively the lowest and



the highest EC50 among all the short-term invertebrates' studies.

Estimated EC50(96h) for *T. tubifex* was 780 mg/L and for *Caenorhabditis elegans* 44400 mg/L. However, these studies were not conducted by standard guidelines and lacked in detail to allow a detailed evaluation of the reliability. Overall, the acute toxicity of reliable K2 studies with invertebrates showed LC50 or EC50 values in the range of 780-44400 mg/L.

There were some K3 studies (6) outside the aforementioned range, however as the quality of these studies could not be verified these were not considered reliable enough for risk assessment purposes.

In conclusion, the short-term invertebrate study selected for risk assessment purposes was the EC50 of 2400 mg/L determined in the most reliable *Daphnia magna* study performed.

Freshwater fish

Effect concentration: 2400 mg/L

7.1.2.2. Long-term toxicity to aquatic invertebrates

The results are summarised in the following table:

Table 7.4. Long-term effects on aquatic invertebrates

Method	Results	Remarks
<i>Daphnia magna</i> freshwater long-term toxicity to aquatic invertebrates according to guideline OECD Guideline 211 (<i>Daphnia magna</i> Reproduction Test)	NOEC (21d): 481 mg/L test mat. (nominal) based on: No. of broods LOEC (21d): 240 mg/L test mat. (nominal) based on: reproduction EC50 (21d): 900 mg/L test mat. (nominal) based on: mortality: Total number living offspring produced at the end of the test per parent <i>daphnia</i> at the start of the test excluding from the analysis parental accidental and/or inadvertent mortality { TG 211 }	2 (reliable with restrictions) key study experimental study Test material calcium dichloride / 10043-52-4 / 233- 140-8, (full information in Annex II). Reference Neda Mažuran, Vladimir Hršak, Goran Kovačević 2015
<i>Daphnia magna</i> long-term toxicity to aquatic invertebrates Method: other: not mentioned	EC50 (21d): 610 mg/L based on: reproductive impairment EC16 (21d): 320 mg/L based on: reproductive impairment LC50 (21d): 920 mg/L based on: mortality	2 (reliable with restrictions) supporting study experimental study Test material



		calcium dichloride / 10043-52-4 / 233- 140-8, (full information in Annex II). Reference Biesinger, K.E. and Christensen, G.M. 1972
--	--	--

Discussion

The following information is taken into account for long-term toxicity to aquatic invertebrates for the derivation of PNEC

Key Information:

The chronic effect of 21-day exposure on reproduction of *Daphnia magna* was investigated in two reliable studies (K2) (Biesinger and Christensen 1972 and Mazuran et al. 2015). However, only one was conducted by a standard guideline and hence selected as key study. The lowest effective concentration for reproduction was 240 mg/L (LOEC). The LOEC was the lowest concentrations tested, hence no NOEC for reproduction could be determined.

Freshwater fish

Effect concentration: 240 mg/L

Relevant studies: Mazuran 2015/K2 KS/Long-term aq invertebrates - *D. magna*

Additional information:

Please note that the NOEC mentioned in the table for key value for chemical safety assessment is a LOEC, not a NOEC. However as it is the lowest reported value, this one was selected to be presented.

7.1.3. Algae and aquatic plants

The results are summarised in the following table:

Table 7.5. Effects on algae and aquatic plants

Method	Results	Remarks
Raphidocelis subcapitata (previous names: Pseudokirchneriella subcapitata, Selenastrum capricornutum) [green algae] (algae)	EC50 (72h): 2900 mg/L based on: biomass EC50 (72h): >4000 mg/L based on: growth rate EC50 (72h): 27000 mg/L based on: growth	1 (reliable without restriction) key study experimental study



toxicity to aquatic algae and cyanobacteria according to guideline OECD Guideline 201 (Alga, Growth Inhibition Test) [before 23 March 2006]	rate EC20 (72h): 1000 mg/L based on: biomass	Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II). Reference de Groot, W.A. 1998
Lemna minor (aquatic plants) according to guideline Method: other	(14d): 9600 mg/L based on: frond number (14d): 7200 mg/L based on: frond number	3 (not reliable) supporting study Test material Information not provided in IUCLID Reference Tkalec, M., Vidakovic-Cifrek, V. and Regula, I. 1998

Discussion

Effects on algae / cyanobacteria

The following information is taken into account for effects on algae / cyanobacteria for the derivation of PNEC:

Key Information:

Among the available studies, only one study with freshwater algae, *Pseudokirchneriella subcapitata* (as *Selenastrum capricornutum*) (de Groot, 1998) was conducted according to OECD guideline 201 and thus selected as key study. The 72-hour EC50 based on biomass and growth rate were 2900 and >4000 mg/L respectively. The 72-hour EC20 obtained on the basis of biomass and growth rate were 1000 mg/L and 27000 mg/L, respectively. The growth rate value was chosen as key value. Note that as in this case no NOEC was presented in the study, the EC20 value was used as surrogate for the NOEC to be reported in the key value for chemical safety assessment.

Value used for CSA:

EC50 for freshwater algae: 4000mg/L

EC50 for marine water algae:

EC10/LC10 or NOEC for freshwater algae: 27000mg/L

EC10/LC10 or NOEC for marine water algae:

Relevant studies: de Groot 1998 - SIDS/K1 KS/Toxicity aq algae and cyanobacteria - P.subcapitata

Discussion

Effects on aquatic plants other than algae

The following information is taken into account for effects on aquatic plants other than algae for the derivation of PNEC:

**Key Information:**

One non-reliable (K3) study was present investigating the toxicity of CaCl₂ on Lemna minor. However, no sufficient data are available about the study to determine a key value.

7.1.4. Sediment organisms

No relevant information available.

Data waiving

Information requirement: Effects on sediment organisms

Reason: study scientifically not necessary / other information available

Justification: - - In accordance with REACH Annex XI, the study does not need to be conducted. In water, calcium chloride is dissociated into calcium and chloride ions. Chloride ions will not adsorb on particulate matter. The calcium ion may bind to particulate matter or may form stable inorganic salts with sulphate and carbonate ions, however calcium is naturally present in soil. Consequently, calcium chloride exposure of the sediment compartment is not likely.

7.1.5. Other aquatic organisms

The results are summarised in the following table:

Table 7.6. Effects on other aquatic organisms

Method	Results	Remarks
<p>Rana sylvatica freshwater static according to guideline ASTM. 2006. E729-96 and U.S., EPA. 1993. EPA 600/4-90/027F. Technical Report. Cincinnati, OH. - Principle of test: The objective of the present study was to assess the direct acute toxicity of six deicing chemicals to native R. sylvatica larvae as a predictor of their relative toxicity in the environment - Short description of test conditions: five tadpoles per 4 replicates in test chambers consisted of glass jars with loosely fitting glass lids to prevent evaporation and allow for sufficient oxygen exchange, filled with two liters of filtered Portage Lake water. 12:12-h light:dark cycle using full-spectrum lights. Water temperature averaged 20.78 °C (range 19.4–21.88 °C) during all trials. - Parameters analysed / observed: Larvae were checked every 24 h, with mortality recorded at each interval.</p>	<p>LC50 (96h): 3.98 g/L test mat. (nominal) based on: mortality (3.46–4.57) LC50 (72h): 4.18 g/L test mat. (nominal) based on: mortality (95% C.L. 3.69–4.73) LC50 (48h): 4.72 g/L test mat. (nominal) based on: mortality (95% C.I. 4.08–5.47) LC50 (24h): 4.85 g/L test mat. (nominal) based on: mortality (95% C.I. 4.16–5.65)</p>	<p>2 (reliable with restrictions) key study experimental study</p> <p>Test material calcium dichloride / 10043-52-4 / 233-140-8, (full information in Annex II).</p> <p>Reference MEAGAN L. HARLESS, CASEY J HUCKINS, JACQUALINE B. GRANT, THOMAS G. PYPKER 2011</p>

Discussion

The following information is taken into account for any hazard / risk assessment:

Key Information:

A study was performed exposing tadpoles of *Rana sylvatica* to the test material for 96h. Test was conducted by standard guideline ASTM "E729-96" and US EPA 1993 "EPA 600/4-90/027F". No analytical monitoring of the test item concentrations during the test was performed. Results showed an estimated LC50 (mortality) of 3980 mg/L.

Relevant studies: Harless 2011/K2 KS/Toxicity other aq vertebrates - *R. sylvatica*

7.2. Terrestrial compartment

Additional information:

Calcium is well known as an essential nutrient for higher plants and has important roles for cell wall formation, cell division and cell elongation. Chloride is an essential micronutrient for plants and has an important role in regulating osmotic pressure of cells (SIDS, 2002).

Demands for calcium and chloride in plants/crops

The calcium content of plants varies between 0.1 and > 0.5% of the dry weight depending on the growing conditions, plant species, and plant organ. In well-balanced growing nutrient solutions with controlled pH, maximal growth rates were obtained at calcium supply levels of 2.5-100 μM . Also, calcium can be supplied at higher concentrations and might reach more than 10% of the dry weight without symptoms of serious inhibition of plant growth, at least in calcicole plant species.

A typical symptom of calcium deficiency is the disintegration of cell walls and the collapse of the affected tissues, such as the petioles and upper parts of the stems. Lower calcium contents in fleshy fruits also increase the losses caused by enhanced senescence of the tissue and by fungal infections.

In plant species with relatively low chloride requirement (<1 mg Cl/g leaf dry wt) the demand for chloride can be covered by a concentration of 100 μM Cl- in the nutrient solution. At the supply of 10 μM Cl- the shoot dry weight drops to 50%, indicating that chloride uptake is not so efficient as phosphorus uptake, because the demand for phosphorus in the leaf, which is much higher than that for chloride, can be fulfilled by the supply at a phosphorus concentration lower than 10 μM . In most plant species the Cl- requirement for optimal growth is in the range of 0.2-0.4 mg/g dry matter. The principal effect of chloride deficiency is a reduction in leaf surface area and thereby plant dry weight. With severe deficiency, curling of the young leaves followed by shrivelling and necrosis might occur (SIDS, 2002).

Biological effects monitoring

High proportion of the total calcium in plant tissues is often found in the cell walls. This unique distribution is mainly due to an abundance of binding sites for calcium in the cell walls and the restricted transport of calcium into the cytoplasm.

The proportion of calcium pectate in the cell walls is of importance for the susceptibility of the tissue to fungal



and bacterial infections and for the ripening of fruits. Calcium has a significant effect on reducing the toxicity of soluble organic acids in the protoplasm of many plants. A soluble organic acid such as oxalic acid combines with Ca to form the very insoluble salt, calcium oxalate, which is not toxic to plants. Calcium has the role in counterbalancing the harmful effects of high concentrations of other cations at the plasma membrane. In the absence of an exogenous calcium supply, root extension quickly ceases. On the other hand, the reduction in plant growth under heavy salinisation is also suppressed by the supply of calcium.

Calcium competes with Na⁺ for binding to the exchangeable sites in soil. Since soil clay has a higher affinity for Ca²⁺ than Na⁺, more Na⁺ is likely to be leached out to lower soil layers where it will become less available for plants roots.

Chloride is essential for the photosynthetic O₂ evolution and the proton-pumping ATPases. Chloride has important functions in osmoregulation at different levels. At the high plant contents it is a main osmoticum in the vacuoles of the bulk tissue (50-150 mM Cl⁻), together with potassium. At low contents that are in the range of micronutrient (~1 mM Cl⁻ or below), these osmoregulatory functions of chloride are presumably confined to specialized tissues or cells, such as the extension zones of roots and shoots. Chloride also plays an essential role in stomatal regulations through mediating opening and closure of the stomata (SIDS, 2002).

Biotransformation and kinetics

Calcium is always present in the external solution in order to fulfil its functions at the plasma membrane, where it regulates the selectivity of ion uptake and prevents solute leakage from the cytoplasm. In the apoplasm, a part of calcium ions are firmly bound to its structures. Another part of the ions are exchangeable at the cell walls and at the exterior surface of the plasma membrane. A high proportion of intracellular calcium might be sequestered in vacuoles whereas the concentration in the cytosol is extremely low. The same is true for the mobility of calcium in the symplasm from cell to cell and in the phloem. Most of the functions of calcium as a structural component of macromolecules are related to its capacity for coordination, by which it provides stable but reversible intermolecular linkages, predominantly in the cell walls and at the plasma membrane.

Chloride is readily taken up by plants and its mobility in short- and long-distance transport is high. In plants chloride occurs mainly as a free anion or is loosely bound to exchange sites (SIDS, 2002).

Toxicity of calcium chloride for terrestrial organisms

Damage to roadside vegetation has been reported and is attributed largely to the absorption of salt splashed foliage. Sugar maples (*Acer saccharum*) were exposed to runoff of sodium chloride and calcium chloride for 6 winters (total treatment of 11.2 tonnes /ha per treatment and 15 treatments per winter at weekly intervals, equalling 11.2 kg/m² in total and 1.87 kg/m² in one season). Leaves of these maple trees contained 3 to 6 times the chloride concentration compared to a control stand. Damage to the maples varied but could be correlated with the chloride concentration in the leaf (EPSO, 1984).

In addition, a study was conducted exposing 2 months old plant of silver maple, *Acer saccharinum*, to test item for up to 360 days. No analytical monitoring of exposure concentrations was performed. Results showed a LOEC and a NOEC for growth (dry weight) of 20 and 40 mM, respectively. Effects on the photosynthetic pigments, chlorophyll a and b, were also assessed however no significant difference in their concentration, compare to the control, was found up to the 360 d exposure period.

From two field experiments with spruce tree (*Picea* sp.) carried out for ten weeks during a winter season, and a total dose of 1.5 kg/m² NaCl, CaCl₂ or a 75/25 NaCl/CaCl₂ mixture, it was found that in the presence of calcium chloride the uptake of Cl⁻ in the root was inhibited (Bogemans et al., 1989). Thus effects of calcium chloride are present but it depends on the amount of accumulated Cl⁻.

A “no-effect-deposition” (NEdep) value was derived for the exposure route for deposition of calcium via road salts or dust suppressors. It should be noted, that although the units refer to exposure via air, this value reflects effects caused by CaCl₂ deposited from air into soil or onto a plants’ surface. An assessment factor of 10 is taken into account. This factor is deemed appropriate as two chronic field studies are available in which plants were exposed for one or more seasons. The total dose is tentatively used as the effect concentration, resulting in a NEdep of 150 g/m².

According to the Canadian Environmental Protection Act (CEPA, 2001), sensitive terrestrial plants may be



affected by soil concentrations greater than about 68 mg sodium/kg and 215 mg chloride/kg. Areas with such soil concentrations extend linearly along roads and highways or other areas where road salts are applied for de-icing or dust control. The impact of aerial dispersion extends up to 200 m from the edge of multi-lane highways and 35 m from two-lane highways where de-icing salts are used. Salt injury to vegetation also occurs along watercourses that drain roadways and salt handling facilities (EHC, 2001).

7.2.1. Toxicity to soil macro-organisms

No relevant information available.

Data waiving

Information requirement: Toxicity to soil macro-organisms except arthropods

Reason: study scientifically not necessary / other information available

Justification: the study does not need to be conducted because direct and indirect exposure of the soil compartment is unlikely [exposure considerations] - In accordance with REACH Annex IX and X, the study does not need to be conducted if direct and indirect exposure of the soil compartment is unlikely. In water, calcium chloride is dissociated into calcium and chloride ions. Chloride ions will not adsorb on particulate matter. The calcium ion may bind to particulate matter or may form stable inorganic salts with sulphate and carbonate ions, however calcium is naturally present in soil. Consequently, calcium chloride exposure of the soil compartment is not likely.

Information requirement: Toxicity to soil arthropods

Reason: study scientifically not necessary / other information available

Justification: the study does not need to be conducted because direct and indirect exposure of the soil compartment is unlikely [exposure considerations] - In accordance with REACH Annex IX and X, the study does not need to be conducted if direct and indirect exposure of the soil compartment is unlikely. In water, calcium chloride is dissociated into calcium and chloride ions. Chloride ions will not adsorb on particulate matter. The calcium ion may bind to particulate matter or may form stable inorganic salts with sulphate and carbonate ions, however calcium is naturally present in soil. Consequently, calcium chloride exposure of the soil compartment is not likely.

7.2.2. Toxicity to terrestrial plants

The results are summarised in the following table:

Table 7.7. Effects on terrestrial plants

Method	Results	Remarks
Acer saccharinum L. (Sapindales) toxicity to terrestrial plants: long-term (laboratory study) not specified Substrate: wet perlite equivalent or similar to guideline OECD Guideline 227 (Terrestrial Plant Test: Vegetative Vigour Test)	Acer saccharinum NOEC (180d): 20 mM test mat. (nominal) based on: growth - dry weight (mg/plant) Acer saccharinum NOEC (360d): 20 mM test mat. (nominal) based on: growth - dry weight (mg/plant) Acer saccharinum LOEC (180d): 40 mM test mat. (nominal) based on: growth - dry weight (mg/plant) Acer saccharinum LOEC (360d): 40 mM test mat. (nominal) based on: growth - dry weight (mg/plant)	2 (reliable with restrictions) supporting study experimental study Test material calcium dichloride / 10043-52-4 / 233- 140-8, (full information in Annex II). Reference Jacek Patykowski, Jeremi Kołodziejek, Mateusz Wala 2018
toxicity to terrestrial plants [deactivated phrase]		2 (reliable with restrictions)



Substrate:		supporting study Test material calcium dichloride / 10043-52-4 / 233- 140-8, (full information in Annex II). Reference Environmental Protection Service Ottawa 1984
toxicity to terrestrial plants [deactivated phrase] Substrate:		2 (reliable with restrictions) supporting study Test material calcium dichloride / 10043-52-4 / 233- 140-8, (full information in Annex II). Reference Bogemans, J., Neirinckx, L. and Stassart, J.M. 1989

Data waiving

Information requirement: Effects on terrestrial plants

Reason: study scientifically not necessary / other information available

Justification: the study does not need to be conducted because direct and indirect exposure of the soil compartment is unlikely [exposure considerations] - In accordance with REACH Annex IX and X, the study does not need to be conducted if direct and indirect exposure of the soil compartment is unlikely. In water, calcium chloride is dissociated into calcium and chloride ions. Chloride ions will not adsorb on particulate matter. The calcium ion may bind to particulate matter or may form stable inorganic salts with sulphate and carbonate ions, however calcium is naturally present in soil. Consequently, calcium chloride exposure of the soil compartment is not likely.

7.2.3. Toxicity to soil micro-organisms

No relevant information available.

Data waiving

Information requirement: Effects on soil micro-organisms

Reason: study scientifically not necessary / other information available

Justification: the study does not need to be conducted because direct and indirect exposure of the soil compartment is unlikely [exposure considerations] - In accordance with REACH Annex IX and X, the study does not need to be conducted if direct and indirect exposure of the soil compartment is unlikely. In water, calcium chloride is dissociated into calcium and chloride ions. Chloride ions will not adsorb on particulate matter. The calcium ion may bind to particulate matter or may form stable inorganic salts with sulphate and carbonate ions, however calcium is naturally present in soil. Consequently, calcium chloride exposure of the soil compartment is not likely.



7.2.4. Toxicity to other terrestrial organisms

No relevant information available.

Data waiving

Information requirement: Toxicity to soil arthropods

Reason: study scientifically not necessary / other information available

Justification: the study does not need to be conducted because direct and indirect exposure of the soil compartment is unlikely [exposure considerations] - In accordance with REACH Annex IX and X, the study does not need to be conducted if direct and indirect exposure of the soil compartment is unlikely. In water, calcium chloride is dissociated into calcium and chloride ions. Chloride ions will not adsorb on particulate matter. The calcium ion may bind to particulate matter or may form stable inorganic salts with sulphate and carbonate ions, however calcium is naturally present in soil. Consequently, calcium chloride exposure of the soil compartment is not likely.

7.3. Atmospheric compartment

No relevant information available.

7.4. Microbiological activity in sewage treatment systems

No relevant information available.

Data waiving

Information requirement: Effects on aquatic micro-organisms

Reason: study scientifically not necessary / other information available

Justification: the study does not need to be conducted because there is no emission to a sewage treatment plant [exposure considerations] - There will be no emission of CaCl₂ as such to the sewage treatment site. Calcium chloride is easily dissociated into calcium and chloride ions. Calcium is known as an essential nutrient for higher plants and one of the basic inorganic elements of algae. Calcium plays crucial roles in strengthening cell walls. Chloride is also an essential micronutrient for bacteria and has important roles in the photosynthesis and osmoregulation

7.5. Non compartment specific effects relevant for the food chain (secondary poisoning)

7.5.1. Toxicity to birds

No relevant information available.

Data waiving

Information requirement: Toxicity to birds

Reason: study scientifically not necessary / other information available

Justification: - - In accordance to Column 2 Annex X, tests on birds are not needed as risk assessment on the data on mammalian toxicity suggest that a risk for secondary poisoning is unlikely. In addition, the absorption, the distribution and the excretion of the ions in animals are regulated separately. Both ions are essential constituents of the body of all animals. Calcium is essential for the formation of skeletons, neural transmission, muscle contraction, coagulation of the blood, and so on. Chloride is required for regulating intracellular osmotic pressure and buffering.

7.5.2. Toxicity to mammals

No relevant information available.



7.6. PNEC derivation and other hazard conclusions

7.6.1. PNEC derivation and other hazard conclusions

Table 7.8. Hazard assessment conclusion for the environment

Compartment	Hazard conclusion	Remarks/Justification
Freshwater	no hazard identified: Intermittent releases:	<p>Because the calcium and chloride concentration varies significantly between aquatic ecosystems (0.06-210 mg/L), it is not considered useful to derive a generic PNEC_{water} or PNEC_{water-added}. Additionally, as no adverse effects were observed in studies at the highest recommended concentrations tested, it can be concluded that no hazard has been identified and no PNEC is to be derived (ECHA Guidance on information requirements and CSA part B, Hazard assessment).</p> <p>This justification applies both to the PNEC_{freshwater} as to the PNEC_{intermittent release}.</p>
Marine water	no hazard identified: Intermittent releases:	<p>Because the calcium and chloride concentration varies significantly between aquatic ecosystems (0.06-210 mg/L), it is not considered useful to derive a generic PNEC_{marine water} or PNEC_{marine water-added}. Additionally, as no adverse effects were observed in studies at the highest recommended concentrations tested, it can be concluded that no hazard has been identified and no PNEC is to be derived (ECHA Guidance on information requirements and CSA part B, Hazard assessment).</p>
Sediments (freshwater)	no hazard identified:	<p>No toxicity data on sediment organisms are available. Calcium chloride is present in the environment as calcium and chloride ions, which implies that it will not adsorb on particulate matter, and it is not considered useful to derive a PNEC_{sediment}.</p>
Sediments (marine water)	no hazard identified:	<p>No toxicity data on sediment organisms are available. Calcium chloride is present in the environment as calcium and chloride ions, which implies that it will not adsorb on particulate matter, and it is not considered useful to derive a PNEC_{sediment}.</p>
Sewage treatment plant	no hazard identified:	<p>No toxicity tests on the effect of calcium chloride on STP organisms are available. Because the calcium and chloride concentration varies significantly between aquatic ecosystems, it is not considered useful to derive a generic PNEC_{STP} or PNEC_{STP-added}.</p>



Soil	no hazard identified:	No reliable and relevant toxicity data on terrestrial organisms are available. Calcium chloride is present in the environment as calcium and chloride ions, which implies that it will not adsorb on particulate matter, and it is not considered useful to derive a PNEC _{terrestrial} .
Air	no hazard identified:	There are no indications that there are any concerns for hazard to air relevant for this substance.
Secondary poisoning	no potential for bioaccumulation:	In view of the nutritional aspects, the metabolism, and the mechanisms of action of calcium and chloride ions, it is not considered useful to derive a PNEC _{coral} (secondary poisoning).

Conclusion on environmental classification

The lowest L(E)C50 value is > 100 mg/l (48-h EC50 is 2400 mg/l in daphnids (*Daphnia magna*)) and the lowest chronic value is well > 1 mg/l (21-d LOEC is 240 mg/l in daphnids (*Daphnia magna*) and a 25d NOEC of 230 mg/L in fish (OECD210, *Oncorhynchus mykiss*)). Therefore calcium chloride needs not to be classified according to the CLP Regulation (Regulation (EC) No 1272/2008).



8. PBT AND vPvB ASSESSMENT

8.1. Assessment of PBT/vPvB Properties

8.1.1. PBT/vPvB criteria and justification

No relevant information available.

8.1.2. Summary and overall conclusions on PBT or vPvB properties

Assessed composition: Boundary composition

Overall conclusion: PBT assessment does not apply.

Justification:

PBT and vPvB criteria are not applicable to inorganic substances.

8.2. Emission characterisation



9. EXPOSURE ASSESSMENT (and related risk characterisation)

The sections 9 and 10 of this CSR have been generated with Chesar 3.7.

9.0. Introduction

9.0.1. Overview on uses

See the description of the various uses in section 2 of the CSR.

The main uses of calcium chloride are as follows:

- de-icing agents (de-icers)
- road stabilization and dust control
- industrial processing
- additive in plastics,
- calcium salt production,
- drainage aid for wastewater treatment etc.
- accelerator in concrete
- oil and gas well fluids
- miscellaneous (tire ballast, additive in fire extinguishers, admixture with starch paste, additive to control scaffolding in blast furnaces, desiccant, brine, food processing agent (e.g. coagulating agent), food additives, medication, additives in herbicide, pH regulating agent and laboratory chemicals).

Percentages of the uses are different among member countries and may vary from year to year.

For all worker contributing scenarios where the use of a calcium chloride as solid substance is relevant, the assumption 'medium dustiness' was assumed.

With regard to the use of the substance in liquid form, this is also considered covered by the assessment of the exposure based on the 'medium dustiness' assessment. This for the following reason. The settings within ECETOC TRA 3.1 for assessing exposure to a liquid are identical to those in which the solid form of the substance is used. The only thing requiring modification in the case of medium dustiness solid vs liquid is the state of the substance. Based on the physico-chemical properties of the substance 'low fugacity' would be normally selected. However, within Chesar it is not possible to select the parameter 'low fugacity' for assessment of a liquid when the 'original' product is a solid. Chesar automatically selects 'high fugacity' for liquid products. As a result, running ECETOC within Chesar with the default settings results in unrealistic and overconservative exposure estimates, especially as the vapour pressure of the substance is very low (< 0.05 Pa). As a consequence, the exposure has been estimated based on the saturated vapour concentrations taking into account a vapour pressure of 0.05 Pa (25°C). This approach is already conservative as the vapour pressure of 0.05 Pa was determined at elevated temperature. Based on ECETOC guidance, this is fully acceptable as long as it can be assured that activities do not regard spraying activities or activities where aerosols are generated. It is also required activities take place at ambient temperature. Hence the saturated vapour pressure method can be applied except for those exposure scenarios where solutions are sprayed, as in those cases an alternative (more traditional, but higher tier) assessment is to be applied.

9.0.2. Assessment entity groups

Not applicable

9.0.3. Introduction to the assessment for the environment

9.0.3.1. Tonnage

Assessed tonnage: 2E5 tonnes/year based on:

- 5E5 tonnes/year manufactured

The following table provides the tonnage per use and the local tonnages used in the assessment for each environmental contributing activity. The local tonnage corresponds to a tonnage at the site for uses taking place at industrial sites and to a tonnage assumed for a town of 10 000 inhabitants for widespread uses.

Table 9.1. Tonnage for assessment



ES#	Exposure scenario (ES) name and related environmental contributing scenarios	Tonnage per use (t/year)	Daily local tonnage (t/day)	Annual local tonnage (t/year)
ES1 (M)	Manufacture	5E5		
	- Manufacturing of substances (ERC 1)		1.67E3	5E5
ES2 (F)	Formulation or re-packing; Distribution of substance	1.2E5		
	- Formulation into mixture (ERC 2)		400	1.2E5
ES3 (IS)	Use at industrial site (e.g. Industrial Indoor use as Chemical Intermediate and Process aid, Industrial Outdoor use)	2E5		
	- Use of non-reactive processing aid at industrial site (no inclusion into or onto article) (ERC 4)		666.6	2E5
	- Use as an intermediate (ERC 6a)		200	6E4
ES4 (PW)	Professional use; Indoor use	1.5E5		
	- Indoor use; Professional use (ERC 8a)		0.083	-
ES5 (PW)	Professional use; Outdoor use	10.5E5		
	- Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor) (ERC 8d)		0.083	-
ES6 (C)	Consumer use; Indoor or outdoor use	2E5		
	- Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor) (ERC 8a)		0.11	-
	- Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor) (ERC 8d)		0.11	-

9.0.3.2. Scope and type of assessment for the environment

Exposure assessment and risk characterisation are not required for the environment as no hazard has been identified for the environment.

9.0.3.3. Fate and distribution parameters

Physicochemical properties used for exposure estimation

The following substance properties are used in the fate estimation done by EUSES. They correspond to the “value used for CSA” reported in sections 1 and 4.

Table 9.2. Substance key phys-chem and fate properties

Substance property	Value
Molecular weight	>= 110.9
Molecular weight used for the assessment	110.9
Melting point at 101 325 Pa	782 °C
Vapour pressure	0.05 Pa at 800 °C
Partition coefficient (Log Kow)	0.05 at 20 °C
Water solubility	7.45E5 mg/L at 20 °C

Caution: The exposure estimates have been obtained with EUSES although the following parameter(s) is/are outside the boundaries of the EUSES model:

- Melting point at 101 325 Pa
- Water solubility

Fate (release percentage) in the modelled biological sewage treatment plant

In a standard (modelled) biological STP, the emissions are distributed in the following way:

Release to water	99.86%
------------------	--------



Release to air	3.11E-12%
Release to sludge	0.139%
Release degraded	0%

The above fractions are calculated by the SIMPLETREAT model integrated in EUSES.

9.0.3.4. Comments on assessment approach for the environment

The regional concentrations are reported in section 10.2.1.1. The local Predicted Exposure Concentrations (PECs) reported for each contributing scenario correspond to the sum of the local concentrations (C_{local}) and the regional concentrations (PEC regional).

Based on the available ecotoxicity information, no PNECs could be derived for this substance. As such it was concluded that there is no environmental hazard associated with the use of calcium chloride and an exposure assessment for the environment is not triggered (ECHA Guidance B, Hazard assessment).

9.0.3.5. Scope and type of assessment for man via environment

The scope of exposure assessment and type of risk characterisation required for man via the environment are described in the following table based on the hazard conclusions presented in section 5.11.

Table 9.3. Type of risk characterisation required for man via the environment

Route of exposure and type of effects	Risk characterisation type	Hazard conclusion (see section 5.11)
Inhalation: Long term, Systemic	Not needed	No hazard identified
Inhalation: Long term, Local	Quantitative	DNEL (Derived No Effect Level) = 2.5 mg/m ³
Oral: Long term, Systemic	Not needed	No hazard identified

9.0.4. Introduction to the assessment for workers

9.0.4.1. Scope and type of assessment for workers

The scope of exposure assessment and type of risk characterisation required for workers are described in the following table based on the hazard conclusions presented in section 5.11.

Table 9.4. Type of risk characterisation required for workers

Route	Type of effect	Risk characterisation type	Hazard conclusion (see section 5.11)
Inhalation	Systemic effects - long term	Not needed	No hazard identified
	Systemic effects - acute	Not needed	No hazard identified
	Local effects - long term	Quantitative	DNEL (Derived No Effect Level) = 5 mg/m ³
	Local effects - acute	Quantitative	DNEL (Derived No Effect Level) = 10 mg/m ³
Dermal	Systemic effects - long term	Not needed	No hazard identified
	Systemic effects - acute	Not needed	No hazard identified
	Local effects - long term	Not needed	No hazard identified
	Local effects - acute	Not needed	No hazard identified



Route	Type of effect	Risk characterisation type	Hazard conclusion (see section 5.11)
Eye	Local effects	Qualitative	Medium hazard (no threshold derived)

9.0.4.2. Comments on assessment approach for workers

Concentration limits for uses in mixture

The following concentration limits are set for use in mixture. If the substance is in a mixture below those concentrations, qualitative risks are assumed to be controlled for the respective routes and types of effect:

- Eye effect: 3%

Explanation:

Calcium chloride is harmonized classified as Eye Irrit. 2 (Annex VI of EC No. 1272/2008). However, as the available information could lead to the classification as Eye Irrit 1, the conservative concentration limit of 3% has been applied within the risk assessment.

Assessment approach related to toxicological hazard:

Qualitative risk assessment:

The following qualitative human exposure assessment is relevant for all exposure scenarios.

Ocular

Calcium chloride is classified as irritating to eyes (H319).

According to the guidance on information requirements and chemical safety assessment (part E), such effects need a qualitative risk assessment rather than a quantitative assessment. The qualitative assessments of risks of hazards without Derived-No-Effect-Levels (DNEL) have been addressed by assessing the likelihood and/or frequency of exposure.

Exposure to the eyes can occur in two ways: direct from the air (splashes, aerosols, dust) or indirect via hand-eye contact.

The likelihood/frequency of hand-eye contact is considered to be very low for all worker contributing scenarios due to the fact that the likelihood of actual hand exposure is at most low and workers have been trained to prevent exposure. The likelihood/frequency of hand-eye contact is considered to be low for all consumer products scenarios both due to the nature of the products and by application of the following phrase "Do not touch eyes when using this product".

Likelihood/frequency of exposure via direct contact with concentrations in the air is considered to be low for all the contributing scenarios, due to the use of suitable eye-protection equipment.

The intensity of exposure is even considered to be very low for the contributing scenarios with aqueous solutions due to the negligible vapour pressure and the negligible dustiness due to dissolving.

Dermal

Calcium chloride is also not classified as irritating to skin; therefore also no DNELs were derived for local dermal effects by either acute or prolonged exposure. However, when the dose applied and the exposure duration significantly exceeded the limits recommended by modern guidelines for skin irritation studies, skin lesions were revealed. Therefore these extreme conditions should be prevented.

The likelihood/frequency of extreme intense contact is considered to be very low for all worker contributing scenarios due to the fact that the likelihood of actual skin exposure is at most low and workers have been trained to prevent exposure. The general risk management measures for irritants to reminding workers of general good occupational hygiene, will further reduce the likelihood and/or frequency of exposure. The likelihood/frequency of extreme intense contact is considered to be very low for the general product due to the low frequency, relative low exposure duration and/or low intensity of exposure.

Quantitative risk assessment:

Overall, the worker exposure scenario for manufacturing of Calcium Chloride is based on measurement data.

The worker exposure assessment for the other worker exposure scenarios have been performed with ECTOC TRAv3.1 (within Chesar).

Furthermore, there are a number of PROC where no specific assessment has been performed with ECTOC TRA for the respective PROC as ECETOC does not produce an exposure estimate for that PROC. In practice this means that:

- activities for PROC 26 (handling of solid inorganic substances at ambient temperature) are covered by PROC8b/PROC9.
- activities for PROC27a and PROC 27b (Production of metal powders (hot processes) respectively (wet processes) are covered by PROC22 and PROC23.



The worker inhalation exposure estimates for production of Calcium Chloride are based on occupational hygiene measured data. A full description of used methodology and results may be found in section 9.1.2. For the exposure assessment and risk characterization described in this CSR, the 90-percentile of the exposure distribution was used.

The worker exposure estimates for the activities associated with the use of Calcium Chloride have been assessed using the Chesar which contains ECETOC TRA v3.1.

It is to be noted that ECETOC TRA v3.1 calculates acute exposure levels by multiplying the 8hr TWA values with a factor 4. This is believed to be a very conservative approach for estimating the potential for exposure for this substance. However, RMMs were defined in function of the exposure levels determined for acute exposure levels. These RMMs are consequently only regarded relevant in case there is potential for peak exposure during the respective activity.

Furthermore:

- PROC 22a and PROC 23a have been assessed by PROC22 and PROC23 respectively as reasonable worst case estimates.

- No specific assessment is performed with ECETOC TRA for PROC26 (handling of solid inorganic substances at ambient temperature). Activities within this PROC are covered by assessments of other PROC. E.g. handling solid inorganic substances at ambient temperature in a laboratory is assessed by PROC 15, pouring solid inorganic substances at ambient temperature from small containers is assessed by PROC9 etc.

- Neither is there a specific assessment performed with ECETOC TRA for PROC27, but activities in PROC27a (Production of metal powders (hot processes)) are assessed by PROC22 and PROC23. Also no specific assessment is performed with ECETOC TRA for 27b (Production of metal powders (wet processes)) activities within this PROC are covered by assessments of other PROC. E.g. laboratory activities upon production of metal powders is assessed by PROC 15, pouring Calcium Chloride from small containers upon manufacturing of metal powders is assessed by PROC9 etc.

DNELs anhydrous vs hydrate form of Calcium chloride

Risk assessment is based on the anhydrous form of Calcium chloride anhydrous (CAS 10043-52-44) and its associated percentage in the used products, however other 4 forms of hydrate Calcium chloride are present in the market, namely:

- calcium chloride monohydrate (CAS 22691-02-7);
- calcium chloride dihydrate (CAS 10035-04 -8);
- calcium chloride tetrahydrate (CAS 25094-02-4);
- calcium chloride hexahydrate (CAS 774-34-7).

The anhydrous form was chosen as it would result in the most conservative assessment, as per the following sections, thus covering also the associated risk to the exposure to the other hydrate forms. Nevertheless, for completeness of information, here are reported the DNELs for the hydrate forms that can be used for a specific risk assessment.

- anhydrous DNELs: local acute= 10 mg/m³; local chronic= 5 mg/m³
- monohydrate DNELs: local acute= 11.6 mg/m³; local chronic= 5.8 mg/m³
- dihydrate DNELs: local acute= 13.2 mg/m³; local chronic= 6.6 mg/m³
- tetrahydrate DNELs: local acute= 16.5 mg/m³; local chronic= 8.2 mg/m³
- hexahydrate DNELs: local acute=19.7 mg/m³; local chronic= 9.9 mg/m³

General information on risk management related to toxicological hazard:

Where necessary a reference is made to the use of suitable eye protection. Below a further exemplification of what is suitable eye protection.

Examples of suitable eye protection include:

- Chemical resistant safety goggles
- Chemical resistant face shield
- Chemical resistant full face masks

9.0.5. Introduction to the assessment for consumers

9.0.5.1. Scope and type of assessment for consumers

The scope of exposure assessment and type of risk characterisation required for consumers are described in the following table based on the hazard conclusions reported and justified in section 5.11.

Table 9.5. Type of risk characterisation required for consumers



Route	Type of effect	Risk characterisation type	Hazard conclusion (see section 5.11)
Inhalation	Systemic effects - long term	Not needed	No hazard identified
	Systemic effects - acute	Not needed	No hazard identified
	Local effects - long term	Quantitative	DNEL (Derived No Effect Level) = 2.5 mg/m ³
	Local effects - acute	Quantitative	DNEL (Derived No Effect Level) = 5 mg/m ³
Dermal	Systemic effects - long term	Not needed	No hazard identified
	Systemic effects - acute	Not needed	No hazard identified
	Local effects - long term	Not needed	No hazard identified
	Local effects - acute	Not needed	No hazard identified
Oral	Systemic effects - long term	Not needed	No hazard identified
Eye	Local effects	Qualitative	Medium hazard (no threshold derived)

9.0.5.2. Comments on assessment approach for consumers

Concentration limits for uses in mixture

The following concentration limits are set for use in mixture. If the substance is in a mixture below those concentrations, qualitative risks are assumed to be controlled for the respective routes and types of effect:

- Eye effect: 3%

Explanation:

Calcium chloride is harmonized classified as Eye Irrit. 2 (Annex VI of EC No. 1272/2008). However, as the available information could lead to the classification as Eye Irrit 1, the conservative concentration limit of 3% has been applied within the risk assessment.

Further information on assessment approach for consumers:

The consumer exposure estimates for the use of Calcium Chloride or products containing Calcium Chloride have been assessed using ConsExpo 4.1 Paragraphs 9.8 contains the operating conditions of the consumer exposure and the consideration regarding the input values required to run the model.

DNELs anhydrous vs hydrate form of Calcium chloride

The anhydrous form was chosen as it would result in the most conservative assessment, as per the following sections, thus covering also the associated risk to the exposure to the other hydrate forms. Nevertheless, for completeness of information, here are reported the DNELs for the hydrate forms that can be used for a specific risk assessment.

- anhydrous DNELs: local acute= 5 mg/m³; local chronic= 2.5 mg/m³
- monohydrate DNELs: local acute= 5.8 mg/m³; local chronic= 2.9 mg/m³
- dihydrate DNELs: local acute= 6.6 mg/m³; local chronic= 3.3 mg/m³
- tetrahydrate DNELs: local acute= 8.2 mg/m³; local chronic= 4.1 mg/m³
- hexahydrate DNELs: local acute= 9.9 mg/m³; local chronic= 4.9 mg/m³



9.1. Exposure scenario 1: Manufacture - Manufacture

Environment contributing scenario(s):		
CS 1	Manufacturing of substances	ERC 1
Worker contributing scenario(s):		
CS 2	Chemical production in closed process without likelihood of exposure or in containment conditions or processes with equivalent containment condition	PROC 1
CS 3	Chemical production in closed continuous process with occasional controlled exposure or processes with equivalent containment condition	PROC 2
CS 4	Manufacture in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	PROC 3
CS 5	Chemical production where opportunity for exposure arises	PROC 4
CS 6	Transfer of a substance or mixture during process sampling at dedicated facilities	PROC 8b , PROC 26
CS 7	Transfer of a substance or mixture during process sampling at non-dedicated facilities	PROC 8a , PROC 26
CS 8	Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	PROC 9 , PROC 26
CS 9	Tabletting, compression, extrusion, pelettisation, granulation	PROC 14
CS 10	Use as laboratory reagent	PROC 15 , PROC 26
CS 11	Transfer of substance or mixture (charging/discharging) at non-dedicated facilities	PROC 8a , PROC 26
CS 12	Transfer of substance or mixture (charging/discharging) at dedicated facilities	PROC 8b , PROC 26
CS 13	Equipment cleaning and maintenance at non-dedicated facilities	PROC 8a , PROC 28
CS 14	Handling of solid inorganic substances at ambient temperature	PROC 26
CS 15	Manual maintenance (cleaning and repair) of machinery at non-dedicated facilities	PROC 28

Further description of the use:

Manufacture of Calcium Chloride includes recycling/ recovery, material transfers, storage, maintenance and loading (including marine vessel/barge, road/rail car and bulk container), sampling and associated laboratory activities. Details on the different types of manufacturing processes applicable can be found in section 2.1 of the CSR.

Explanation on the approach taken for the ES:

The worker inhalation exposure estimates for production of Calcium Chloride are based on occupational hygiene measured data. For the exposure assessment and risk characterization described in this CSR, the 90th percentile of the exposure distribution was used.

The data was chosen to be representative as reasonable worst case for manufacturing, since the data was collected during activities with the highest exposure potential within the manufacturing process. The measurement data is also representative for the whole industry as reasonable worst case, as they were conducted at a site in Europe which also produces Calcium Chloride powder (medium dustiness) which is the Calcium Chloride form with the highest exposure potential while also sites for only crystals (medium dustiness) pellets and flakes (low dustiness) or aqueous solutions are common in Europe (The 90th percentile of 32 measurements at another site in Europe producing flakes (stationary sampling near a bagging machine); 1 mg/m³ confirmed these measurements are reasonable worst case for the whole industry). The containment of the processes at the site of the measurements is typical even though sites in Europe exist with more contained process; this makes the containment of the measurement data also reasonable worst case. Moreover the exposure measurements were conducted at a site which produces similar amounts compared to other companies within Europe.



107 measurements were made by sampling with personal aspirator (filter type FIPRO 25 according to standards PN-91/Z-04030/06 and PN-Z-04008-7). The duration of each measurement was 1 hour. The exposure activities during measurements are representative for reasonable worst case full shift exposure as commonly 6 measurements were done successively in one shift.

Three different workers situations were monitored:

- Worker bagging Calcium Chloride at non-dedicated facility, exposure related to dust or spillage to be expected. With respect to the whole process relatively both high frequency and intensity of exposure.
- Worker at a part of the process where significant opportunity for exposure to Calcium Chloride arises; at the dryer. With respect to the whole process relatively high frequency but low intensity of exposure.
- Worker at a part of the process where significant opportunity for exposure to Calcium Chloride arises; liquid treatment & dust packaging. With respect to the whole process relatively low frequency but high intensity of exposure.

The locations of potential exposure are situated indoors. No risk management measures influencing inhalation exposure were applied during measurements other than non-forced ventilation in the roof. In general good ventilation is prescribed. So the prescribed operational conditions/risk management measures to control worker exposure are more severe as the ones applied during the measurements. This means when applying the prescribed OC/RMM actual exposure will be lower than the measurement data.

Comparison with the derived no effect level (DNEL).

The measurement duration of 1 hour for the exposure activity is so close to the duration of acute exposure (which is considered to be 15 minutes) that a correction from the estimated exposure over 1 hour to an acute exposure over 15 minutes is considered not necessary. The 90 percentiles of exposure values of the 1 hour measurements are used as the short term exposure levels and compared with the short term inhalation DNEL (worker) of 10 mg/m³.

The reasonable worst case estimates (e.g. 90th percentiles) of full shift measurements are commonly lower than the reasonable worst case estimates (90th percentiles) of short term exposure. However as worst-case assumption the exposure is considered to be the same during the full shift exposure as during short term exposure. So also for comparison with the long-term DNEL the 90 percentiles of the exposure values from the 1 hour measurements are used without any extrapolation.

The 90th percentile of exposure values measured for the packaging operator (bags and big bags) describes exposure during transfer activities at a non-dedicated facilities, so this value is used for the contributing scenarios aiming mainly at transfer activities. The measured exposure values are most relevant for PROC8a (transfer of the substance at non-dedicated facilities) and conservative for PROC8b and PROC9 (transfer of the substance at dedicated facilities). The 90 percentile of exposure values measured by the installation operator dryers matches PROC2/3 as the predominant handling is in a contained manner but some occasional exposure to Calcium Chloride occurs. The 90 percentile of exposure values measured by the installation operator liquid treatment and dust packaging matches PROC4 as more significant exposure to Calcium Chloride occurs. For PROC1 and PROC15, the exposure is expected to be lower than the 90th percentile of exposure values measured by the installation operator dryers, due to the high integrity of the system of PROC 1 and by smaller quantities and specific procedures in the laboratory of PROC15. So this value is used as a worst case value for PROC1 and PROC15.

For PROC6 (calendering) the exposure potential is comparable to or lower than the exposure potential during transfer activities so for this PROC the 90th percentile of exposure values measured by the packaging operator (bags and big bags) is used as reasonable worst case value.

9.1.1. Env CS 1: Manufacturing of substances (ERC 1)

9.1.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: <= 1.67E3 tonnes/day <i>based on 300 emission days</i>
• Annual use amount at site: <= 5E5 tonnes/year
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 0.139%]
• Discharge rate of STP: >= 2E3 m ³ /day
• Application of the STP sludge on agricultural soil: Yes



Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations
Other conditions affecting environmental exposure
• Receiving surface water flow rate: $\geq 1.8E4$ m ³ /day

9.1.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.6. Local releases to the environment

Release	Release estimation method	Explanations
Water	ERC	Release factor before on site RMM: 6% Release factor after on site RMM: 6% Local release rate: 1E5 kg/day
Air	Estimated release factor	Release factor before on site RMM: 0.5% Release factor after on site RMM: 0.5% Local release rate: 8.33E3 kg/day Explanation: Calcium chloride is produced in large quantities as a by-product from different chemical processes. In the BREF document “Large Volume Inorganic Chemicals – Solids and Others Industry” (EC, 2007), the different processes are described. According to the document, emissions to air are limited. The worst potential for emission of dust can occur from the process routes to manufacture solid grades of calcium chloride via soda ash or magnesium oxide. These process routes are however usually controlled by dedusting equipment, such as cyclones, scrubbers or predominantly dry bag filters. According to the BREF document, in 2007, consumption and emission levels relating to production processes leading to the production of CaCl ₂ liquors and solid CaCl ₂ products are given in Table 7.70 through to Table 7.73 of the BREF document (EC, 2007). In summary, the BREF document reported information indicates that the dust emitted from a calcium chloride plant is around 0.15 – 0.40 kg of dust per tonne of solid CaCl ₂ product (EC, 2007), due to dedusting off-gases from the flake dryer and the prilling tower, using available abatement techniques (e.g. efficient scrubbing with calcium chloride brine (which is to be recycled to the process)). This translates to, at worst, a release factor to air of 0.04%, which is more than 100 times lower than the default release factor for ERC1 “Manufacture of the substance” of 5%. Hence, in a conservative approach, and taking in account different processes to manufacture CaCl ₂ , deviations from the reported dust emission in BREF may occur. Consequently, reduction factor of ‘only’ 10 has been applied to the default 5% ERC1 release to air factor, resulting in a 0.5% release factor to air. In case, additional data would become available in the future, this factor can be further refined.
Non agricultural soil	ERC	Release factor after on site RMM: 0.01%

9.1.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The



exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.7. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Man via environment - Inhalation (local effects)	Concentration in air: 1.904 mg/m ³	RCR = 0.762

9.1.2. Worker CS 2: Chemical production in closed process without likelihood of exposure or in containment conditions or processes with equivalent containment condition (PROC 1)

9.1.2.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Advanced	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	
• Operating temperature: ≤ 40 °C	

9.1.2.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.8. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1.774 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.355
Inhalation, local, acute	1.774 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.177

Remarks on measured exposure:

Occupational hygiene measurements:

Identity of the substance used: calcium chloride

Inhalation exposure, long term concentration: Number of measured data points: 107

Inhalation exposure, short term concentration: Number of measured data points: 107

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)

**Risk characterisation**

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.1.3. Worker CS 3: Chemical production in closed continuous process with occasional controlled exposure or processes with equivalent containment condition (PROC 2)

9.1.3.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Advanced	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	
• Operating temperature: <= 40 °C	

9.1.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.9. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1.774 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.355
Inhalation, local, acute	1.774 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.177

Remarks on measured exposure:

Occupational hygiene measurements:

Identity of the substance used: calcium chloride

Inhalation exposure, long term concentration: Number of measured data points: 107

Inhalation exposure, short term concentration: Number of measured data points: 107

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)

Risk characterisation



Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.1.4. Worker CS 4: Manufacture in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC 3)

9.1.4.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Advanced	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	
• Operating temperature: <= 40 °C	

9.1.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.10. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1.774 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.355
Inhalation, local, acute	1.774 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.177

Remarks on measured exposure:

Occupational hygiene measurements:

Identity of the substance used: calcium chloride

Inhalation exposure, long term concentration: Number of measured data points: 107

Inhalation exposure, short term concentration: Number of measured data points: 107

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)

Risk characterisation

Qualitative risk characterisation (Eye, local):



Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.1.5. Worker CS 5: Chemical production where opportunity for exposure arises (PROC 4)

Batch process (open systems) with sample collection; filling/ preparation of equipment from drums or containers

9.1.5.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Advanced	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	
• Operating temperature: <= 40 °C	

9.1.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.11. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1.881 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.376
Inhalation, local, acute	1.881 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.188

Remarks on measured exposure:

Occupational hygiene measurements:

Identity of the substance used: calcium chloride

Inhalation exposure, long term concentration: Number of measured data points: 107

Inhalation exposure, short term concentration: Number of measured data points: 107

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)

Risk characterisation

Qualitative risk characterisation (Eye, local):



Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.1.6. Worker CS 6: Transfer of a substance or mixture during process sampling at dedicated facilities (PROC 8b, PROC 26)

9.1.6.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Advanced	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	
• Operating temperature: <= 40 °C	

9.1.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.12. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.548
Inhalation, local, acute	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.274

Remarks on measured exposure:

Occupational hygiene measurements:

Identity of the substance used: calcium chloride

Inhalation exposure, long term concentration: Number of measured data points: 107

Inhalation exposure, short term concentration: Number of measured data points: 107

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.



9.1.7. Worker CS 7: Transfer of a substance or mixture during process sampling at non-dedicated facilities (PROC 8a, PROC 26)

9.1.7.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Advanced	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	

9.1.7.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.13. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.548
Inhalation, local, acute	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.274

Remarks on measured exposure:

Occupational hygiene measurements:

Identity of the substance used: calcium chloride

Inhalation exposure, long term concentration: Number of measured data points: 107

Inhalation exposure, short term concentration: Number of measured data points: 107

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.1.8. Worker CS 8: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9, PROC 26)

**9.1.8.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Advanced	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	

9.1.8.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.14. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.548
Inhalation, local, acute	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.274

Remarks on measured exposure:**Occupational hygiene measurements:**

Identity of the substance used: calcium chloride

Inhalation exposure, long term concentration: Number of measured data points: 107

Inhalation exposure, short term concentration: Number of measured data points: 107

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.1.9. Worker CS 9: Tableting, compression, extrusion, pelettisation, granulation (PROC 14)**9.1.9.1. Conditions of use**



	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Advanced	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	
• Operating temperature: $\leq 40^\circ\text{C}$	

9.1.9.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.15. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.548
Inhalation, local, acute	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.274

Remarks on measured exposure:

Occupational hygiene measurements:

Identity of the substance used: calcium chloride

Inhalation exposure, long term concentration: Number of measured data points: 107

Inhalation exposure, short term concentration: Number of measured data points: 107

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.1.10. Worker CS 10: Use as laboratory reagent (PROC 15, PROC 26)

9.1.10.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	



	Method
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Advanced	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	
• Operating temperature: ≤ 40 °C	

9.1.10.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.16. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1.774 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.355
Inhalation, local, acute	1.774 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.177

Remarks on measured exposure:

Occupational hygiene measurements:

Identity of the substance used: calcium chloride

Inhalation exposure, long term concentration: Number of measured data points: 107

Inhalation exposure, short term concentration: Number of measured data points: 107

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.1.11. Worker CS 11: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC 8a, PROC 26)

9.1.11.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	
• Physical form of the used product: Solid (material with medium dustiness)	



	Method
<i>Covers also liquid form. See "overview on uses" for more details</i>	
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Advanced	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	
• Operating temperature: ≤ 40 °C	

9.1.11.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.17. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.548
Inhalation, local, acute	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.274

Remarks on measured exposure:

Occupational hygiene measurements:

Identity of the substance used: calcium chloride

Inhalation exposure, long term concentration: Number of measured data points: 107

Inhalation exposure, short term concentration: Number of measured data points: 107

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.1.12. Worker CS 12: Transfer of substance or mixture (charging/discharging) at dedicated-facilities (PROC 8b, PROC 26)

9.1.12.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	



	Method
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Advanced	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	
• Operating temperature: ≤ 40 °C	

9.1.12.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.18. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.548
Inhalation, local, acute	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.274

Remarks on measured exposure:

Occupational hygiene measurements:

Identity of the substance used: calcium chloride

Inhalation exposure, long term concentration: Number of measured data points: 107

Inhalation exposure, short term concentration: Number of measured data points: 107

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.1.13. Worker CS 13: Equipment cleaning and maintenance at non-dedicated facility (PROC 8a, PROC 28)

Equivalent to PROC 28

9.1.13.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	



	Method
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Advanced	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	
• Operating temperature: ≤ 40 °C	

9.1.13.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.19. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.548
Inhalation, local, acute	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.274

Remarks on measured exposure:

Occupational hygiene measurements:

Identity of the substance used: calcium chloride

Inhalation exposure, long term concentration: Number of measured data points: 107

Inhalation exposure, short term concentration: Number of measured data points: 107

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.1.14. Worker CS 14: Handling of solid inorganic substances at ambient temperature (PROC 26)

This PROC can be covered by PROC15, PROC8a, PROC8b or PROC9 dependent on the actual activity.

9.1.14.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	



	Method
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Advanced	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	
• Operating temperature: ≤ 40 °C	

9.1.14.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.20. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.548
Inhalation, local, acute	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.274

Remarks on measured exposure:

Occupational hygiene measurements:

Identity of the substance used: calcium chloride

Inhalation exposure, long term concentration: Number of measured data points: 107

Inhalation exposure, short term concentration: Number of measured data points: 107

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.1.15. Worker CS 15: Manual maintenance (cleaning and repair) of machinery at non-dedicated facility (PROC 28)

This PROC can be covered by PROC8a.

9.1.15.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	



	Method
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Advanced	
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	
• Operating temperature: ≤ 40 °C	

9.1.15.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.21. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.548
Inhalation, local, acute	2.742 mg/m ³ (Measured data: Occupational hygiene measurements)	RCR = 0.274

Remarks on measured exposure:

Occupational hygiene measurements:

Identity of the substance used: calcium chloride

Inhalation exposure, long term concentration: Number of measured data points: 107

Inhalation exposure, short term concentration: Number of measured data points: 107

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.



9.2. Exposure scenario 2: Formulation or re-packing - Formulation or re-packing; Distribution of substance

Environment contributing scenario(s):		
CS 1	Formulation into mixture	ERC 2
Worker contributing scenario(s):		
CS 2	Chemical production in closed process without likelihood of exposure or in containment conditions.	PROC 1
CS 3	Chemical production in closed continuous process with occasional controlled exposure.	PROC 2
CS 4	Formulation in closed batch processes with occasional controlled exposure.	PROC 3
CS 5	Chemical production where opportunity for exposure arises	PROC 4
CS 6	Mixing or blending in batch processes	PROC 5
CS 7	Transfer of a substance or mixture during process sampling at dedicated facilities	PROC 8b , PROC 26
CS 8	Transfer of a substance or mixture during process sampling at non-dedicated facilities	PROC 8a , PROC 26
CS 9	Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	PROC 9 , PROC 26
CS 10	Use as laboratory reagent	PROC 15 , PROC 26
CS 11	Tabletting, compression, extrusion, pelettisation, granulation	PROC 14
CS 12	Transfer of substance or mixture (charging/discharging) at non-dedicated facilities	PROC 8a , PROC 26
CS 13	Transfer of substance or mixture (charging/discharging) at dedicated facilities	PROC 8b , PROC 26
CS 14	Equipment cleaning and maintenance at non-dedicated facility	PROC 8a , PROC 28
CS 15	Manual maintenance (cleaning and repair) of machinery	PROC 28

Further description of the use:

Formulation and distribution, packing and re-packing (including drums and small packs) of the Calcium Chloride and its mixtures in batch or continuous operations, including storage, materials transfers, mixing, large and small scale packing, loading (including marine vessel/barge, rail/road car and IBC loading), maintenance and associated laboratory activities. e.g. production of adsorbents, cosmetics, metals, fertilizers, plant protection, cement, haemodialysis solution and general distributor activities with Calcium Chloride.

Explanation on the approach taken for the ES:

Calcium Chloride is frequently used in formulations. Meaning Calcium Chloride or products containing Calcium Chloride are mixed and blended becoming part of the new product. Typical example of formulations includes adsorbents, cosmetics, fertilizers, plant protection formulations, cement and haemodialysis solution Calcium Chloride can be distributed pure or in formulation. Typical distributor activities besides storage and transfer/re-packaging also include diluting/mixing.

Worker exposure to Calcium Chloride was assessed by ECETOC TRA v3.1, taking into account reasonable worst case assumptions:

- The setting is industrial and indoors.
- The dustiness category 'medium' was used for all contributing scenarios.
- The concentration Calcium Chloride a worker can be exposed to is set at 100% for all contributing scenarios.

Besides being used as a solid, Calcium Chloride is frequently used in industry and by professional in (aqueous) solutions.

With regard to the use of the substance in liquid form, this is considered covered by the assessment of the exposure based on the 'medium dustiness' assessment. This for the following reason. The settings within



ECETOC TRA 3.1 for assessing exposure to a liquid are identical to those in which the solid form of the substance is used. The only thing requiring modification in the case of medium dustiness solid vs liquid is the state of the substance. Based on the physico-chemical properties of the substance 'low fugacity' would be normally selected. However, within Chesar it is not possible to select the parameter 'low fugacity' for assessment of a liquid when the 'original' product is a solid. Chesar automatically selects 'high fugacity' for liquid products. As a result, running ECETOC within Chesar with the default settings results in unrealistic and overconservative exposure estimates, especially as the vapour pressure of the substance is very low (< 0.05 Pa). As a consequence, the exposure has been estimated based on the saturated vapour concentrations taking into account a vapour pressure of 0.05 Pa (25°C). This approach is already conservative as the vapour pressure of 0.05 Pa was determined at elevated temperature. Based on ECETOC guidance, this is fully acceptable as long as it can be assured that activities do not regard spraying activities or activities where aerosols are generated. It is also required activities take place at ambient temperature. Hence the saturated vapour pressure method can be applied except for those exposure scenarios where solutions are sprayed, as in those cases an alternative (more traditional, but higher tier) assessment is to be applied.

9.2.1. Env CS 1: Formulation into mixture (ERC 2)

9.2.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: ≤ 400 tonnes/day
• Annual use amount at site: $\leq 1.2\text{E}5$ tonnes/year
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 0.139%]
• Discharge rate of STP: $\geq 2\text{E}3$ m ³ /day
• Application of the STP sludge on agricultural soil: Yes
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations
Other conditions affecting environmental exposure
• Receiving surface water flow rate: $\geq 1.8\text{E}4$ m ³ /day

9.2.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.22. Local releases to the environment

Release	Release estimation method	Explanations
Water	ERC	Release factor before on site RMM: 2% Release factor after on site RMM: 2% Local release rate: $8\text{E}3$ kg/day
Air	ERC	Release factor before on site RMM: 2.5% Release factor after on site RMM: 2.5% Local release rate: $1\text{E}4$ kg/day
Non agricultural soil	ERC	Release factor after on site RMM: 0.01%

9.2.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.23. Exposure concentrations and risks for the environment and man via the environment



Protection target	Exposure concentration	Risk quantification
Man via environment - Inhalation (local effects)	Concentration in air: 2.285 mg/m ³	RCR = 0.914

9.2.2. Worker CS 2: Chemical production in closed process without likelihood of exposure or in containment conditions. (PROC 1)

9.2.2.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 % <i>Covers percentage substance in the product up to 100 %</i>	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day <i>Covers daily exposures up to 8 hours</i>	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

9.2.2.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.24. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.01 mg/m ³ (TRA Workers)	RCR < 0.01
Inhalation, local, acute	0.04 mg/m ³ (TRA Workers)	RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.2.3. Worker CS 3: Chemical production in closed continuous process with

**occasional controlled exposure. (PROC 2)****9.2.3.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.2.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.25. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.5 mg/m ³ (TRA Workers)	RCR = 0.1
Inhalation, local, acute	2 mg/m ³ (TRA Workers)	RCR = 0.2

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.2.4. Worker CS 4: Formulation in closed batch processes with occasional controlled exposure. (PROC 3)**9.2.4.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0



	Method
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: ≤ 40 °C	TRA Workers 3.0

9.2.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.26. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1 mg/m ³ (TRA Workers)	RCR = 0.2
Inhalation, local, acute	4 mg/m ³ (TRA Workers)	RCR = 0.4

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.2.5. Worker CS 5: Chemical production where opportunity for exposure arises (PROC 4)

9.2.5.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0



	Method
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure. Alternatively, good general ventilation with a minimum of 5-10 air changes per air can be applied.</i>	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.2.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.27. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.2.6. Worker CS 6: Mixing or blending in batch processes (PROC 5)

9.2.6.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: $\leq 8\text{ h/day}$	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0



	Method
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure. Alternatively, good general ventilation with a minimum of 5-10 air changes per air can be applied.</i>	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.2.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.28. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.2.7. Worker CS 7: Transfer of a substance or mixture during process sampling at dedicated facilities (PROC 8b, PROC 26)

9.2.7.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: $\leq 8\text{ h/day}$	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	



	Method
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.2.7.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.29. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.7 mg/m ³ (TRA Workers)	RCR = 0.14
Inhalation, local, acute	2.8 mg/m ³ (TRA Workers)	RCR = 0.28

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.2.8. Worker CS 8: Transfer of a substance or mixture during process sampling at non-dedicated facilities (PROC 8a, PROC 26)

9.2.8.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: $\leq 1\text{ h/day}$	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure. Alternatively, good general ventilation with a minimum of 5-10 air changes per air can be applied.</i>	TRA Workers 3.0
• Face/eye protection: No	



	Method
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.2.8.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.30. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.1 mg/m ³ (TRA Workers)	RCR = 0.02
Inhalation, local, acute	2 mg/m ³ (TRA Workers)	RCR = 0.2

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.2.9. Worker CS 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9, PROC 26)

9.2.9.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: $\leq 8\text{ h/day}$	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure. Alternatively, good general ventilation with a minimum of 5-10 air changes per air can be applied.</i>	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0



	Method
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40^{\circ}\text{C}$	TRA Workers 3.0

9.2.9.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.31. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.2.10. Worker CS 10: Use as laboratory reagent (PROC 15, PROC 26)

9.2.10.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40^{\circ}\text{C}$	TRA Workers 3.0



9.2.10.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.32. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.5 mg/m ³ (TRA Workers)	RCR = 0.1
Inhalation, local, acute	2 mg/m ³ (TRA Workers)	RCR = 0.2

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.2.11. Worker CS 11: Tableting, compression, extrusion, pelettisation, granulation (PROC 14)

9.2.11.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

9.2.11.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.33. Exposure concentrations and risks for workers



Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1 mg/m ³ (TRA Workers)	RCR = 0.2
Inhalation, local, acute	4 mg/m ³ (TRA Workers)	RCR = 0.4

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.2.12. Worker CS 12: Transfer of substance or mixture (charging/discharging) at non dedicated-facilities (PROC 8a, PROC 26)

9.2.12.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure. Alternatively, good general ventilation with a minimum of 5-10 air changes per air can be applied.</i>	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: ≤ 40 °C	TRA Workers 3.0

9.2.12.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.34. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07



Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.2.13. Worker CS 13: Transfer of substance or mixture (charging/discharging) at dedicated-facilities (PROC 8b, PROC 26)

9.2.13.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: ≤ 40 °C	TRA Workers 3.0

9.2.13.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.35. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.7 mg/m ³ (TRA Workers)	RCR = 0.14
Inhalation, local, acute	2.8 mg/m ³ (TRA Workers)	RCR = 0.28

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

**Risk characterisation**

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.2.14. Worker CS 14: Equipment cleaning and maintenance at non-dedicated facility (PROC 8a, PROC 28)

9.2.14.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Local exhaust ventilation: No	TRA Workers 3.0
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Handle within closed system: Handle substance within a closed system [ES47] Drain down and flush system prior to equipment break-in or maintenance [E55] Transfer via enclosed lines [E52] <i>Applying this measure typically results in an exposure reduction of 80%. Please note however, that this is not taken into account in the exposure assessment as presented here.</i>	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF >= 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure. Alternatively, good general ventilation with a minimum of 5-10 air changes per air can be applied.</i>	TRA Workers 3.0
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

9.2.14.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.36. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.5 mg/m ³ (TRA Workers)	RCR = 0.1
Inhalation, local, acute	2 mg/m ³ (TRA Workers)	RCR = 0.2

Remarks on exposure dataset obtained with ECETOC TRA



The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.
Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.2.15. Worker CS 15: Manual maintenance (cleaning and repair) of machinery (PROC 28)

This PROC can be covered by PROC8a.

9.2.15.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	PROC 8a estimate used to cover PROC 28 ECETOC TRA 3.1
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	PROC 8a estimate used to cover PROC 28 ECETOC TRA 3.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	PROC 8a estimate used to cover PROC 28 ECETOC TRA 3.1
Technical and organisational conditions and measures	
• Local exhaust ventilation: No	PROC 8a estimate used to cover PROC 28 ECETOC TRA 3.1
• Room ventilation: Basic (up to 3 ACH)	PROC 8a estimate used to cover PROC 28 ECETOC TRA 3.1
• Handle within closed system: Handle substance within a closed system [ES47] Drain down and flush system prior to equipment break-in or maintenance [E55] Transfer via enclosed lines [E52] <i>Applying this measure typically results in an exposure reduction of 80%. Please note however, that this is not taken into account in the exposure assessment as presented here.</i>	
• Occupational Health and Safety Management System: Advanced	PROC 8a estimate used to cover PROC 28 ECETOC TRA 3.1
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF >= 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure. Alternatively, good general ventilation with a minimum of 5-10 air changes per air can be applied.</i>	PROC 8a estimate used to cover PROC 28 ECETOC TRA 3.1
• Face/eye protection: No	



	Method
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	PROC 8a estimate used to cover PROC 28 ECETOC TRA 3.1
• Operating temperature: $\leq 40^{\circ}\text{C}$	PROC 8a estimate used to cover PROC 28 ECETOC TRA 3.1

9.2.15.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.37. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.5 mg/m ³ (PROC 8a estimate used to cover PROC 28 ECETOC TRA 3.1)	RCR = 0.1
Inhalation, local, acute	2 mg/m ³ (PROC 8a estimate used to cover PROC 28 ECETOC TRA 3.1)	RCR = 0.2

Remarks on exposure data from external estimation tools:

PROC 8a estimate used to cover PROC 28 ECETOC TRA 3.1:

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.



9.3. Exposure scenario 3: Use at industrial sites - Use at industrial site (e.g. Industrial Indoor use as Chemical Intermediate and Process aid, Industrial Outdoor use)

Sector of use: SU 1: Agriculture, forestry, fishery; SU 2a: Mining (without offshore industries); SU 2b: Offshore industries; SU 4: Manufacture of food products; SU 5: Manufacture of textiles, leather, fur; SU 6b: Manufacture of pulp, paper and paper products; SU 8: Manufacture of bulk, large scale chemicals (including petroleum products); SU 9: Manufacture of fine chemicals; SU 11: Manufacture of rubber products; SU 12: Manufacture of plastics products, including compounding and conversion; SU 13: Manufacture of other non-metallic mineral products, e.g. plasters, cement; SU 14: Manufacture of basic metals, including alloys; SU 15: Manufacture of fabricated metal products, except machinery and equipment; SU 16: Manufacture of computer, electronic and optical products, electrical equipment; SU 17: General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment.

Environment contributing scenario(s):		
CS 1	Use of non-reactive processing aid at industrial site (no inclusion into or onto article)	ERC 4
CS 2	Use as an intermediate	ERC 6a
Worker contributing scenario(s):		
CS 3	Chemical production in closed process without likelihood of exposure or in containment conditions or processes with equivalent containment conditions	PROC 1
CS 4	Chemical production in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions	PROC 2
CS 5	Manufacture or formulation in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	PROC 3
CS 6	Chemical production where opportunity for exposure arises	PROC 4
CS 7	Mixing or blending in batch processes	PROC 5
CS 8	Calendering operations	PROC 6
CS 9	Indoor use; Industrial spraying; Solid in solution	PROC 7
CS 10	Outdoor use; Industrial spraying	PROC 7
CS 11	Outdoor use; Industrial spraying	PROC 7
CS 12	Transfer of a substance or mixture during process sampling at non-dedicated facilities with a local exhaust ventilation	PROC 8a, PROC 26
CS 13	Transfer of a substance or mixture during process sampling at non-dedicated facilities without a local exhaust ventilation	PROC 8a, PROC 26
CS 14	Transfer of a substance or mixture during process sampling at dedicated facilities with a local exhaust ventilation	PROC 8b, PROC 26
CS 15	Transfer of a substance or mixture during process sampling at dedicated facilities without a local exhaust ventilation	PROC 8b, PROC 26
CS 16	Transfer of substance or mixture (charging/discharging) at non-dedicated facilities with a local exhaust ventilation.	PROC 8a, PROC 26
CS 17	Transfer of substance or mixture (charging/discharging) at non-dedicated facilities without a local exhaust ventilation.	PROC 8a, PROC 26
CS 18	Transfer of substance or mixture (charging/discharging) at dedicated facilities with a local exhaust ventilation.	PROC 8b, PROC 26
CS 19	Transfer of substance or mixture (charging/discharging) at dedicated facilities without a local exhaust ventilation.	PROC 8b, PROC 26
CS 20	Equipment cleaning and maintenance at non-dedicated facility	PROC 8a, PROC 28



CS 21	Transfer of substance or mixture into small containers (dedicated filling line, including weighing) at facilities with a local exhaust ventilation	PROC 9, PROC 26, PROC 27b
CS 22	Transfer of substance or mixture into small containers (dedicated filling line, including weighing) at facilities without a local exhaust ventilation	PROC 9, PROC 26
CS 23	Roller application or brushing	PROC 10
CS 24	Treatment of articles by dipping and pouring	PROC 13
CS 25	Tabletting, compression, extrusion, pelettisation, granulation	PROC 14
CS 26	Use as laboratory reagent	PROC 15, PROC 26, PROC 27b
CS 27	Manufacturing and processing of minerals and/or metals at substantially elevated temperature	PROC 22, PROC 27a
CS 28	Open processing and transfer operations at substantially elevated temperature	PROC 23, PROC 27a
CS 29	Manual maintenance (cleaning and repair) of machinery at non-dedicated facilities	PROC 28

Further description of the use:

Calcium Chloride can be used for different industrial applications. Within this industrial scenario, 3 applications are specifically covered: use as intermediate, use as processing aid and industrial outdoor use. This is however a non-exhaustive list and other industrial uses can be covered within this use of the operational conditions are applicable as described here.

1) Use of Calcium Chloride as chemical intermediate. This means that Calcium Chloride is consumed in or used for chemical processing in order to be transformed into another substance(s). This use includes recycling/recovery, material transfers, storage, maintenance and loading (including marine vessel/barge, road/rail car and bulk container), sampling and associated laboratory activities.

2) Use of Calcium Chloride as processing aid. This means Calcium Chloride, or products containing Calcium Chloride are used upon manufacturing without becoming part of the product or without being consumed/transformed to be part of the product. This relates for example to the use as a process chemical or extraction agent and included includes recycling/recovery, material transfers, storage, maintenance and loading (including marine vessel/barge, road/rail car and bulk container), sampling and associated laboratory activities. For example, functions as adsorbent, coagulant, emulsion breaker, alginates, extraction agent, completion fluid, heat transfer fluid, water treatment chemical, industrial dehumidification or use within paper industry for example as antistatic apply to this use.

3) Industrial outdoor use of Calcium Chloride. This covers the end use of Calcium Chloride either pure or in formulation by spreading, spraying and pouring, including storage, materials transfers, mixing, loading and maintenance. For example, the use of dust suppression - and de-icing/anti-freeze mixtures is relevant for this use.

Explanation on the approach taken for the ES:

Calcium Chloride is frequently used for industrial uses (Chemical intermediate, Processing aid and industrial outdoor use).

For the human health assessment the following applies:

Worker exposure to Calcium Chloride was assessed by ECETOC TRA v3.1, taking into account reasonable worst case assumptions (unless explicitly described otherwise in the contributing scenario e.g. in the case outdoor industrial use):

- The setting is industrial and indoors.
- The dustiness category 'medium' was used for all contributing scenarios.
- The concentration Calcium Chloride a worker can be exposed to is set at 100% for all contributing scenarios.

Besides being used as a solid, Calcium Chloride is frequently used in industry and by professional in (aqueous) solutions.



With regard to the use of the substance in liquid form, this is considered covered by the assessment of the exposure based on the 'medium dustiness' assessment. This for the following reason. The settings within ECETOC TRA 3.1 for assessing exposure to a liquid are identical to those in which the solid form of the substance is used. The only thing requiring modification in the case of medium dustiness solid vs liquid is the state of the substance. Based on the physico-chemical properties of the substance 'low fugacity' would be normally selected. However, within Chesar it is not possible to select the parameter 'low fugacity' for assessment of a liquid when the 'original' product is a solid. Chesar automatically selects 'high fugacity' for liquid products. As a result, running ECETOC within Chesar with the default settings results in unrealistic and overconservative exposure estimates, especially as the vapour pressure of the substance is very low (< 0.05 Pa). As a consequence, the exposure has been estimated based on the saturated vapour concentrations taking into account a vapour pressure of 0.05 Pa (25°C). This approach is already conservative as the vapour pressure of 0.05 Pa was determined at elevated temperature. Based on ECETOC guidance, this is fully acceptable as long as it can be assured that activities do not regard spraying activities or activities where aerosols are generated. It is also required activities take place at ambient temperature. Hence the saturated vapour pressure method can be applied except for those exposure scenarios where solutions are sprayed, as in those cases an alternative (more traditional, but higher tier) assessment is to be applied.

For the environmental assessment the following applies:

Normally no environmental assessment is required as no PNECs could be derived on the basis of the available ecotoxicity information. If this is the case, the substance is regarded as not associated with hazardous properties and no exposure/risk assessment is required (ECHA Guidance B, Hazard assessment).

However, although, no environmental risk assessment is triggered based on the absence of PNECs, an environmental assessment for this scenario outdoor industrial scenario (ERC4) was performed as it specifically regards outdoor use and threshold for deposition was derived allowing to evaluate the risks associated with deposition of the substance on plants. This scenario is applicable both to the industrial and professional outdoor use of the substance. Below the key elements of the assessment, the full description can be found in the scenario for professional outdoor use.

Section 2.2	Control of environmental exposure
Product characteristics	Substance is a unique structure. Inorganic substance.
Operational conditions	Outdoor use.
Contributing scenario	De-icing agent, application as a mixture of 70% NaCl and 30% of a 20% solution of CaCl₂
Amounts used	
Annual tonnage of road salt	1.5 tonnes/km
Fraction of CaCl ₂ in road salt	0.06
Annual tonnage of CaCl ₂	0.09 tonnes/km
Frequency and duration of use	
Type of release	Dispersive use.
Emission Days (days/year):	25
Environmental factors not influenced by risk management	
Spreading width (m):	10
Other Operational Conditions of use affecting environmental exposure	Use in open systems.
Release fraction to air from process (initial release prior to RMM):	0
Release fraction to wastewater from process (release after RMMs are applied):	0
Release fraction to soil from process (initial release prior to RMM):	1
Conditions and measures related to municipal	Not applicable as there is no release to wastewater.



sewage treatment plant	
Other environmental control measures additional to above	Avoid spilling salt directly onto plants.
Contributing scenario	De-icing agent, application as liquid CaCl₂ brine (max. 35 % solution)
Amounts used	
Annual tonnage of road salt	0.8 tonnes/km
Fraction of CaCl ₂ in road salt	0.35
Annual tonnage of CaCl ₂	0.28 tonnes/km
Frequency and duration of use	
Type of release	Dispersive use.
Emission Days (days/year):	25
Environmental factors not influenced by risk management	
Spreading width (m):	10
Other Operational Conditions of use affecting environmental exposure	Use in open systems.
Release fraction to air from process (initial release prior to RMM):	0
Release fraction to wastewater from process (release after RMMs are applied):	0
Release fraction to soil from process (initial release prior to RMM):	1
Conditions and measures related to municipal sewage treatment plant	Not applicable as there is no release to wastewater.
Other environmental control measures additional to above	Avoid spilling salt directly onto plants.
Contributing scenario	De-icing agent, application as solid CaCl₂ (up to 100 %)
Amounts used	
Annual tonnage of road salt	0.25 tonnes/km
Fraction of CaCl ₂ in road salt	1
Annual tonnage of CaCl ₂	0.25 tonnes/km
Frequency and duration of use	
Type of release	Dispersive use.
Emission Days (days/year):	25
Environmental factors not influenced by risk management	
Spreading width (m):	10
Other Operational Conditions of use affecting environmental exposure	Use in open systems.
Release fraction to air from process (initial release prior to RMM):	0
Release fraction to wastewater from process (release after RMMs are applied):	0
Release fraction to soil from process (initial release prior to RMM):	1
Conditions and measures related to municipal sewage treatment plant	Not applicable as there is no release to wastewater.



Other environmental control measures additional to above	Avoid spilling salt directly onto plants.
Contributing scenario	Dust suppressor, application as solid CaCl₂ (up to 80 %)
Amounts used	
Annual tonnage of road salt	3 tonnes/km
Fraction of CaCl ₂ in road salt	0.8
Annual tonnage of CaCl ₂	2.4 tonnes/km
Frequency and duration of use	
Type of release	Dispersive use.
Emission Days (days/year):	3
Environmental factors not influenced by risk management	
Spreading width (m):	10
Other Operational Conditions of use affecting environmental exposure	Use in open systems.
Release fraction to air from process (initial release prior to RMM):	0
Release fraction to wastewater from process (release after RMMs are applied):	0
Release fraction to soil from process (initial release prior to RMM):	1
Conditions and measures related to municipal sewage treatment plant	Not applicable as there is no release to wastewater.
Other environmental control measures additional to above	Avoid spilling salt directly onto plants.
Contributing scenario	Dust suppressor, application as CaCl₂ solution (up to 37 %)
Amounts used	
Annual tonnage of road salt	3 tonnes/km
Fraction of CaCl ₂ in road salt	0.37
Annual tonnage of CaCl ₂	1.11 tonnes/km
Frequency and duration of use	
Type of release	Dispersive use.
Emission Days (days/year):	3
Environmental factors not influenced by risk management	
Spreading width (m)/	10
Other Operational Conditions of use affecting environmental exposure	Use in open systems.
Release fraction to air from process (initial release prior to RMM) [OOC4]:	0
Release fraction to wastewater from process (release after RMMs are applied):	0
Release fraction to soil from process (initial release prior to RMM) [OOC6]:	1
Conditions and measures related to municipal sewage treatment plant	Not applicable as there is no release to wastewater.
Other environmental control measures additional	Avoid spilling salt directly onto plants.



to above

9.3.1. Env CS 1: Use of non-reactive processing aid at industrial site (no inclusion into or onto article) (ERC 4)

9.3.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: ≤ 666.6 tonnes/day <i>based on 300 emission days</i>
• Annual use amount at site: $\leq 2E5$ tonnes/year
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 0.139%]
• Discharge rate of STP: $\geq 2E3$ m ³ /day
• Application of the STP sludge on agricultural soil: Yes
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations
Other conditions affecting environmental exposure
• Receiving surface water flow rate: $\geq 1.8E4$ m ³ /day

9.3.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.38. Local releases to the environment

Release	Release estimation method	Explanations
Water	ERC	Release factor before on site RMM: 100% Release factor after on site RMM: 100% Local release rate: 6.67E5 kg/day
Air	Estimated release factor (estimated release factor)	Release factor before on site RMM: 0.5% Release factor after on site RMM: 0.5% Local release rate: 3.33E3 kg/day Explanation: According to the APPENDIX A.16-1: ENVIRONMENTAL RELEASE CATEGORIES of the Guidance “R.16: Environmental exposure assessment Version 3.0 – February 2016”, process aids substances, represented by ERC 4, are 100 % emitted via air or water without a proper release abatement or waste treatment. Further, it states that “default release factors for industrial use of processing aids have been derived from the release factor tables for industrial use of processing aids (processing). For air, the release factor is set at 100%, for instance, to represent the use of propellants in aerosol cans. For water, the release factor is also set a 100% for instance for the use of cleaning and washing agents and surface-active agents in all kinds of cleaning products. The release of these types of chemicals is assumed to be complete to either air or water”. Calcium chloride as inorganic substance is represented by no to a negligible vapour pressure, it is highly soluble in water and



Release	Release estimation method	Explanations
		<p>the EUSES model for the biological STP shows that >99% of the substance is directed to water.</p> <p>Hence, taking in account the ERC 4 default setting and the phys-chem proprieties and fate of the substance, it is unlikely that the release of the substance will be to air.</p> <p>For example, the A.I.S.E. association developed a spERC applicable to few of the uses covered by this exposure scenario. This spERC for ERC4, AISE SPERC 4.1.v2, covering substances in a broad range of specific applications (e.g. surface cleaning, surface treatment, metal treatment, surface finishing, corrosion inhibition, vehicle cleaning, industrial laundry etc.) a 0% release factor to air is applied as there is no direct release to air due to their negligible volatilization.</p> <p>Nevertheless, as for this exposure scenario no actual measured data are available, a release factor to air of 0.5 % for ERC 4, in accordance with the release factor to air of the manufacturing process, has been applied in this risk assessment. This is believed to be a conservative approach, hence justified.</p> <p>In case, additional data would become available in the future however, this factor can be further refined.</p>
Non agricultural soil	ERC	Release factor after on site RMM: 5%

9.3.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.39. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Man via environment - Inhalation (local effects)	Concentration in air: 0.762 mg/m ³	RCR = 0.305

9.3.2. Env CS 2: Use as an intermediate (ERC 6a)

9.3.2.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily use amount at site: <= 200 tonnes/day <i>based on 300 emission days</i>
• Annual use amount at site: <= 6E4 tonnes/year
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 0.139%]
• Discharge rate of STP: >= 2E3 m ³ /day
• Application of the STP sludge on agricultural soil: Yes
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations
Other conditions affecting environmental exposure
• Receiving surface water flow rate: >= 1.8E4 m ³ /day

9.3.2.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not



account for the removal in the modelled biological STP.

Table 9.40. Local releases to the environment

Release	Release estimation method	Explanations
Water	ERC	Release factor before on site RMM: 2% Release factor after on site RMM: 2% Local release rate: 4E3 kg/day
Air	ERC	Release factor before on site RMM: 5% Release factor after on site RMM: 5% Local release rate: 1E4 kg/day
Non agricultural soil	ERC	Release factor after on site RMM: 0.1%

9.3.2.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.41. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Man via environment - Inhalation (local effects)	Concentration in air: 2.285 mg/m ³	RCR = 0.914

9.3.3. Worker CS 3: Chemical production in closed process without likelihood of exposure or in containment conditions or processes with equivalent containment conditions (PROC 1)

9.3.3.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0



9.3.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.42. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.01 mg/m ³ (TRA Workers)	RCR < 0.01
Inhalation, local, acute	0.04 mg/m ³ (TRA Workers)	RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.3.4. Worker CS 4: Chemical production in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC 2)

9.3.4.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

9.3.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.43. Exposure concentrations and risks for workers



Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.5 mg/m ³ (TRA Workers)	RCR = 0.1
Inhalation, local, acute	2 mg/m ³ (TRA Workers)	RCR = 0.2

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.3.5. Worker CS 5: Manufacture or formulation in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC 3)

9.3.5.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

9.3.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.44. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1 mg/m ³ (TRA Workers)	RCR = 0.2
Inhalation, local, acute	4 mg/m ³ (TRA Workers)	RCR = 0.4

**Remarks on exposure dataset obtained with ECETOC TRA**

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.
Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.3.6. Worker CS 6: Chemical production where opportunity for exposure arises (PROC 4)

9.3.6.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: Yes, specifically designed fixed capturing hood, on tool extraction or enclosing hoods (assumed effectiveness >= 90-95%)	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

9.3.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.45. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.
Local exhaust ventilation effectiveness used by TRA: inhalation 90 %

Risk characterisation

Qualitative risk characterisation (Eye, local):



Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.3.7. Worker CS 7: Mixing or blending in batch processes (PROC 5)

9.3.7.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF >= 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure.</i>	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

9.3.7.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.46. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.3.8. Worker CS 8: Calendering operations (PROC 6)

9.3.8.1. Conditions of use



	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure. Alternatively, good general ventilation with a minimum of 5-10 air changes per air can be applied.</i>	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40^\circ\text{C}$	TRA Workers 3.0

9.3.8.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.47. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.3.9. Worker CS 9: Indoor use; Industrial spraying; Solid in solution (PROC 7)

Applicable to:

- Indoor spraying use without a LEV

9.3.9.1. Conditions of use



	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 35\%$	ART 1.5
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Physical form of the product is assumed as liquid, this is conservative as it is a solid in a liquid with a very low vapour pressure.</i>	ART 1.5
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 2 h/day	ART 1.5
Technical and organisational conditions and measures	
• Local exhaust ventilation: Yes, enclosing hood with very high effectiveness such as fume cupboard (assumed effectiveness $\geq 95\%$) <i>Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings [E60].</i>	ART 1.5
• Application rate for spray applications of liquids: $> 0.3 - 3$ L/minute (moderate application rate)	ART 1.5
• Room ventilation: Basic (up to 3 ACH)	ART 1.5
• Spray direction for surface spraying of liquids: Only horizontal or downward spraying	ART 1.5
• Occupational Health and Safety Management System: Advanced	ART 1.5
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	ART 1.5
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	ART 1.5
• Operating temperature: $\leq 40^\circ\text{C}$	ART 1.5

9.3.9.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.48. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1.2 mg/m ³ (ART 1.5)	RCR = 0.24
Inhalation, local, acute	9.6 mg/m ³ (ART 1.5)	RCR = 0.96

Remarks on exposure data from external estimation tools:

ART 1.5:

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.3.10. Worker CS 10: Outdoor use; Industrial spraying (PROC 7)

Applicable to:

- Outdoor industrial use (0.25 hr/near field/mask APF 20)

**9.3.10.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 35\%$	ART 1.5
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Physical form of the product is assumed as liquid, this is conservative as it is a solid in a liquid with a very low vapour pressure.</i>	ART 1.5
Amount used (or contained in articles), frequency and duration of use/exposure	
• Exposure duration (near field): ≤ 0.25 hrs	ART 1.5
• Duration of activity: ≤ 0.25 h/day	ART 1.5
Technical and organisational conditions and measures	
• Spray technique for surface spraying of liquids: Spraying with high compressed air use	ART 1.5
• Local exhaust ventilation: No	ART 1.5
• Application rate for spray applications of liquids: > 3 L/minute (high application rate)	ART 1.5
• Room ventilation: Basic (up to 3 ACH)	ART 1.5
• Spray direction for surface spraying of liquids: Spraying in any direction (including upwards)	ART 1.5
• Occupational Health and Safety Management System: Advanced	ART 1.5
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 20) <i>Covers spraying activity wearing respiratory protection with minimum efficiency of 95% (i.e. APF of 20)</i>	ART 1.5
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	ART 1.5
• Operating temperature: ≤ 40 °C	ART 1.5

9.3.10.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.49. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1.2 mg/m ³ (ART 1.5)	RCR = 0.24
Inhalation, local, acute	9.6 mg/m ³ (ART 1.5)	RCR = 0.96

Remarks on exposure data from external estimation tools:**ART 1.5:**

Explanation:

90th percentile of ART long term exposure estimation for this scenario are 24 mg/m³. Workers wear for the duration of exposure a respiratory protection mask with APF 20, thus a reduction factor of 95% was applied to ART estimation.

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)

Risk characterisation

Qualitative risk characterisation (Eye, local):



Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.3.11. Worker CS 11: Outdoor use; Industrial spraying (PROC 7)

Applicable to:

- Outdoor industrial use (2hr/far field/partial enclosure/downward+horizontal)

9.3.11.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 35 %	ART 1.5
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Physical form of the product is assumed as liquid, this is conservative as it is a solid in a liquid with a very low vapour pressure.</i>	ART 1.5
Amount used (or contained in articles), frequency and duration of use/exposure	
• Exposure duration (far field): <= 2 hrs	
• Duration of activity: <= 2 h/day	ART 1.5
Technical and organisational conditions and measures	
• Spray technique for surface spraying of liquids: Spraying with high compressed air use	ART 1.5
• Local exhaust ventilation: No	ART 1.5
• Application rate for spray applications of liquids: > 3 L/minute (high application rate)	ART 1.5
• Room ventilation: Basic (up to 3 ACH)	ART 1.5
• Spray direction for surface spraying of liquids: Only horizontal or downward spraying	ART 1.5
• Occupational Health and Safety Management System: Advanced	ART 1.5
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	ART 1.5
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	ART 1.5
• Personal Enclosure: Partial personal enclosure without ventilation	
• Operating temperature: <= 40 °C	ART 1.5

9.3.11.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.50. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1.2 mg/m ³ (ART 1.5)	RCR = 0.24
Inhalation, local, acute	9.6 mg/m ³ (ART 1.5)	RCR = 0.96

Remarks on exposure data from external estimation tools:

ART 1.5:

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)

**Risk characterisation**

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.3.12. Worker CS 12: Transfer of a substance or mixture during process sampling at non-dedicated facilities with a local exhaust ventilation (PROC 8a, PROC 26)

Applicable to:

Situation WITH local exhaust ventilation

9.3.12.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 1 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: Yes, specifically designed fixed capturing hood, on tool extraction or enclosing hoods (assumed effectiveness >= 90-95%)	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

9.3.12.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.51. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.1 mg/m ³ (TRA Workers)	RCR = 0.02
Inhalation, local, acute	2 mg/m ³ (TRA Workers)	RCR = 0.2

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 90 %

Risk characterisation

Qualitative risk characterisation (Eye, local):



Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.3.13. Worker CS 13: Transfer of a substance or mixture during process sampling at non-dedicated facilities without a local exhaust ventilation (PROC 8a, PROC 26)

Applicable to:

Situation WITHOUT local exhaust ventilation

9.3.13.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 1 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF >= 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure. Alternatively, good general ventilation with a minimum of 5-10 air changes per air can be applied.</i>	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

9.3.13.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.52. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.1 mg/m ³ (TRA Workers)	RCR = 0.02
Inhalation, local, acute	2 mg/m ³ (TRA Workers)	RCR = 0.2

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):



Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.3.14. Worker CS 14: Transfer of a substance or mixture during process sampling at dedicated facilities with a local exhaust ventilation (PROC 8b, PROC 26)

Applicable to:

Situation WITH local exhaust ventilation

9.3.14.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: Yes, enclosing hood with very high effectiveness such as fume cupboard (assumed effectiveness >= 95%)	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

9.3.14.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.53. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.05 mg/m ³ (TRA Workers)	RCR = 0.01
Inhalation, local, acute	0.2 mg/m ³ (TRA Workers)	RCR = 0.02

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 95 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.



9.3.15. Worker CS 15: Transfer of a substance or mixture during process sampling at dedicated facilities without a local exhaust ventilation (PROC 8b, PROC 26)

Applicable to:
Situation WITHOUT local exhaust ventilation

9.3.15.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor <i>Covers also outdoor uses</i>	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.3.15.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.54. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1 mg/m ³ (TRA Workers)	RCR = 0.2
Inhalation, local, acute	4 mg/m ³ (TRA Workers)	RCR = 0.4

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.
Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.3.16. Worker CS 16: Transfer of substance or mixture



(charging/discharging) at non-dedicated facilities with a local exhaust ventilation. (PROC 8a, PROC 26)

Applicable to:
Use WITH local exhaust ventilation.

9.3.16.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: Yes, specifically designed fixed capturing hood, on tool extraction or enclosing hoods (assumed effectiveness $\geq 90-95\%$)	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.3.16.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.55. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.
Local exhaust ventilation effectiveness used by TRA: inhalation 90 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.3.17. Worker CS 17: Transfer of substance or mixture (charging/discharging) at non-dedicated facilities without a local exhaust

**ventilation. (PROC 8a, PROC 26)**

Applicable to:

Use WITHOUT local exhaust ventilation.

9.3.17.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure. Alternatively, indoor good general ventilation with a minimum of 5-10 air changes per air can be applied.</i>	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor <i>Covers also outdoor use</i>	TRA Workers 3.0
• Operating temperature: $\leq 40^\circ\text{C}$	TRA Workers 3.0

9.3.17.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.56. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.**9.3.18. Worker CS 18: Transfer of substance or mixture**



(charging/discharging) at dedicated facilities with a local exhaust ventilation. (PROC 8b, PROC 26)

Applicable to:

Use WITH local exhaust ventilation.

9.3.18.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: Yes, enclosing hood with very high effectiveness such as fume cupboard (assumed effectiveness $\geq 95\%$)	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.3.18.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.57. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.035 mg/m ³ (TRA Workers)	RCR < 0.01
Inhalation, local, acute	0.14 mg/m ³ (TRA Workers)	RCR = 0.014

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 95 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.3.19. Worker CS 19: Transfer of substance or mixture (charging/discharging) at dedicated facilities without a local exhaust

**ventilation. (PROC 8b, PROC 26)**

Applicable to:

Use WITHOUT local exhaust ventilation.

9.3.19.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor <i>Covers also outdoor use</i>	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.3.19.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.58. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.7 mg/m ³ (TRA Workers)	RCR = 0.14
Inhalation, local, acute	2.8 mg/m ³ (TRA Workers)	RCR = 0.28

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.3.20. Worker CS 20: Equipment cleaning and maintenance at non-dedicated facility (PROC 8a, PROC 28)**9.3.20.1. Conditions of use**



	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Local exhaust ventilation: Yes, specifically designed fixed capturing hood, on tool extraction or enclosing hoods (assumed effectiveness $\geq 90-95\%$) <i>Covers also absence of LEV system</i>	TRA Workers 3.0
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Handle within closed system: Handle substance within a closed system [ES47] Drain down and flush system prior to equipment break-in or maintenance [E55] Transfer via enclosed lines [E52] <i>Applying this measure typically results in an exposure reduction of 80%. Please note however, that this is not taken into account in the exposure assessment as presented here.</i>	
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40^\circ\text{C}$	TRA Workers 3.0

9.3.20.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.59. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.5 mg/m ³ (TRA Workers)	RCR = 0.1
Inhalation, local, acute	2 mg/m ³ (TRA Workers)	RCR = 0.2

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 90 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.3.21. Worker CS 21: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) at facilities with a



local exhaust ventilation (PROC 9, PROC 26, PROC 27b)

Applicable to:

Use WITH local exhaust ventilation.

9.3.21.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: Yes, specifically designed fixed capturing hood, on tool extraction or enclosing hoods (assumed effectiveness $\geq 90-95\%$)	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.3.21.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.60. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 90 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.3.22. Worker CS 22: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) at facilities without a local exhaust ventilation (PROC 9, PROC 26)



Applicable to:
Use WITHOUT local exhaust ventilation.

9.3.22.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure. Alternatively, good general ventilation with a minimum of 5-10 air changes per air can be applied.</i>	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40^\circ\text{C}$	TRA Workers 3.0

9.3.22.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.61. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.5 mg/m ³ (TRA Workers)	RCR = 0.1
Inhalation, local, acute	2 mg/m ³ (TRA Workers)	RCR = 0.2

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.
Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.3.23. Worker CS 23: Roller application or brushing (PROC 10)

9.3.23.1. Conditions of use



	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure. Alternatively, good general ventilation with a minimum of 5-10 air changes per air can be applied.</i>	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.3.23.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.62. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.3.24. Worker CS 24: Treatment of articles by dipping and pouring (PROC 13)

9.3.24.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0



	Method
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: ≤ 40 °C	TRA Workers 3.0

9.3.24.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.63. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1 mg/m ³ (TRA Workers)	RCR = 0.2
Inhalation, local, acute	4 mg/m ³ (TRA Workers)	RCR = 0.4

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.3.25. Worker CS 25: Tableting, compression, extrusion, pelettisation, granulation (PROC 14)

9.3.25.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0



	Method
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40^{\circ}\text{C}$	TRA Workers 3.0

9.3.25.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.64. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1 mg/m ³ (TRA Workers)	RCR = 0.2
Inhalation, local, acute	4 mg/m ³ (TRA Workers)	RCR = 0.4

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.3.26. Worker CS 26: Use as laboratory reagent (PROC 15, PROC 26, PROC 27b)

9.3.26.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0



	Method
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.3.26.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.65. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.5 mg/m ³ (TRA Workers)	RCR = 0.1
Inhalation, local, acute	2 mg/m ³ (TRA Workers)	RCR = 0.2

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.3.27. Worker CS 27: Manufacturing and processing of minerals and/or metals at substantially elevated temperature (PROC 22, PROC 27a)

9.3.27.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers use as a solid only.</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: $\leq 8\text{ h/day}$	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: Yes, specifically designed fixed capturing hood, on tool extraction or enclosing hoods (assumed effectiveness $\geq 90\text{-}95\%$)	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	



	Method
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 200\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.3.27.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.66. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.1 mg/m ³ (TRA Workers)	RCR = 0.02
Inhalation, local, acute	0.4 mg/m ³ (TRA Workers)	RCR = 0.04

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (200°C) used for the calculation is 1E4 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 90 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.3.28. Worker CS 28: Open processing and transfer operations at substantially elevated temperature (PROC 23, PROC 27a)

9.3.28.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers use as a solid only.</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: $\leq 8\text{ h/day}$	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Advanced	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	



	Method
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 200\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.3.28.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.67. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1 mg/m ³ (TRA Workers)	RCR = 0.2
Inhalation, local, acute	4 mg/m ³ (TRA Workers)	RCR = 0.4

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (200°C) used for the calculation is 1E4 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.3.29. Worker CS 29: Manual maintenance (cleaning and repair) of machinery at non-dedicated facilities (PROC 28)

This PROC can be covered by PROC8a.

9.3.29.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: $\leq 8\text{ h/day}$	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28
Technical and organisational conditions and measures	
• Local exhaust ventilation: No <i>Covers also absence of LEV system</i>	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28
• Room ventilation: Basic (up to 3 ACH)	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28
• Handle within closed system: Handle substance within a closed system [ES47] Drain	ECETOC TRA



	Method
down and flush system prior to equipment break-in or maintenance [E55] Transfer via enclosed lines [E52] <i>Applying this measure typically results in an exposure reduction of 80%. Please note however, that this is not taken into account in the exposure assessment as presented here.</i>	Workers PROC 8a estimate used to cover PROC 28
• Occupational Health and Safety Management System: Advanced	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28
• Operating temperature: ≤ 40 °C	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28

9.3.29.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.68. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.5 mg/m ³ (ECETOC TRA Workers PROC 8a estimate used to cover PROC 28)	RCR = 0.1
Inhalation, local, acute	2 mg/m ³ (ECETOC TRA Workers PROC 8a estimate used to cover PROC 28)	RCR = 0.2

Remarks on exposure data from external estimation tools:

ECETOC TRA Workers PROC 8a estimate used to cover PROC 28:

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.



9.4. Exposure scenario 4: Widespread use by professional workers - Professional use; Indoor use

Sector of use: SU 0: Other; SU 1: Agriculture, forestry, fishery; SU 13: Manufacture of other non-metallic mineral products, e.g. plasters, cement; SU 19: Building and construction work; SU 20: Health services

Environment contributing scenario(s):		
CS 1	Indoor use; Professional use	ERC 8a
Worker contributing scenario(s):		
CS 2	Chemical production in closed process without likelihood of exposure or in containment conditions or processes with equivalent containment conditions	PROC 1
CS 3	Chemical production in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions	PROC 2
CS 4	Manufacture or formulation in closed batch processes with occasional controlled exposure or processes with equivalent containment condition	PROC 3
CS 5	Chemical production where opportunity for exposure arises	PROC 4
CS 6	Mixing or blending in batch processes	PROC 5
CS 7	Transfer of substance or mixture (charging/discharging) at non-dedicated facilities	PROC 8a , PROC 26
CS 8	Transfer of substance or mixture (charging/discharging) at dedicated facilities	PROC 8b , PROC 26
CS 9	Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	PROC 9 , PROC 26
CS 10	Roller application or brushing	PROC 10
CS 11	Indoor use; Non-industrial spraying; Solid in solution	PROC 11
CS 12	Use as laboratory reagent	PROC 15 , PROC 26
CS 13	Manual activities involving hand contact	PROC 19
CS 14	Use of functional fluids in small devices	PROC 20
CS 15	Equipment cleaning and maintenance at non-dedicated facility	PROC 8a , PROC 28
CS 16	Manual maintenance (cleaning and repair) of machinery at non-dedicated facility	PROC 28

Further description of the use:

Professional indoor use of Calcium Chloride. Covers the end use of Calcium Chloride either pure or in formulation including pouring/unloading from drums or containers; and exposures during mixing/diluting in the preparatory phase and by spraying, brushing, dipping, wiping automated and by hand. For example, the use of, washing and cleaning products or use as heat transfer fluid.

Explanation on the approach taken for the ES:

Calcium Chloride and Calcium Chloride containing products are frequently used by professionals for example by using washing and cleaning product containing Calcium Chloride.

Worker exposure to Calcium Chloride was assessed by ECETOC TRA v3.1 by taking into account following reasonable worst case assumptions:

- The setting is professional and indoors.
- The dustiness category 'medium' was used for all contributing scenarios.
- The concentration Calcium Chloride a worker can be exposed to is set at 100% for all contributing scenarios.

Besides being used as a solid, Calcium Chloride is frequently used in industry and by professional in (aqueous) solutions.

With regard to the use of the substance in liquid form, this is considered covered by the assessment of the



exposure based on the 'medium dustiness' assessment. This for the following reason. The settings within ECETOC TRA 3.1 for assessing exposure to a liquid are identical to those in which the solid form of the substance is used. The only thing requiring modification in the case of medium dustiness solid vs liquid is the state of the substance. Based on the physico-chemical properties of the substance 'low fugacity' would be normally selected. However, within Chesar it is not possible to select the parameter 'low fugacity' for assessment of a liquid when the 'original' product is a solid. Chesar automatically selects 'high fugacity' for liquid products. As a result, running ECETOC within Chesar with the default settings results in unrealistic and overconservative exposure estimates, especially as the vapour pressure of the substance is very low (< 0.05 Pa). As a consequence, the exposure has been estimated based on the saturated vapour concentrations taking into account a vapour pressure of 0.05 Pa (25°C). This approach is already conservative as the vapour pressure of 0.05 Pa was determined at elevated temperature. Based on ECETOC guidance, this is fully acceptable as long as it can be assured that activities do not regard spraying activities or activities where aerosols are generated. It is also required activities take place at ambient temperature. Hence the saturated vapour pressure method can be applied except for those exposure scenarios where solutions are sprayed, as in those cases an alternative (more traditional, but higher tier) assessment is to be applied.

9.4.1. Env CS 1: Indoor use; Professional use (ERC 8a)

9.4.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: ≤ 0.083 tonnes/day
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 0.139%]
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations

9.4.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.69. Local releases to the environment

Release	Release estimation method	Explanations
Water	ERC	Release factor before on site RMM: 100% Release factor after on site RMM: 100% Local release rate: 82.5 kg/day
Air	ERC	Release factor before on site RMM: 100% Release factor after on site RMM: 100%
Non agricultural soil	ERC	Release factor after on site RMM: 0%

9.4.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.70. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Man via environment - Inhalation (local effects)	Concentration in air: $1.52\text{E-}12$ mg/m ³	RCR < 0.01

9.4.2. Worker CS 2: Chemical production in closed process without likelihood of exposure or in containment conditions or processes with equivalent containment conditions (PROC 1)

**9.4.2.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$ <i>Covers percentage substance in the product up to 100 %</i>	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day <i>Covers daily exposures up to 8 hours</i>	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.4.2.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.71. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.01 mg/m ³ (TRA Workers)	RCR < 0.01
Inhalation, local, acute	0.04 mg/m ³ (TRA Workers)	RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.4.3. Worker CS 3: Chemical production in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC 2)**9.4.3.1. Conditions of use**



	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.4.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.72. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1 mg/m ³ (TRA Workers)	RCR = 0.2
Inhalation, local, acute	4 mg/m ³ (TRA Workers)	RCR = 0.4

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.4.4. Worker CS 4: Manufacture or formulation in closed batch processes with occasional controlled exposure or processes with equivalent containment condition (PROC 3)

9.4.4.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness)	TRA Workers 3.0



	Method
<i>Covers also liquid form. See "overview on uses" for more details</i>	
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: ≤ 40 °C	TRA Workers 3.0

9.4.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.73. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.7 mg/m ³ (TRA Workers)	RCR = 0.14
Inhalation, local, acute	2.8 mg/m ³ (TRA Workers)	RCR = 0.28

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.4.5. Worker CS 5: Chemical production where opportunity for exposure arises (PROC 4)

9.4.5.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	



	Method
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: Yes, specifically designed LEV such as receiving hoods (assumed effectiveness $\geq 80-90\%$)	TRA Workers 3.0
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.4.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.74. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.7 mg/m ³ (TRA Workers)	RCR = 0.14
Inhalation, local, acute	2.8 mg/m ³ (TRA Workers)	RCR = 0.28

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 80 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.4.6. Worker CS 6: Mixing or blending in batch processes (PROC 5)

9.4.6.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: $\leq 8\text{ h/day}$	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: Yes, specifically designed LEV such as receiving hoods (assumed effectiveness $\geq 80-90\%$)	TRA Workers 3.0
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	



	Method
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.4.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.75. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.7 mg/m ³ (TRA Workers)	RCR = 0.14
Inhalation, local, acute	2.8 mg/m ³ (TRA Workers)	RCR = 0.28

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 80 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.4.7. Worker CS 7: Transfer of substance or mixture (charging/discharging) at non-dedicated facilities (PROC 8a, PROC 26)

9.4.7.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: $\leq 8\text{ h/day}$	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: Yes, specifically designed LEV such as receiving hoods (assumed effectiveness $\geq 80\text{-}90\%$)	TRA Workers 3.0
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0



	Method
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40^{\circ}\text{C}$	TRA Workers 3.0

9.4.7.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.76. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1.4 mg/m ³ (TRA Workers)	RCR = 0.28
Inhalation, local, acute	5.6 mg/m ³ (TRA Workers)	RCR = 0.56

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 80 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.4.8. Worker CS 8: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC 8b, PROC 26)

9.4.8.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: Yes, specifically designed LEV such as receiving hoods (assumed effectiveness $\geq 80\text{-}90\%$)	TRA Workers 3.0
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0



	Method
• Operating temperature: $\leq 40^{\circ}\text{C}$	TRA Workers 3.0

9.4.8.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.77. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.7 mg/m ³ (TRA Workers)	RCR = 0.14
Inhalation, local, acute	2.8 mg/m ³ (TRA Workers)	RCR = 0.28

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 80 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.4.9. Worker CS 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9, PROC 26)

Transport

9.4.9.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: Yes, specifically designed LEV such as receiving hoods (assumed effectiveness $\geq 80-90\%$)	TRA Workers 3.0
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40^{\circ}\text{C}$	TRA Workers 3.0



9.4.9.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.78. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.7 mg/m ³ (TRA Workers)	RCR = 0.14
Inhalation, local, acute	2.8 mg/m ³ (TRA Workers)	RCR = 0.28

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 80 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.4.10. Worker CS 10: Roller application or brushing (PROC 10)

9.4.10.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: Yes, specifically designed fixed capturing hood, on tool extraction or enclosing hoods (assumed effectiveness ≥ 90-95%)	TRA Workers 3.0
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: ≤ 40 °C	TRA Workers 3.0

9.4.10.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.79. Exposure concentrations and risks for workers



Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.7 mg/m ³ (TRA Workers)	RCR = 0.14
Inhalation, local, acute	2.8 mg/m ³ (TRA Workers)	RCR = 0.28

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 80 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.4.11. Worker CS 11: Indoor use; Non-industrial spraying; Solid in solution (PROC 11)

Applicable to:

- Professional indoor spraying use

9.4.11.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 35 %	ART 1.5
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Physical form of the product is assumed as liquid, this is conservative as it is a solid in a liquid with a very low vapour pressure.</i>	ART 1.5
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 2 h/day	ART 1.5
Technical and organisational conditions and measures	
• Local exhaust ventilation: Yes, specifically designed LEV such as receiving hoods (assumed effectiveness ≥ 80-90%) <i>Minimise exposure by partial enclosure of the operation or equipment and provide extract ventilation at openings [E60].</i>	ART 1.5
• Application rate for spray applications of liquids: > 0.3 - 3 L/minute (moderate application rate)	ART 1.5
• Room ventilation: Basic (up to 3 ACH)	ART 1.5
• Spray direction for surface spraying of liquids: Only horizontal or downward spraying	ART 1.5
• Occupational Health and Safety Management System: Basic	ART 1.5
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	ART 1.5
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	ART 1.5
• Operating temperature: ≤ 40 °C	ART 1.5

9.4.11.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.80. Exposure concentrations and risks for workers



Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1.2 mg/m ³ (ART 1.5)	RCR = 0.24
Inhalation, local, acute	9.6 mg/m ³ (ART 1.5)	RCR = 0.96

Remarks on exposure data from external estimation tools:**ART 1.5:**Additional conditions of use related to the exposure estimate:

- Dermal protection: Yes (effectiveness $\geq 80\%$)

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.4.12. Worker CS 12: Use as laboratory reagent (PROC 15, PROC 26)**9.4.12.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: ≤ 40 °C	TRA Workers 3.0

9.4.12.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.81. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA



The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.
Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.4.13. Worker CS 13: Manual activities involving hand contact (PROC 19)

9.4.13.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Local exhaust ventilation: Yes, specifically designed LEV such as receiving hoods (assumed effectiveness >= 80-90%)	TRA Workers 3.0
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

9.4.13.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.82. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.7 mg/m ³ (TRA Workers)	RCR = 0.14
Inhalation, local, acute	2.8 mg/m ³ (TRA Workers)	RCR = 0.28

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.
Local exhaust ventilation effectiveness used by TRA: inhalation 80 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all



situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.4.14. Worker CS 14: Use of functional fluids in small devices (PROC 20)

9.4.14.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	TRA Workers 3.0
• Local exhaust ventilation: No	TRA Workers 3.0
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

9.4.14.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.83. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1 mg/m ³ (TRA Workers)	RCR = 0.2
Inhalation, local, acute	4 mg/m ³ (TRA Workers)	RCR = 0.4

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.4.15. Worker CS 15: Equipment cleaning and maintenance at non-dedicated facility (PROC 8a, PROC 28)

9.4.15.1. Conditions of use



	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Local exhaust ventilation: No	TRA Workers 3.0
• Room ventilation: Good (3 to 5 ACH)	TRA Workers 3.0
• Handle within closed system: Handle substance within a closed system [ES47] Drain down and flush system prior to equipment break-in or maintenance [E55] Transfer via enclosed lines [E52] <i>Applying this measure typically results in an exposure reduction of 80%. Please note however, that this is not taken into account in the exposure assessment as presented here.</i>	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure. Alternatively, good general ventilation with a minimum of 5-10 air changes per air can be applied.</i>	TRA Workers 3.0
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	TRA Workers 3.0
• Operating temperature: $\leq 40^\circ\text{C}$	TRA Workers 3.0

9.4.15.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.84. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.7 mg/m ³ (TRA Workers)	RCR = 0.14
Inhalation, local, acute	2.8 mg/m ³ (TRA Workers)	RCR = 0.28

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation 0 %

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.4.16. Worker CS 16: Manual maintenance (cleaning and repair) of machinery at non-dedicated facility (PROC 28)



This PROC can be covered by PROC8a.

9.4.16.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28
Technical and organisational conditions and measures	
• Local exhaust ventilation: No <i>Covers also absence of LEV system</i>	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28
• Room ventilation: Basic (up to 3 ACH)	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28
• Handle within closed system: Handle substance within a closed system [ES47] Drain down and flush system prior to equipment break-in or maintenance [E55] Transfer via enclosed lines [E52] <i>Applying this measure typically results in an exposure reduction of 80%. Please note however, that this is not taken into account in the exposure assessment as presented here.</i>	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28
• Occupational Health and Safety Management System: Basic	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Indoor	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	ECETOC TRA Workers PROC 8a estimate used to cover PROC 28



9.4.16.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.85. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.7 mg/m ³ (ECETOC TRA Workers PROC 8a estimate used to cover PROC 28)	RCR = 0.14
Inhalation, local, acute	2.8 mg/m ³ (ECETOC TRA Workers PROC 8a estimate used to cover PROC 28)	RCR = 0.28

Remarks on exposure data from external estimation tools:

ECETOC TRA Workers PROC 8a estimate used to cover PROC 28:

Additional conditions of use related to the exposure estimate:

- Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness \geq 90%)

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.



9.5. Exposure scenario 5: Widespread use by professional workers - Professional use; Outdoor use

Sector of use: SU 0: Other; SU 1: Agriculture, forestry, fishery; SU 5: Manufacture of textiles, leather, fur; SU 13: Manufacture of other non-metallic mineral products, e.g. plasters, cement; SU 19: Building and construction work; SU 20: Health services

Environment contributing scenario(s):		
CS 1	Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)	ERC 8d
Worker contributing scenario(s):		
CS 2	Chemical production in closed process without likelihood of exposure or in containment conditions.	PROC 1
CS 3	Chemical production in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions	PROC 2
CS 4	Manufacture or formulation in closed batch processes with occasional controlled exposure or processes with equivalent containment conditions	PROC 3
CS 5	Chemical production where opportunity for exposure arises	PROC 4
CS 6	Mixing or blending in batch processes	PROC 5
CS 7	Transfer of substance or mixture (charging/discharging) at non-dedicated facilities	PROC 8a , PROC 26
CS 8	Transfer of substance or mixture (charging/discharging) at dedicated facilities	PROC 8b , PROC 26
CS 9	Transfer of substance or mixture into small containers (dedicated filling line, including weighing)	PROC 9 , PROC 26
CS 10	Roller application or brushing	PROC 10
CS 11	Outdoor use; Non-industrial spraying	PROC 11
CS 12	Outdoor use; Non-industrial spraying	PROC 11
CS 13	Use as laboratory reagent	PROC 15 , PROC 26
CS 14	Mixing operations; Manual activities involving hand contact	PROC 19
CS 15	Equipment cleaning and maintenance at non-dedicated facility	PROC 8a
CS 16	Use of functional fluids in small devices	PROC 20

Further description of the use:

Professional outdoor use of Calcium Chloride. Covers the end use of Calcium chloride either pure or in formulation including pouring/unloading from drums or containers; and exposures during mixing/diluting in the preparatory phase and by spraying, brushing, dipping, spreading automated and by hand. Including storage, equipment clean-downs and disposal. For example, the use of agrochemicals, dust suppression- and de-icing-mixtures and the use of cement.

Explanation on the approach taken for the ES:

For the human health assessment the following applies:

Calcium Chloride is frequently used by professional outdoors for example as de-icing/anti-freeze or for dust binding, either pure or formulations.

Worker exposure to Calcium Chloride was assessed by ECETOC TRA v3.1 by taking into account following reasonable worst case assumptions:

- The setting is professional and outdoors.
- The dustiness category 'medium' was used for all contributing scenarios.
- The concentration Calcium Chloride a worker can be exposed to is set at 100% for all contributing scenarios.

Besides being used as a solid, Calcium Chloride is frequently used in industry and by professional in

**(aqueous) solutions.**

With regard to the use of the substance in liquid form, this is considered covered by the assessment of the exposure based on the 'medium dustiness' assessment. This for the following reason. The settings within ECETOC TRA 3.1 for assessing exposure to a liquid are identical to those in which the solid form of the substance is used. The only thing requiring modification in the case of medium dustiness solid vs liquid is the state of the substance. Based on the physico-chemical properties of the substance 'low fugacity' would be normally selected. However, within Chesar it is not possible to select the parameter 'low fugacity' for assessment of a liquid when the 'original' product is a solid. Chesar automatically selects 'high fugacity' for liquid products. As a result, running ECETOC within Chesar with the default settings results in unrealistic and overconservative exposure estimates, especially as the vapour pressure of the substance is very low (< 0.05 Pa). As a consequence, the exposure has been estimated based on the saturated vapour concentrations taking into account a vapour pressure of 0.05 Pa (25°C). This approach is already conservative as the vapour pressure of 0.05 Pa was determined at elevated temperature. Based on ECETOC guidance, this is fully acceptable as long as it can be assured that activities do not regard spraying activities or activities where aerosols are generated. It is also required activities take place at ambient temperature. Hence the saturated vapour pressure method can be applied except for those exposure scenarios where solutions are sprayed, as in those cases an alternative (more traditional, but higher tier) assessment is to be applied.

For the environmental assessment the following applies:

Normally no environmental assessment is required as no PNECs could be derived on the basis of the available ecotoxicity information. If this is the case, the substance is regarded as not associated with hazardous properties and no exposure/risk assessment is required (ECHA Guidance B, Hazard assessment).

Although no environmental risk assessment is triggered based on the absence of PNECs, an environmental assessment for this scenario was performed as it specifically regards **outdoor use** and there is a threshold value for deposition which was derived allowing to evaluate the risk associated with **deposition of the substance on plants**. This scenario is applicable both to the industrial and professional outdoor use of the substance.

Calcium chloride is used both as a de-icing agent all over Europe and as a de-dusting agent, which is a typical use for the Northern European countries.

Calcium chloride is applied on roads as a de-icing agent in three different forms:

- 1) Together with NaCl, in a ratio of 70% NaCl and 30% CaCl_2
- 2) In the form of liquid calcium chloride brine
- 3) As solid calcium chloride

Calcium chloride is applied on road as a dust suppressor in two different forms:

- 1) As solid calcium chloride
- 2) As liquid calcium chloride

Environmental releases:

Road salts are directly sprayed on roads; therefore the main exposure route is the terrestrial compartment. An assessment for the other compartments is not performed as it is assumed that when control of risk is demonstrated for the terrestrial compartment all other routes are covered as well, especially as the substance is not to be considered hazardous to the aquatic compartment.

De-icing agent, application as 70% NaCl and 30% CaCl_2 solution

The typical application of CaCl_2 is together with NaCl, in a ratio of 70% NaCl and 30% CaCl_2 . The CaCl_2 is in a solution of 20%, resulting in 6% CaCl_2 in road salts. On average 1.5 tons per km is used per winter season (in 25 spreadings). Road salt is usually spread over a width of 10 m. This equals a total deposition volume of road salt of 150 g/m^2 per season, equalling 9.0 g/m^2 of CaCl_2 per season (see Table below).

However, in high traffic areas it is expected that road salt is quickly removed to the sides of the road. Assuming that the road salt is spread over a width of 1 m from each side of the road, a 5 times higher concentration can be anticipated resulting in a deposition volume of 45 g/m^2 per season. This equals a dissolved salt concentration of 64.3 mg/L taking into account an annual precipitation of 700 mm (EUSES v2.1, 2008). The default fraction of water in soil is 0.2 (EUSES v2.1, 2008), which results in a soil concentration of 12.9 mg/kg season (see Table below).

De-icing agent, application as liquid calcium chloride brine (max. 35% solution)

CaCl_2 30-35 % is sometimes used without NaCl. Liquid calcium chloride brine with a 30-35 % CaCl_2 concentration is sprayed directly onto the road surface. A maximum of 0.8 tons per km may be used per winter season (in 25 spreadings). Road salt is usually spread over a width of 10 m. This equals a total deposition volume of road salt of 8 g/m^2 per season, equaling a maximum of 28 g/m^2 of CaCl_2 per season (see Table below).

However, in high traffic areas it is expected that road salt is quickly removed to the sides of the road. Assuming



that the road salt is spread over a width of 1 m from each side of the road, a 5 times higher concentration can be anticipated resulting in a deposition volume of 140 g/m² per season. This equals a dissolved salt concentration of 200 mg/L taking into account an annual precipitation of 700 mm (EUSES v2.1, 2008). The default fraction of water in soil is 0.2 (EUSES v2.1, 2008), which results in a soil concentration of 40 mg/kg season (see Table below).

De-icing agent, application as solid calcium chloride (up to 100%)

Direct spreading of solid (77-100 % CaCl₂) is also sometimes used although on limited areas. A maximum of 0.25 tons per km may be used per winter season (in 25 spreadings). Road salt is usually spread over a width of 10 m. This equals a total deposition volume of road salt of 25 g/m² per season, equalling a maximum of 25 g/m² of CaCl₂ per season (see Table below).

However, in high traffic areas it is expected that road salt is quickly removed to the sides of the road. Assuming that the road salt is spread over a width of 1 m from each side of the road, a 5 times higher concentration can be anticipated resulting in a deposition volume of 125 g/m² per season. This equals a dissolved salt concentration of 179 mg/L taking into account an annual precipitation of 700 mm (EUSES v2.1, 2008). The default fraction of water in soil is 0.2 (EUSES v2.1, 2008), which results in a soil concentration of 35.7 mg/kg season (see Table below).

Dust suppressor, application as solid calcium chloride (up to 80%)

During spring and summer time typically 3 times per season CaCl₂ prills or flakes are spread in quantities of 1 ton per km per spreading, in order to bind dust on dirt roads. The calcium chloride is typically spread on a 4 meter wide road and it can be assumed that calcium chloride is deposited to an area of 10 m besides each side of the road. This equals a deposition volume of dust suppressor of 125 g/m². Dust suppressor contains 80% calcium chloride, equalling a depositing volume of 100 g/m² per season (see Table below). This equals a dissolved salt concentration of 143 mg/L taking an annual precipitation of 700 mm (EUSES v2.1, 2008) into account. The default fraction of water in soil is 0.2 (EUSES v2.1, 2008), which results in a soil concentration of 28.6 mg/kg season (see Table below).

Dust suppressor, application as calcium chloride solution (up to 37%)

CaCl₂ is sometimes also spread as a 35 to 37% solution in quantities of 1 ton per km per spreading, in order to bind dust on dirt roads. Liquid dust suppressor is usually spread over a width of 10 m. This equals a deposition volume of dust suppressor of 300 g/m², equalling a maximum of 111 g/m² of CaCl₂ per season (see Table below). This equals a dissolved salt concentration of 159 mg/L taking into account an annual precipitation of 700 mm (EUSES v2.1, 2008). The default fraction of water in soil is 0.2 (EUSES v2.1, 2008), which results in a soil concentration of 32 mg/kg season (see Table below).

Section 2.2	Control of environmental exposure
Product characteristics	Substance is a unique structure.
Inorganic substance.	
Operational conditions	Outdoor use.
Contributing scenario	De-icing agent, application as a mixture of 70% NaCl and 30% of a 20% solution of CaCl₂
Amounts used	
Annual tonnage of road salt	1.5 tonnes/km
Fraction of CaCl ₂ in road salt	0.06
Annual tonnage of CaCl ₂	0.09 tonnes/km
Frequency and duration of use	



Type of release	Dispersive use.
Emission Days (days/year):	25
Environmental factors not influenced by risk management	
Spreading width (m):	10
Other Operational Conditions of use affecting environmental exposure	Use in open systems.
Release fraction to air from process (initial release prior to RMM):	0
Release fraction to wastewater from process (release after RMMs are applied):	0
Release fraction to soil from process (initial release prior to RMM):	1
Conditions and measures related to municipal sewage treatment plant	Not applicable as there is no release to wastewater.
Other environmental control measures additional to above	Avoid spilling salt directly onto plants.
Contributing scenario	De-icing agent, application as liquid CaCl₂ brine (max. 35% solution)
Amounts used	
Annual tonnage of road salt	0.8 tonnes/km
Fraction of CaCl ₂ in road salt	0.35
Annual tonnage of CaCl ₂	0.28 tonnes/km
Frequency and duration of use	
Type of release	Dispersive use.
Emission Days (days/year) [FD4]:	25
Environmental factors not influenced by risk management	
Spreading width (m):	10
Other Operational Conditions of use affecting environmental exposure	Use in open systems.



Release fraction to air from process (initial release prior to RMM) [OOC4]:	0
Release fraction to wastewater from process (release after RMMs are applied):	0
Release fraction to soil from process (initial release prior to RMM) [OOC6]:	1
Conditions and measures related to municipal sewage treatment plant	Not applicable as there is no release to wastewater.
Other environmental control measures additional to above	Avoid spilling salt directly onto plants.
Contributing scenario	De-icing agent, application as solid CaCl₂ (up to 100%)
Amounts used	
Annual tonnage of road salt	0.25 tonnes/km
Fraction of CaCl ₂ in road salt	1
Annual tonnage of CaCl ₂	0.25 tonnes/km
Frequency and duration of use	
Type of release	Dispersive use.
Emission Days (days/year) [FD4]:	25
Environmental factors not influenced by risk management	
Spreading width (m):	10
Other Operational Conditions of use affecting environmental exposure	Use in open systems.
Release fraction to air from process (initial release prior to RMM) [OOC4]:	0
Release fraction to wastewater from process (release after RMMs are applied):	0
Release fraction to soil from process (initial release prior to RMM) [OOC6]:	1
Conditions and measures related to municipal sewage treatment plant	Not applicable as there is no release to wastewater.
Other environmental control measures additional	Avoid spilling salt directly onto plants.



to above	
Contributing scenario	Dust suppressor, application as solid CaCl₂ (up to 80 %)
Amounts used	
Annual tonnage of road salt	3 tonnes/km
Fraction of CaCl ₂ in road salt	0.8
Annual tonnage of CaCl ₂	2.4 tonnes/km
Frequency and duration of use	
Type of release	Dispersive use.
Emission Days (days/year) [FD4]:	3
Environmental factors not influenced by risk management	
Spreading width (m):	10
Other Operational Conditions of use affecting environmental exposure	Use in open systems.
Release fraction to air from process (initial release prior to RMM) [OOC4]:	0
Release fraction to wastewater from process (release after RMMs are applied):	0
Release fraction to soil from process (initial release prior to RMM) [OOC6]:	1
Conditions and measures related to municipal sewage treatment plant	Not applicable as there is no release to wastewater.
Other environmental control measures additional to above	Avoid spilling salt directly onto plants.
Contributing scenario	Dust suppressor, application as CaCl₂ solution (up to 37 %)
Amounts used	
Annual tonnage of road salt	3 tonnes/km
Fraction of CaCl ₂ in road salt	0.37
Annual tonnage of CaCl ₂	1.11 tonnes/km



Frequency and duration of use	
Type of release	Dispersive use.
Emission Days (days/year) [FD4]:	3
Environmental factors not influenced by risk management	
Spreading width (m):	10
Other Operational Conditions of use affecting environmental exposure	Use in open systems.
Release fraction to air from process (initial release prior to RMM) [OOC4]:	0
Release fraction to wastewater from process (release after RMMs are applied):	0
Release fraction to soil from process (initial release prior to RMM) [OOC6]:	1
Conditions and measures related to municipal sewage treatment plant	Not applicable as there is no release to wastewater.
Other environmental control measures additional to above	Avoid spilling salt directly onto plants.

Predicted deposition volumes onto soil and exposure concentrations in soil.

Use	Deposition volume (g/m ²)		Calcium chloride concentration in soil (mg/kg)
	Low-medium traffic areas	High traffic areas	
De-icing agent, application as 70% NaCl and 30% CaCl ₂ solution	9.0	45.0	12.9
De-icing agent, application as liquid calcium chloride brine (max. 35% solution)	28.0	140	40.0
De-icing agent, application as solid calcium chloride (up to 100%)	25.0	125	35.7
Dust suppressor, application as solid calcium chloride (up to 80%)	100	n.a.	28.6
Dust suppressor, application as calcium chloride solution (up to 37%)	111	n.a.	31.7

n.a. – not applicable

**Risk characterisation for environmental compartment:**

De-icing salts have been observed to accumulate in roadside vegetation and induce visible symptoms such as tip burn, browning and chlorosis of foliage (e.g. EPSO, 1984; Bogemans *et al.*, 1989; ECHC, 2001). Application of road salts may also cause deleterious effects on physico-chemical properties of soil such as soil dispersion, soil permeability, soil swelling and crusting and soil osmotic potential.

The Canadian assessment report, evaluating the impact of road salts to the environment for 5 years (1995-2000) under Canadian Environment Protection Act (ECHC, 2001), has concluded that excess amount of road salts consisting of inorganic chloride salts may be harmful to the environment.

Two vectors of salt injury in plants have been noted: direct spray of road melt, and soil/root uptake. Coniferous trees have been observed to display severe symptoms and seem to be affected most by de-icer salts, because, unlike deciduous trees, they retain their foliage during the winter and thus have more foliar surface area by which to receive salt spray (Bryson and Barker, 2002). Soil uptake injury symptoms are typically more dispersed throughout the tree (rather than being more severe on the side of the tree facing the road), and manifest in spring and summer when deciduous trees begin leafing (Button, 1964). Both vectors of salt injury manifest similar symptoms.

The primary cause of the damage to roadside plants is considered to be the accumulation of chloride in plant tissues to a toxic level by excess loading of inorganic chloride salts. The terrestrial toxicity data for calcium chloride reveal that the substance is less toxic than other road salts. In addition, there is a report that shows the uptake of chloride by plants is considerably inhibited in the presence of calcium chloride. The impact of calcium chloride on plants is expected to be minimal compared to other chloride containing agents.

The tables below present the risk characterisation for deposition of calcium chloride onto soil in low, medium and high traffic areas and the risk characterisation for the complete soil compartment.

Risk characterisation for deposition of calcium chloride onto soil in low to medium traffic areas.

Use	Deposition volume (g/m ²)	NEdep	RCR
De-icing agent, application as 70% NaCl and 30% CaCl ₂ solution	9	150	0.060
De-icing agent, application as liquid calcium chloride brine (max. 35% solution)	28.0	150	0.187
De-icing agent, application as solid calcium chloride (up to 100%)	25.0	150	0.167
Dust suppressor, application as solid calcium chloride (up to 80%)	100	150	0.667
Dust suppressor, application as calcium chloride solution (up to 37%)	111	150	0.740

Risk characterisation for deposition volumes onto soil in high traffic areas.

Use	Deposition volume (g/m ²)	NEdep	RCR
De-icing agent, application as 70% NaCl and 30% CaCl ₂ solution	45	150	0.300
De-icing agent, application as liquid calcium chloride brine (max. 35% solution)	140	150	0.933
De-icing agent, application	125	150	0.833



as solid calcium chloride (up to 100%)			
Dust suppressor, application as solid calcium chloride (up to 80%)	n.a.		
Dust suppressor, application as calcium chloride solution (up to 37%)	n.a.		

Risk characterisation for calcium chloride in soil.

Use	Calcium chloride concentration in soil (mg/kg)	Safe Cl- concentration CEPA (mg/kg)	RCR
De-icing agent, application as 70% NaCl and 30% CaCl ₂ solution	12.9	215	<0.060
De-icing agent, application as liquid calcium chloride brine (max. 35% solution)	42.5	215	<0.186
De-icing agent, application as solid calcium chloride (up to 100%)	42.9	215	<0.166
Dust suppressor, application as solid calcium chloride (up to 80%)	28.6	215	<0.133
Dust suppressor, application as calcium chloride solution (up to 37%)	31.7	215	<0.148

9.5.1. Env CS 1: Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor) (ERC 8d)

9.5.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 0.083 tonnes/day
Conditions and measures related to biological sewage treatment plant
• Biological STP: Standard [Effectiveness Water: 0.139%]
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations

9.5.1.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.86. Local releases to the environment



Release	Release estimation method	Explanations
Water	ERC	Release factor before on site RMM: 100% Release factor after on site RMM: 100% Local release rate: 82.5 kg/day
Air	ERC	Release factor before on site RMM: 100% Release factor after on site RMM: 100%
Non agricultural soil	ERC	Release factor after on site RMM: 20%

9.5.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.87. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Man via environment - Inhalation (local effects)	Concentration in air: 1.52E-12 mg/m ³	RCR < 0.01

9.5.2. Worker CS 2: Chemical production in closed process without likelihood of exposure or in containment conditions. (PROC 1)

9.5.2.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 % <i>Covers percentage substance in the product up to 100 %</i>	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day <i>Covers daily exposures up to 8 hours</i>	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

9.5.2.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

**Table 9.88. Exposure concentrations and risks for workers**

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	7E-3 mg/m ³ (TRA Workers)	RCR < 0.01
Inhalation, local, acute	0.028 mg/m ³ (TRA Workers)	RCR < 0.01

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.5.3. Worker CS 3: Chemical production in closed continuous process with occasional controlled exposure or processes with equivalent containment conditions (PROC 2)

9.5.3.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

9.5.3.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.89. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.7 mg/m ³ (TRA Workers)	RCR = 0.14



Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, acute	2.8 mg/m ³ (TRA Workers)	RCR = 0.28

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.5.4. Worker CS 4: Manufacture or formulation in closed batch processes with occasional controlled exposure or processes with equivalent containment conditions (PROC 3)

9.5.4.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

9.5.4.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.90. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.7 mg/m ³ (TRA Workers)	RCR = 0.14
Inhalation, local, acute	2.8 mg/m ³ (TRA Workers)	RCR = 0.28

Remarks on exposure dataset obtained with ECETOC TRA



The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.5.5. Worker CS 5: Chemical production where opportunity for exposure arises (PROC 4)

9.5.5.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF >= 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure.</i>	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

9.5.5.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.91. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation

Risk characterisation

Qualitative risk characterisation (Eye, local):



Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.5.6. Worker CS 6: Mixing or blending in batch processes (PROC 5)

9.5.6.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: <= 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF >= 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure.</i>	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness >= 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	TRA Workers 3.0
• Operating temperature: <= 40 °C	TRA Workers 3.0

9.5.6.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.92. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.5.7. Worker CS 7: Transfer of substance or mixture (charging/discharging) at non-dedicated facilities (PROC 8a, PROC 26)

**9.5.7.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure.</i>	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.5.7.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.93. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.7 mg/m ³ (TRA Workers)	RCR = 0.14
Inhalation, local, acute	2.8 mg/m ³ (TRA Workers)	RCR = 0.28

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.5.8. Worker CS 8: Transfer of substance or mixture (charging/discharging) at dedicated facilities (PROC 8b, PROC 26)**9.5.8.1. Conditions of use**

	Method
Product (article) characteristics	



	Method
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure.</i>	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.5.8.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.94. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.5.9. Worker CS 9: Transfer of substance or mixture into small containers (dedicated filling line, including weighing) (PROC 9, PROC 26)

Dum/batch transfer. Pouring from small containers. Transport.

9.5.9.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0



	Method
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure.</i>	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness ≥ 90%)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	TRA Workers 3.0
• Operating temperature: ≤ 40 °C	TRA Workers 3.0

9.5.9.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.95. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.5.10. Worker CS 10: Roller application or brushing (PROC 10)

9.5.10.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 %	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0



	Method
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure.</i>	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.5.10.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.96. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.5.11. Worker CS 11: Outdoor use; Non-industrial spraying (PROC 11)

Applicable to:

- Outdoor professional use (2hr/far field/partial enclosure/downward+horizontal)

9.5.11.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 35\%$	ART 1.5
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Physical form of the product is assumed as liquid, this is conservative as it is a solid in a liquid with a very low vapour pressure.</i>	ART 1.5
Amount used (or contained in articles), frequency and duration of use/exposure	
• Exposure duration (far field): ≤ 2 hrs	
• Duration of activity: ≤ 2 h/day	ART 1.5



	Method
Technical and organisational conditions and measures	
• Spray technique for surface spraying of liquids: Spraying with high compressed air use	ART 1.5
• Local exhaust ventilation: No	ART 1.5
• Application rate for spray applications of liquids: > 3 L/minute (high application rate)	ART 1.5
• Room ventilation: Basic (up to 3 ACH)	ART 1.5
• Spray direction for surface spraying of liquids: Only horizontal or downward spraying	ART 1.5
• Occupational Health and Safety Management System: Basic	ART 1.5
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	ART 1.5
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	ART 1.5
• Personal Enclosure: Partial personal enclosure without ventilation	
• Operating temperature: ≤ 40 °C	ART 1.5

9.5.11.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.97. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1.2 mg/m ³ (ART 1.5)	RCR = 0.24
Inhalation, local, acute	9.6 mg/m ³ (ART 1.5)	RCR = 0.96

Remarks on exposure data from external estimation tools:

ART 1.5:

Additional conditions of use related to the exposure estimate:

- Dermal protection: Yes (effectiveness ≥ 80%)

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.5.12. Worker CS 12: Outdoor use; Non-industrial spraying (PROC 11)

Applicable to:

- Outdoor professional use (0.25 hr/near field/mask APF 20)

9.5.12.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 35 %	ART 1.5
• Physical form of the used product: Liquid, including paste/slurry/suspension <i>Physical form of the product is assumed as liquid, this is conservative as it is a solid in a liquid with a very low vapour pressure.</i>	ART 1.5



	Method
Amount used (or contained in articles), frequency and duration of use/exposure	
• Exposure duration (near field): ≤ 0.25 hrs	ART 1.5
• Duration of activity: ≤ 0.25 h/day	ART 1.5
Technical and organisational conditions and measures	
• Spray technique for surface spraying of liquids: Spraying with high compressed air use	ART 1.5
• Local exhaust ventilation: No	ART 1.5
• Application rate for spray applications of liquids: > 3 L/minute (high application rate)	ART 1.5
• Room ventilation: Basic (up to 3 ACH)	ART 1.5
• Spray direction for surface spraying of liquids: Spraying in any direction (including upwards)	ART 1.5
• Occupational Health and Safety Management System: Basic	ART 1.5
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 20) <i>Covers spraying activity wearing respiratory protection with minimum efficiency of 95% (i.e. APF of 20)</i>	ART 1.5
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	ART 1.5
• Operating temperature: ≤ 40 °C	ART 1.5

9.5.12.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.98. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	1.2 mg/m ³ (ART 1.5)	RCR = 0.24
Inhalation, local, acute	9.6 mg/m ³ (ART 1.5)	RCR = 0.96

Remarks on exposure data from external estimation tools:

ART 1.5:

Explanation:

90th percentile of ART long term exposure estimation for this scenario are 24 mg/m³. Workers wear for the duration of exposure a respiratory protection mask with APF 20, thus a reduction factor of 95% was applied to ART estimation.

Additional conditions of use related to the exposure estimate:

- Dermal protection: Yes (effectiveness $\geq 80\%$)

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.5.13. Worker CS 13: Use as laboratory reagent (PROC 15, PROC 26)

9.5.13.1. Conditions of use



	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.5.13.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.99. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.5.14. Worker CS 14: Mixing operations; Manual activities involving hand contact (PROC 19)

9.5.14.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0



	Method
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure.</i>	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	TRA Workers 3.0
• Operating temperature: ≤ 40 °C	TRA Workers 3.0

9.5.14.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.100. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.35 mg/m ³ (TRA Workers)	RCR = 0.07
Inhalation, local, acute	1.4 mg/m ³ (TRA Workers)	RCR = 0.14

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.5.15. Worker CS 15: Equipment cleaning and maintenance at non-dedicated facility (PROC 8a)

9.5.15.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: ≤ 8 h/day	TRA Workers 3.0
Technical and organisational conditions and measures	



	Method
• Local exhaust ventilation: No	
• Room ventilation: Basic (up to 3 ACH)	
• Handle within closed system: Handle substance within a closed system [ES47] Drain down and flush system prior to equipment break-in or maintenance [E55] Transfer via enclosed lines [E52] <i>Applying this measure typically results in an exposure reduction of 80%. Please note however, that this is not taken into account in the exposure assessment as presented here.</i>	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: Yes (APF ≥ 10) <i>Respiratory protection is to be worn in those case where there is potential for peak exposure.</i>	TRA Workers 3.0
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Face/eye protection: No	
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.5.15.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.101. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.7 mg/m ³ (TRA Workers)	RCR = 0.14
Inhalation, local, acute	2.8 mg/m ³ (TRA Workers)	RCR = 0.28

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.5.16. Worker CS 16: Use of functional fluids in small devices (PROC 20)

9.5.16.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$	TRA Workers 3.0
• Physical form of the used product: Solid (material with medium dustiness) <i>Covers also liquid form. See "overview on uses" for more details</i>	TRA Workers 3.0
Amount used (or contained in articles), frequency and duration of use/exposure	
• Duration of activity: $\leq 8\text{ h/day}$	TRA Workers 3.0



	Method
Technical and organisational conditions and measures	
• Room ventilation: Basic (up to 3 ACH)	
• Local exhaust ventilation: No	
• Occupational Health and Safety Management System: Basic	TRA Workers 3.0
Conditions and measures related to personal protection, hygiene and health evaluation	
• Respiratory protection: No	TRA Workers 3.0
• Face/eye protection: No	
• Dermal protection: Chemical resistant dermal protection with basic employee training. (effectiveness $\geq 90\%$)	TRA Workers 3.0
• Eye Protection: [PPE26]: Use suitable eye protection	
Other conditions affecting workers exposure	
• Place of use: Outdoor	TRA Workers 3.0
• Operating temperature: $\leq 40\text{ }^{\circ}\text{C}$	TRA Workers 3.0

9.5.16.2. Exposure and risks for workers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.102. Exposure concentrations and risks for workers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.7 mg/m ³ (TRA Workers)	RCR = 0.14
Inhalation, local, acute	2.8 mg/m ³ (TRA Workers)	RCR = 0.28

Remarks on exposure dataset obtained with ECETOC TRA

The vapour pressure at operating temperature (40°C) used for the calculation is 1.67E-8 Pa.

Local exhaust ventilation effectiveness used by TRA: inhalation

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.



9.6. Exposure scenario 6: Consumer use - Consumer use; Indoor or outdoor use

Environment contributing scenario(s):		
CS 1	Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor)	ERC 8a
CS 2	Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor)	ERC 8d
Consumer contributing scenario(s):		
CS 3	Dust suppressant; No spraying	PC 0
CS 4	Dust suppressant; Spraying	PC 0
CS 5	Humidity adsorbents	PC 0
CS 6	Cement/concrete/mortar	PC 0
CS 7	Adsorbents	PC 2
CS 8	Anti-freeze and de-icing products; No spraying	PC 4
CS 9	Anti-freeze and de-icing products; Spraying	PC 4
CS 10	Fertilizers; No spraying	PC 12
CS 11	Fertilizers; Spraying	PC 12
CS 12	Heat transfer fluids	PC 16
CS 13	Plant protection products; No spraying	PC 27
CS 14	Plant protection products; Spraying	PC 27
CS 15	Water treatment chemicals	PC 37
CS 16	Washing and cleaning products; No spraying	PC 35
CS 17	Washing and cleaning products; Spraying	PC 35

Further description of the use:

Calcium Chloride and Calcium Chloride containing products are frequently used by consumers. For example as domestic dehumidifier, as anti-freeze/de-icer, for dust binding, in clays and putties, in cement, in agrochemical/fertilizers, in washing and cleaning agents and for water treatment (e.g. aquariums).

Explanation on the approach taken for the ES:

The consumer exposure was assessed by ConsExpo 4.1. Two reasonable worst case scenarios were assessed; one with the evaporation model and one with the spray can model.

Assessment with the evaporation model: PC2, PC4, PC9b, PC12 spreading and transfer, PC16, PC27 spreading and transfer, PC35, PC37 and PC0-UCN code K35100

Assessment with the spray can model: PC12 spraying, PC27 spraying

9.6.1. Env CS 1: Widespread use of non-reactive processing aid (no inclusion into or onto article, indoor) (ERC 8a)

9.6.1.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 0.11 tonnes/day
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations
Other conditions affecting environmental exposure
• Biological STP: Standard [Effectiveness Water: 0.139%]

9.6.1.2. Releases



The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.103. Local releases to the environment

Release	Release estimation method	Explanations
Water	ERC	Release factor before on site RMM: 100% Release factor after on site RMM: 100% Local release rate: 110 kg/day
Air	ERC	Release factor before on site RMM: 100% Release factor after on site RMM: 100%
Non agricultural soil	ERC	Release factor after on site RMM: 0%

9.6.1.3. Exposure and risks for the environment and man via the environment

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.104. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Man via environment - Inhalation (local effects)	Concentration in air: 1.52E-12 mg/m ³	RCR < 0.01

9.6.2. Env CS 2: Widespread use of non-reactive processing aid (no inclusion into or onto article, outdoor) (ERC 8d)

9.6.2.1. Conditions of use

Amount used, frequency and duration of use (or from service life)
• Daily local widespread use amount: <= 0.11 tonnes/day
Conditions and measures related to external treatment of waste (including article waste)
• Particular considerations on the waste treatment operations
Other conditions affecting environmental exposure
• Biological STP: Standard [Effectiveness Water: 0.139%]

9.6.2.2. Releases

The local releases to the environment are reported in the following table. Note that the releases reported do not account for the removal in the modelled biological STP.

Table 9.105. Local releases to the environment

Release	Release estimation method	Explanations
Water	ERC	Release factor before on site RMM: 100% Release factor after on site RMM: 100% Local release rate: 110 kg/day
Air	ERC	Release factor before on site RMM: 100% Release factor after on site RMM: 100%
Non agricultural soil	ERC	Release factor after on site RMM: 20%

9.6.2.3. Exposure and risks for the environment and man via the environment



The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table. The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 9.106. Exposure concentrations and risks for the environment and man via the environment

Protection target	Exposure concentration	Risk quantification
Man via environment - Inhalation (local effects)	Concentration in air: 1.52E-12 mg/m ³	RCR < 0.01

9.6.3. Cons CS 3: Dust suppressant; No spraying (PC 0)

Dust binding

9.6.3.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 % <i>up to saturation</i>	ConsExpo 4.1
• Physical form of the used product: Solid (medium dusty form) <i>Covers also liquid form. See "overview on uses" for more details</i>	ConsExpo 4.1
• Exposure via inhalation route: Yes	ConsExpo 4.1
• Spray: No <i>Mode of release: evaporation</i>	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Amount of product used per application: ≤ 5E4 g/event	ConsExpo 4.1
• Exposure time per event: = 24 h/event <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
• Frequency of use over a day: = 1 events per day <i>every day</i>	ConsExpo 4.1
• Application duration: ≤ 1.44E3 min <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
Information and behavioral advice for consumers	
• Inhalation rate: = 32.9 m ³ /day <i>Default ConsExpo light exercise- 60 kg. Average bw women, is reasonable worst cas</i>	ConsExpo 4.1
• Room volume: = 1 m ³ <i>Room volume of 1 m³ 'Room volume' is interpreted here as personal space: a small area of 1 m³ around the use</i>	ConsExpo 4.1
• Ventilation rate: = 0.6 ACH/hour <i>Minimum. Equals to indoor typical (ConsExpo General Factsheet (RIVM report 320104002/2006)-unspecified room</i>	ConsExpo 4.1
• Eye Protection: [E73]: Avoid direct eye contact with product, also via contamination on hands.	
• Mass transfer rate: = 3.54E3 m/min <i>Langmuir model- Reasonable worst case</i>	ConsExpo 4.1
• Uptake fraction model - Inhalation: 1 <i>Reasonable worst case</i>	ConsExpo 4.1
Other conditions affecting consumers exposure	
• Release area: ≤ 125 m ² <i>Reasonable worst-case (e.g. Agrochemical)</i>	ConsExpo 4.1
• Inhalation transfer factor: = 1	ConsExpo 4.1

9.6.3.2. Exposure and risks for consumers



The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.107. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	5E-3 mg/m ³ (ConsExpo 4.1)	RCR < 0.01
Inhalation, local, acute	0.01 mg/m ³ (ConsExpo 4.1)	RCR < 0.01

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.6.4. Cons CS 4: Dust suppressant; Spraying (PC 0)

CaCl₂ used for dust suppressant spraying activities

9.6.4.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 45 % <i>weight fraction compound</i>	ConsExpo 4.1
• Physical form of the used product: Liquid for spraying (spraying can)	ConsExpo 4.1
• Spray: Yes	ConsExpo 4.1
• Exposure via inhalation route: Yes	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Exposure time per event: = 24 h/event	ConsExpo 4.1
• Sprayed amount per time: ≤ 0.75 g/sec <i>Sprayed amount per time</i>	ConsExpo 4.1
• Frequency of use over a day: = 1 events per day <i>every day</i>	ConsExpo 4.1
• Duration of application: = 10 minutes	ConsExpo 4.1
Information and behavioral advice for consumers	
• Inhalation rate: = 32.9 m ³ /day <i>Default ConsExpo light exercise- 60 kg. Average bw women, is reasonable worst cas</i>	ConsExpo 4.1
• Room volume: = 58 m ³ <i>Covers use in room of 58 m³ with room height of 2.5m</i>	ConsExpo 4.1
• Ventilation rate: = 0.6 ACH/hour <i>Minimum. Equals to indoor typical (ConsExpo General Factsheet (RIVM report 320104002/2006)-unspecified room</i>	ConsExpo 4.1
• Eye Protection: [E73]: Avoid direct eye contact with product, also via contamination on hands.	
• Uptake fraction model - Inhalation: 1 <i>Reasonable worst case</i>	ConsExpo 4.1
Other conditions affecting consumers exposure	
• Inhalation transfer factor: = 1	ConsExpo 4.1

9.6.4.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.108. Exposure concentrations and risks for consumers



Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.687 mg/m ³ (ConsExpo 4.1)	RCR = 0.275
Inhalation, local, acute	0.69 mg/m ³ (ConsExpo 4.1)	RCR = 0.138

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.6.5. Cons CS 5: Humidity adsorbants (PC 0)**9.6.5.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 % <i>up to saturation</i>	ConsExpo 4.1
• Physical form of the used product: Solid (medium dusty form) <i>Covers also liquid form. See "overview on uses" for more details</i>	ConsExpo 4.1
• Exposure via inhalation route: Yes	ConsExpo 4.1
• Spray: No <i>Mode of release: evaporation</i>	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Amount of product used per application: ≤ 5E4 g/event	ConsExpo 4.1
• Exposure time per event: = 24 h/event <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
• Frequency of use over a day: = 1 events per day <i>every day</i>	ConsExpo 4.1
• Application duration: ≤ 1.44E3 min <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
Information and behavioral advice for consumers	
• Inhalation rate: = 32.9 m ³ /day <i>Default ConsExpo light exercise- 60 kg. Average bw women, is reasonable worst cas</i>	ConsExpo 4.1
• Room volume: = 1 m ³ <i>Room volume of 1 m³ 'Room volume' is interpreted here as personal space: a small area of 1 m³ around the use</i>	ConsExpo 4.1
• Ventilation rate: = 0.6 ACH/hour <i>Minimum. Equals to indoor typical (ConsExpo General Factsheet (RIVM report 320104002/2006)-unspecified room</i>	ConsExpo 4.1
• Eye Protection: [E73]: Avoid direct eye contact with product, also via contamination on hands.	
• Mass transfer rate: = 3.54E3 m/min <i>Langmuir model- Reasonable worst case</i>	
• Uptake fraction model - Inhalation: 1 <i>Reasonable worst case</i>	
Other conditions affecting consumers exposure	
• Release area: ≤ 125 m ² <i>Reasonable worst-case (e.g. Agrochemical)</i>	
• Inhalation transfer factor: = 1	



9.6.5.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.109. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	5E-3 mg/m ³ (ConsExpo 4.1)	RCR < 0.01
Inhalation, local, acute	0.01 mg/m ³ (ConsExpo 4.1)	RCR < 0.01

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.6.6. Cons CS 6: Cement/concrete/mortar (PC 0)

9.6.6.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 % <i>up to saturation</i>	ConsExpo 4.1
• Physical form of the used product: Solid (medium dusty form) <i>Covers also liquid form. See "overview on uses" for more details</i>	ConsExpo 4.1
• Exposure via inhalation route: Yes	ConsExpo 4.1
• Spray: No <i>Mode of release: evaporation</i>	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Amount of product used per application: ≤ 5E4 g/event	ConsExpo 4.1
• Exposure time per event: = 24 h/event <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
• Frequency of use over a day: = 1 events per day <i>every day</i>	ConsExpo 4.1
• Application duration: ≤ 1.44E3 min <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
Information and behavioral advice for consumers	
• Inhalation rate: = 32.9 m ³ /day <i>Default ConsExpo light exercise- 60 kg. Average bw women, is reasonable worst cas</i>	ConsExpo 4.1
• Room volume: = 1 m ³ <i>Room volume of 1 m³ 'Room volume' is interpreted here as personal space: a small area of 1 m³ around the use</i>	ConsExpo 4.1
• Ventilation rate: = 0.6 ACH/hour <i>Minimum. Equals to indoor typical (ConsExpo General Factsheet (RIVM report 320104002/2006)-unspecified room</i>	ConsExpo 4.1
• Eye Protection: [E73]: Avoid direct eye contact with product, also via contamination on hands.	
• Mass transfer rate: = 3.54E3 m/min <i>Langmuir model- Reasonable worst case</i>	ConsExpo 4.1
• Uptake fraction model - Inhalation: 1 <i>Reasonable worst case</i>	ConsExpo 4.1
Other conditions affecting consumers exposure	



	Method
• Release area: $\leq 125 \text{ m}^2$ <i>Reasonable worst-case (e.g. Agrochemical)</i>	ConsExpo 4.1
• Inhalation transfer factor: = 1	

9.6.6.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.110. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	5E-3 mg/m ³ (ConsExpo 4.1)	RCR < 0.01
Inhalation, local, acute	0.01 mg/m ³ (ConsExpo 4.1)	RCR < 0.01

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.6.7. Cons CS 7: Adsorbents (PC 2)

CaCl₂ used as domestic dehumidifier.

9.6.7.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100 \%$ <i>up to saturation</i>	ConsExpo 4.1
• Physical form of the used product: Solid (medium dusty form) <i>Covers also liquid form. See "overview on uses" for more details</i>	ConsExpo 4.1
• Exposure via inhalation route: Yes	ConsExpo 4.1
• Spray: No <i>Mode of release: evaporation</i>	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Amount of product used per application: $\leq 5\text{E}4 \text{ g/event}$	ConsExpo 4.1
• Exposure time per event: = 24 h/event <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
• Frequency of use over a day: = 1 events per day <i>every day</i>	ConsExpo 4.1
• Application duration: $\leq 1.44\text{E}3 \text{ min}$ <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
Information and behavioral advice for consumers	
• Inhalation rate: = 32.9 m ³ /day <i>Default ConsExpo light exercise- 60 kg. Average bw women, is reasonable worst cas</i>	ConsExpo 4.1
• Room volume: = 1 m ³ <i>Room volume of 1 m³ 'Room volume' is interpreted here as personal space: a small area of 1 m³ around the use</i>	ConsExpo 4.1
• Ventilation rate: = 0.6 ACH/hour <i>Minimum. Equals to indoor typical (ConsExpo General Factsheet (RIVM report 320104002/2006)-unspecified room</i>	ConsExpo 4.1



	Method
• Eye Protection: [E73]: Avoid direct eye contact with product, also via contamination on hands.	
• Mass transfer rate: = 3.54E3 m/min <i>Langmuir model- Reasonable worst case</i>	ConsExpo 4.1
• Uptake fraction model - Inhalation: 1 <i>Reasonable worst case</i>	ConsExpo 4.1
Other conditions affecting consumers exposure	
• Release area: <= 125 m ² <i>Reasonable worst-case (e.g. Agrochemical)</i>	ConsExpo 4.1
• Inhalation transfer factor: = 1	ConsExpo 4.1

9.6.7.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.111. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	5E-3 mg/m ³ (ConsExpo 4.1)	RCR < 0.01
Inhalation, local, acute	0.01 mg/m ³ (ConsExpo 4.1)	RCR < 0.01

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.6.8. Cons CS 8: Anti-freeze and de-icing products; No spraying (PC 4)

CaCl₂ used for de-icing and antifreeze

9.6.8.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 % <i>up to saturation</i>	ConsExpo 4.1
• Physical form of the used product: Solid (medium dusty form) <i>Covers also liquid form. See "overview on uses" for more details</i>	ConsExpo 4.1
• Exposure via inhalation route: Yes	ConsExpo 4.1
• Spray: No <i>Mode of release: evaporation</i>	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Amount of product used per application: <= 5E4 g/event	ConsExpo 4.1
• Exposure time per event: = 24 h/event <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
• Frequency of use over a day: = 1 events per day <i>every day</i>	ConsExpo 4.1
• Application duration: <= 1.44E3 min <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
Information and behavioral advice for consumers	
• Inhalation rate: = 32.9 m ³ /day	ConsExpo 4.1



	Method
<i>Default ConsExpo light exercise- 60 kg. Average bw women, is reasonable worst cas</i>	
• Room volume: = 1 m ³ <i>Room volume of 1 m³ 'Room volume' is interpreted here as personal space: a small area of 1 m³ around the use</i>	ConsExpo 4.1
• Ventilation rate: = 0.6 ACH/hour <i>Minimum. Equals to indoor typical (ConsExpo General Factsheet (RIVM report 320104002/2006)-unspecified room</i>	ConsExpo 4.1
• Eye Protection: [E73]: Avoid direct eye contact with product, also via contamination on hands.	
• Mass transfer rate: = 3.54E3 m/min <i>Langmuir model- Reasonable worst case</i>	ConsExpo 4.1
• Uptake fraction model - Inhalation: 1 <i>Reasonable worst case</i>	ConsExpo 4.1
Other conditions affecting consumers exposure	
• Release area: <= 125 m ² <i>Reasonable worst-case (e.g. Agrochemical)</i>	ConsExpo 4.1
• Inhalation transfer factor: = 1	ConsExpo 4.1

9.6.8.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.112. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	5E-3 mg/m ³ (ConsExpo 4.1)	RCR < 0.01
Inhalation, local, acute	0.01 mg/m ³ (ConsExpo 4.1)	RCR < 0.01

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.6.9. Cons CS 9: Anti-freeze and de-icing products; Spraying (PC 4)

CaCl₂ used for de-icing spraying activities

9.6.9.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 45 % <i>weight fraction compound</i>	ConsExpo 4.1
• Physical form of the used product: Liquid for spraying (spraying can)	ConsExpo 4.1
• Spray: Yes	ConsExpo 4.1
• Exposure via inhalation route: Yes	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Exposure time per event: = 24 h/event	ConsExpo 4.1
• Sprayed amount per time: <= 0.75 g/sec <i>Sprayed amount per time</i>	ConsExpo 4.1
• Frequency of use over a day: = 1 events per day	ConsExpo 4.1



	Method
<i>every day</i>	
• Duration of application: = 10 minutes	ConsExpo 4.1
Information and behavioral advice for consumers	
• Inhalation rate: = 32.9 m ³ /day <i>Default ConsExpo light exercise- 60 kg. Average bw women, is reasonable worst cas</i>	ConsExpo 4.1
• Room volume: = 58 m ³ <i>Covers use in room of 58 m³ with room height of 2.5m</i>	ConsExpo 4.1
• Ventilation rate: = 0.6 ACH/hour <i>Minimum. Equals to indoor typical (ConsExpo General Factsheet (RIVM report 320104002/2006)-unspecified room</i>	ConsExpo 4.1
• Eye Protection: [E73]: Avoid direct eye contact with product, also via contamination on hands.	
• Uptake fraction model - Inhalation: 1 <i>Reasonable worst case</i>	ConsExpo 4.1
Other conditions affecting consumers exposure	
• Inhalation transfer factor: = 1	ConsExpo 4.1

9.6.9.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.113. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.687 mg/m ³ (ConsExpo 4.1)	RCR = 0.275
Inhalation, local, acute	0.69 mg/m ³ (ConsExpo 4.1)	RCR = 0.138

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.6.10. Cons CS 10: Fertilizers; No spraying (PC 12)

CaCl₂ used for domestic fertilizers

9.6.10.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: <= 100 % <i>up to saturation</i>	ConsExpo 4.1
• Physical form of the used product: Solid (medium dusty form) <i>Covers also liquid form. See "overview on uses" for more details</i>	ConsExpo 4.1
• Exposure via inhalation route: Yes	ConsExpo 4.1
• Spray: No <i>Mode of release: evaporation</i>	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Amount of product used per application: <= 5E4 g/event	ConsExpo 4.1
• Exposure time per event: = 24 h/event <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1



	Method
• Frequency of use over a day: = 1 events per day <i>every day</i>	ConsExpo 4.1
• Application duration: $\leq 1.44E3$ min <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
Information and behavioral advice for consumers	
• Inhalation rate: = 32.9 m ³ /day <i>Default ConsExpo light exercise- 60 kg. Average bw women, is reasonable worst cas</i>	ConsExpo 4.1
• Room volume: = 1 m ³ <i>Room volume of 1 m³ 'Room volume' is interpreted here as personal space: a small area of 1 m³ around the use</i>	ConsExpo 4.1
• Ventilation rate: = 0.6 ACH/hour <i>Minimum. Equals to indoor typical (ConsExpo General Factsheet (RIVM report 320104002/2006)-unspecified room</i>	ConsExpo 4.1
• Eye Protection: [E73]: Avoid direct eye contact with product, also via contamination on hands.	
• Mass transfer rate: = 3.54E3 m/min <i>Langmuir model- Reasonable worst case</i>	ConsExpo 4.1
• Uptake fraction model - Inhalation: 1 <i>Reasonable worst case</i>	ConsExpo 4.1
Other conditions affecting consumers exposure	
• Release area: ≤ 125 m ² <i>Reasonable worst-case (e.g. Agrochemical)</i>	ConsExpo 4.1
• Inhalation transfer factor: = 1	ConsExpo 4.1

9.6.10.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.114. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	5E-3 mg/m ³ (ConsExpo 4.1)	RCR < 0.01
Inhalation, local, acute	0.01 mg/m ³ (ConsExpo 4.1)	RCR < 0.01

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.6.11. Cons CS 11: Fertilizers; Spraying (PC 12)

CaCl₂ used for fertilizers spraying activities

9.6.11.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 45 % <i>weight fraction compound</i>	ConsExpo 4.1
• Physical form of the used product: Liquid for spraying (spraying can)	ConsExpo 4.1
• Spray: Yes	ConsExpo 4.1



	Method
• Exposure via inhalation route: Yes	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Exposure time per event: = 24 h/event	ConsExpo 4.1
• Sprayed amount per time: ≤ 0.75 g/sec <i>Sprayed amount per time</i>	ConsExpo 4.1
• Frequency of use over a day: = 1 events per day <i>every day</i>	ConsExpo 4.1
• Duration of application: = 10 minutes	ConsExpo 4.1
Information and behavioral advice for consumers	
• Inhalation rate: = 32.9 m ³ /day <i>Default ConsExpo light exercise- 60 kg. Average bw women, is reasonable worst cas</i>	ConsExpo 4.1
• Room volume: = 58 m ³ <i>Covers use in room of 58 m³ with room height of 2.5m</i>	ConsExpo 4.1
• Ventilation rate: = 0.6 ACH/hour <i>Minimum. Equals to indoor typical (ConsExpo General Factsheet (RIVM report 320104002/2006)-unspecified room</i>	ConsExpo 4.1
• Eye Protection: [E73]: Avoid direct eye contact with product, also via contamination on hands.	
• Uptake fraction model - Inhalation: 1 <i>Reasonable worst case</i>	ConsExpo 4.1
Other conditions affecting consumers exposure	
• Inhalation transfer factor: = 1	ConsExpo 4.1

9.6.11.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.115. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.687 mg/m ³ (ConsExpo 4.1)	RCR = 0.275
Inhalation, local, acute	0.69 mg/m ³ (ConsExpo 4.1)	RCR = 0.138

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.6.12. Cons CS 12: Heat transfer fluids (PC 16)

CaCl₂ used as energy source in self-heating-cup. Refrigerator system.

9.6.12.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 100 % <i>up to saturation</i>	ConsExpo 4.1
• Physical form of the used product: Solid (medium dusty form) <i>Covers also liquid form. See "overview on uses" for more details</i>	ConsExpo 4.1
• Exposure via inhalation route: Yes	ConsExpo 4.1



	Method
• Spray: No <i>Mode of release: evaporation</i>	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Amount of product used per application: $\leq 5E4$ g/event	ConsExpo 4.1
• Exposure time per event: = 24 h/event <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
• Frequency of use over a day: = 1 events per day <i>every day</i>	ConsExpo 4.1
• Application duration: $\leq 1.44E3$ min <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
Information and behavioral advice for consumers	
• Inhalation rate: = 32.9 m ³ /day <i>Default ConsExpo light exercise- 60 kg. Average bw women, is reasonable worst case</i>	ConsExpo 4.1
• Room volume: = 1 m ³ <i>Room volume of 1 m³ 'Room volume' is interpreted here as personal space: a small area of 1 m³ around the use</i>	ConsExpo 4.1
• Ventilation rate: = 0.6 ACH/hour <i>Minimum. Equals to indoor typical (ConsExpo General Factsheet (RIVM report 320104002/2006)-unspecified room</i>	ConsExpo 4.1
• Eye Protection: [E73]: Avoid direct eye contact with product, also via contamination on hands.	
• Mass transfer rate: = 3.54E3 m/min <i>Langmuir model- Reasonable worst case</i>	ConsExpo 4.1
• Uptake fraction model - Inhalation: 1 <i>Reasonable worst case</i>	ConsExpo 4.1
Other conditions affecting consumers exposure	
• Release area: ≤ 125 m ² <i>Reasonable worst-case (e.g. Agrochemical)</i>	ConsExpo 4.1
• Inhalation transfer factor: = 1	ConsExpo 4.1

9.6.12.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.116. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	5E-3 mg/m ³ (ConsExpo 4.1)	RCR < 0.01
Inhalation, local, acute	0.01 mg/m ³ (ConsExpo 4.1)	RCR < 0.01

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.6.13. Cons CS 13: Plant protection products; No spraying (PC 27)

9.6.13.1. Conditions of use

	Method
Product (article) characteristics	



	Method
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$ <i>up to saturation</i>	ConsExpo 4.1
• Physical form of the used product: Solid (medium dusty form) <i>Covers also liquid form. See "overview on uses" for more details</i>	ConsExpo 4.1
• Exposure via inhalation route: Yes	ConsExpo 4.1
• Spray: No <i>Mode of release: evaporation</i>	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Amount of product used per application: $\leq 5E4$ g/event	ConsExpo 4.1
• Exposure time per event: = 24 h/event <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
• Frequency of use over a day: = 1 events per day <i>every day</i>	ConsExpo 4.1
• Application duration: $\leq 1.44E3$ min <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
Information and behavioral advice for consumers	
• Inhalation rate: = 32.9 m ³ /day <i>Default ConsExpo light exercise- 60 kg. Average bw women, is reasonable worst case</i>	ConsExpo 4.1
• Room volume: = 1 m ³ <i>Room volume of 1 m³ 'Room volume' is interpreted here as personal space: a small area of 1 m³ around the use</i>	ConsExpo 4.1
• Ventilation rate: = 0.6 ACH/hour <i>Minimum. Equals to indoor typical (ConsExpo General Factsheet (RIVM report 320104002/2006)-unspecified room</i>	ConsExpo 4.1
• Eye Protection: [E73]: Avoid direct eye contact with product, also via contamination on hands.	
• Mass transfer rate: = 3.54E3 m/min <i>Langmuir model- Reasonable worst case</i>	ConsExpo 4.1
• Uptake fraction model - Inhalation: 1 <i>Reasonable worst case</i>	ConsExpo 4.1
Other conditions affecting consumers exposure	
• Release area: ≤ 125 m ² <i>Reasonable worst-case (e.g. Agrochemical)</i>	ConsExpo 4.1
• Inhalation transfer factor: = 1	ConsExpo 4.1

9.6.13.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.117. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	5E-3 mg/m ³ (ConsExpo 4.1)	RCR < 0.01
Inhalation, local, acute	0.01 mg/m ³ (ConsExpo 4.1)	RCR < 0.01

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.



9.6.14. Cons CS 14: Plant protection products; Spraying (PC 27)

9.6.14.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 45\%$ <i>weight fraction compound</i>	ConsExpo 4.1
• Physical form of the used product: Liquid for spraying (spraying can)	ConsExpo 4.1
• Spray: Yes	ConsExpo 4.1
• Exposure via inhalation route: Yes	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Exposure time per event: = 24 h/event	ConsExpo 4.1
• Sprayed amount per time: ≤ 0.75 g/sec <i>Sprayed amount per time</i>	ConsExpo 4.1
• Frequency of use over a day: = 1 events per day <i>every day</i>	ConsExpo 4.1
• Duration of application: = 10 minutes	ConsExpo 4.1
Information and behavioral advice for consumers	
• Inhalation rate: = 32.9 m ³ /day <i>Default ConsExpo light exercise- 60 kg. Average bw women, is reasonable worst cas</i>	ConsExpo 4.1
• Room volume: = 58 m ³ <i>Covers use in room of 58 m³ with room height of 2.5m</i>	ConsExpo 4.1
• Ventilation rate: = 0.6 ACH/hour <i>Minimum. Equals to indoor typical (ConsExpo General Factsheet (RIVM report 320104002/2006)-unspecified room</i>	ConsExpo 4.1
• Eye Protection: [E73]: Avoid direct eye contact with product, also via contamination on hands.	
• Uptake fraction model - Inhalation: 1 <i>Reasonable worst case</i>	ConsExpo 4.1
Other conditions affecting consumers exposure	
• Inhalation transfer factor: = 1	ConsExpo 4.1

9.6.14.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.118. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.687 mg/m ³ (ConsExpo 4.1)	RCR = 0.275
Inhalation, local, acute	0.69 mg/m ³ (ConsExpo 4.1)	RCR = 0.138

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride $> 3\%$.

9.6.15. Cons CS 15: Water treatment chemicals (PC 37)

9.6.15.1. Conditions of use



	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$ <i>up to saturation</i>	ConsExpo 4.1
• Physical form of the used product: Solid (medium dusty form) <i>Covers also liquid form. See "overview on uses" for more details</i>	ConsExpo 4.1
• Exposure via inhalation route: Yes	ConsExpo 4.1
• Spray: No <i>Mode of release: evaporation</i>	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Amount of product used per application: $\leq 5E4$ g/event	ConsExpo 4.1
• Exposure time per event: = 24 h/event <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
• Frequency of use over a day: = 1 events per day <i>every day</i>	ConsExpo 4.1
• Application duration: $\leq 1.44E3$ min <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
Information and behavioral advice for consumers	
• Inhalation rate: = 32.9 m ³ /day <i>Default ConsExpo light exercise- 60 kg. Average bw women, is reasonable worst cas</i>	ConsExpo 4.1
• Room volume: = 1 m ³ <i>Room volume of 1 m³ 'Room volume' is interpreted here as personal space: a small area of 1 m³ around the use</i>	ConsExpo 4.1
• Ventilation rate: = 0.6 ACH/hour <i>Minimum. Equals to indoor typical (ConsExpo General Factsheet (RIVM report 320104002/2006)-unspecified room</i>	ConsExpo 4.1
• Eye Protection: [E73]: Avoid direct eye contact with product, also via contamination on hands.	
• Mass transfer rate: = 3.54E3 m/min <i>Langmuir model- Reasonable worst case</i>	ConsExpo 4.1
• Uptake fraction model - Inhalation: 1 <i>Reasonable worst case</i>	ConsExpo 4.1
Other conditions affecting consumers exposure	
• Release area: ≤ 125 m ² <i>Reasonable worst-case (e.g. Agrochemical)</i>	ConsExpo 4.1
• Inhalation transfer factor: = 1	ConsExpo 4.1

9.6.15.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.119. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	5E-3 mg/m ³ (ConsExpo 4.1)	RCR < 0.01
Inhalation, local, acute	0.01 mg/m ³ (ConsExpo 4.1)	RCR < 0.01

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.



9.6.16. Cons CS 16: Washing and cleaning products; No spraying (PC 35)

Including solvent based products.

9.6.16.1. Conditions of use

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: $\leq 100\%$ <i>up to saturation</i>	ConsExpo 4.1
• Physical form of the used product: Solid (medium dusty form) <i>Covers also liquid form. See "overview on uses" for more details</i>	ConsExpo 4.1
• Exposure via inhalation route: Yes	ConsExpo 4.1
• Spray: No <i>Mode of release: evaporation</i>	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Amount of product used per application: $\leq 5E4$ g/event	ConsExpo 4.1
• Exposure time per event: = 24 h/event <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
• Frequency of use over a day: = 1 events per day <i>every day</i>	ConsExpo 4.1
• Application duration: $\leq 1.44E3$ min <i>Reasonable worst case (e.g. domestic dehumidifier)</i>	ConsExpo 4.1
Information and behavioral advice for consumers	
• Inhalation rate: = 32.9 m ³ /day <i>Default ConsExpo light exercise- 60 kg. Average bw women, is reasonable worst cas</i>	ConsExpo 4.1
• Room volume: = 1 m ³ <i>Room volume of 1 m³ 'Room volume' is interpreted here as personal space: a small area of 1 m³ around the use</i>	ConsExpo 4.1
• Ventilation rate: = 0.6 ACH/hour <i>Minimum. Equals to indoor typical (ConsExpo General Factsheet (RIVM report 320104002/2006)-unspecified room</i>	ConsExpo 4.1
• Eye Protection: [E73]: Avoid direct eye contact with product, also via contamination on hands.	
• Mass transfer rate: = 3.54E3 m/min <i>Langmuir model- Reasonable worst case</i>	ConsExpo 4.1
• Uptake fraction model - Inhalation: 1 <i>Reasonable worst case</i>	ConsExpo 4.1
Other conditions affecting consumers exposure	
• Release area: ≤ 125 m ² <i>Reasonable worst-case (e.g. Agrochemical)</i>	ConsExpo 4.1
• Inhalation transfer factor: = 1	ConsExpo 4.1

9.6.16.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.120. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	5E-3 mg/m ³ (ConsExpo 4.1)	RCR < 0.01



Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, acute	0.01 mg/m ³ (ConsExpo 4.1)	RCR < 0.01

Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.

9.6.17. Cons CS 17: Washing and cleaning products; Spraying (PC 35)**9.6.17.1. Conditions of use**

	Method
Product (article) characteristics	
• Percentage (w/w) of substance in mixture/article: ≤ 45 % <i>weight fraction compound</i>	ConsExpo 4.1
• Physical form of the used product: Liquid for spraying (spraying can)	ConsExpo 4.1
• Spray: Yes	ConsExpo 4.1
• Exposure via inhalation route: Yes	ConsExpo 4.1
Amount used (or contained in articles), frequency and duration of use/exposure	
• Exposure time per event: = 24 h/event	ConsExpo 4.1
• Sprayed amount per time: ≤ 0.75 g/sec <i>Sprayed amount per time</i>	ConsExpo 4.1
• Frequency of use over a day: = 1 events per day <i>every day</i>	ConsExpo 4.1
• Duration of application: = 10 minutes	ConsExpo 4.1
Information and behavioral advice for consumers	
• Inhalation rate: = 32.9 m ³ /day <i>Default ConsExpo light exercise- 60 kg. Average bw women, is reasonable worst cas</i>	ConsExpo 4.1
• Room volume: = 58 m ³ <i>Covers use in room of 58 m³ with room height of 2.5m</i>	ConsExpo 4.1
• Ventilation rate: = 0.6 ACH/hour <i>Minimum. Equals to indoor typical (ConsExpo General Factsheet (RIVM report 320104002/2006)-unspecified room</i>	ConsExpo 4.1
• Eye Protection: [E73]: Avoid direct eye contact with product, also via contamination on hands.	
• Uptake fraction model - Inhalation: 1 <i>Reasonable worst case</i>	ConsExpo 4.1
Other conditions affecting consumers exposure	
• Inhalation transfer factor: = 1	ConsExpo 4.1

9.6.17.2. Exposure and risks for consumers

The exposure concentrations and risk characterisation ratios (RCR) are reported in the following table.

Table 9.121. Exposure concentrations and risks for consumers

Route of exposure and type of effects	Exposure concentration	Risk quantification
Inhalation, local, long term	0.687 mg/m ³ (ConsExpo 4.1)	RCR = 0.275
Inhalation, local, acute	0.69 mg/m ³ (ConsExpo 4.1)	RCR = 0.138



Risk characterisation

Qualitative risk characterisation (Eye, local):

Suitable eye protection is to be worn where there is potential for exposure. This is especially relevant in all situations where there is potential for exposure to formulations with concentration of calcium chloride > 3%.



10. RISK CHARACTERISATION RELATED TO COMBINED EXPOSURE

10.1. Human health

10.1.1. Workers

The registrant does not have a full overview on which WCS could be combined leading to combined exposure. However, as most of the WCS activities are based on 8hr exposure and all have been demonstrated to present safe use, it is not considered likely that a combination of different WCS leads to a risk situation.

10.1.2. Consumer

The registrant does not have a full overview on which consumer scenarios could be combined leading to combined exposure. However, based on the RCRs determined for the different individual consumer scenarios, exposure of a consumer as a result of a combination of different uses should not lead to an unsafe situation with a combined RCR > 1.

10.2. Environment (combined for all emission sources)

10.2.1. All uses (regional scale)

10.2.1.1. Total releases

The total releases to the environment from all the exposure scenarios covered are presented in the table below. This is the sum of the releases to the environments from all exposure scenarios addressed.

Where there is more than one contributing scenario for the environment for a given exposure scenario, the highest release per route across all the contributing scenarios within the use has been taken into account as the release for the use (both for the regional and the exposure due to all the widespread uses). This may lead to overestimation of the PEC.

Table 10.1. Total releases to the environment per year from all life cycle stages

Release route	Total releases per year
Water	7.32E8 kg/year
Air	5.16E8 kg/year
Soil	8.01E7 kg/year

10.2.2. Regional assessment

The regional predicted environmental concentration (PEC regional) and the related risk characterisation ratios when a PNEC is available are presented in the table below. The exposure to man via the environment from regional exposure and the related risk characterisation ratios are also provided (when relevant). The exposure concentration for human via inhalation is equal to the PEC air.

The exposure estimates have been obtained with EUSES 2.1.2 unless stated otherwise.

Table 10.2. Predicted regional exposure concentrations (Regional PEC) and risks for the environment

Protection target	Regional PEC	Risk characterisation
Man via environment - Inhalation (local effects)	Concentration in air: 1.52E-12 mg/m ³	RCR < 0.01
Man via environment - combined routes		RCR < 0.01

Remarks on risk characterisation for regional concentrations:

Not applicable as an environmental risk assessment is not required.

10.2.3. Local exposure due to all widespread uses



The predicted local environmental concentrations (PEC local) and the exposure to man via the environment (when relevant) based on the releases from all widespread uses are reported in the table below, when relevant, together with the risk characterisation ratio when a PNEC is available. The exposure estimates have been obtained with EUSES 2.1.2.

Table 10.3. Predicted exposure concentrations and risks for the environment and man via the environment due to all widespread uses

Protection target	PEC local due to all widespread uses	Risk characterisation
Man via environment - Inhalation (local effects)	PEC: 1.52E-12 mg/m ³	RCR < 0.01
Man via environment - combined routes		RCR < 0.01



Annexes



1. Annex: References

Ganong, W.F. 2001: Review of Medical Physiology (review article or handbook), 20th ed., McGraw-Hill Medical Publishing Division, New York.

Gomei, T. (chief ed.) 1998: Eiyougaku Handobukku (Handbook of Nutritional Science), (review article or handbook), 3rd ed., Gihoudou Publishing Co., Tokyo. (in Japanese).

Marcus, R. 2001: Agents affecting calcification and bone turnover: calcium, phosphate, parathyroid hormone, vitamin D, calcitonin, and other compounds. In Goodman & Gilman's The Pharmacological Basis of Therapeutics, (review article or handbook), 10th ed. (Hardman, J.G. and Limbird, L.E., eds.), McGraw-Hill Medical Publishing Division, New York, pp. 1715-1743..

Standing Committee on the Scientific Evaluation of Dietary Reference Intakes 1999: Dietary reference intakes for calcium, phosphorus, magnesium, vitamin D, and fluoride. (review article or handbook), National Academy Press, Washington, D.C..

Toxicol Laboratories Limited 1987: Calcium chloride acute oral toxicity study in the rat (study report), Testing laboratory: Toxicol Laboratories Limited, Bromyard Road, Ledbury, Herefordshire, HR8 1LH, England, Report no: 201/8702. Owner company; Tetra Chemicals, Report date: Jun 1, 1987

Akatsuka, K., Hashimoto, T. and Takeuchi, K. 1977: Pharmacological studies on Ca meso-tartrate . Acute and subacute toxicity tests (publication), Ouyou-Yakuri, 14, 963-975..

Akatsuka, K., Hashimoto, T. and Takeuchi, K. 1977: Pharmacological studies on Ca meso-tartrate I. Acute and subacute toxicity tests (publication), Ouyou-Yakuri, 14, 963-975..

Koopman, T.S.M. and Pot, T.E. 1986: Acute oral toxicity study with anhydrous calcium chloride in male rabbits. (study report), Owner company; Duphar, Study number: 56645/52/86.,

Koopman, T.S.M. and Pot, T.E. 1986: Acute oral toxicity study with calcium chloride dihydrate in male rabbits (study report), Owner company; Duphar, Study number: 56645/51/86,

Koopman, T.S.M. and Pot, T.E. 1986: Acute oral toxicity study with calcium chloride hexahydrate in male rabbits (study report), Owner company; Duphar, Study number: 56645/49/86,

Koopman, T.S.M. and Pot, T.E. 1986: Acute oral toxicity study with calcium chloride 33% in male rabbits (study report), Report no: 56645/50/86. Owner company; Duphar,

Akatsuka, K., Hashimoto, T. and Takeuchi, K. 1977: Pharmacological studies on Ca meso-tartrate I. Acute and subacute toxicity tests (publication), Ouyou-Yakuri, 14, 963-975. (in Japanese).

Carreon, R.E., Yano, B.L. and New, M.A. 1981: Peladow calcium chloride (94-97%): acute toxicological properties and industrial handling hazards. (other company data), Unpublished Dow Chemical Company report.. Report no: Unpublished Dow Chemical Company report..

Vinnikov PL, Slepova RI, Sataev IF 1962: Inhalation of calcium chloride aerosols in complex therapy of pulmonary tuberculosis. (publication), Kazan Med Zh. , 4, 7-9.

Koopman, T.S.M. and Pot, T.E. 1986: Primary irritation study of anhydrous calcium chloride to the skin of the male rabbit (study report), Testing laboratory: Duphar, Report no: 56645/30/86. Owner company; Duphar,

Koopman, T.S.M. and Pot, T.E. 1986: Primary irritation study of calcium chloride dihydrate to the skin of the male rabbit (study report), Report no: 56645/29/86. Owner company; Duphar,

Koopman, T.S.M. and Pot, T.E. 1986: Primary irritation study of calcium chloride hexahydrate to the skin of the male rabbit (study report), Report no: 56645/32/86. Owner company; Duphar,

Koopman, T.S.M. and Pot, T.E. 1986: Primary irritation study of calcium chloride 33% to the skin of the male rabbit (study report), Report no: 56645/31/86. Owner company; Duphar,



- Carreon, R.E., Yano, B.L. and New, M.A. 1981: Peladow calcium chloride (94-97%): acute toxicological properties and industrial handling hazards. (other company data), Owner company; Dow Chemical Company,
- Norris, J.M. 1971: Eye and skin irritation properties of DOWFLAKE calcium chloride (Unpublished report), Owner company; Dow Chemical Company,
- Norris, J.M. 1971: Eye and skin irritation properties of LIQUIDOW liquid calcium chloride (Unpublished report), Owner company; Dow Chemical Company,
- Patel, R. et al. 2010: Acquired perforating calcific collagenosis after topical calcium chloride exposure (publication), Journal of Cutaneous Pathology; 2010, 37, p. 593-596.
- Koopman, T.S.M. and Pot, T.E. 1986: Primary irritation study of anhydrous calcium chloride to the eye of the male rabbit (study report), Testing laboratory: Duphar, Report no: 56645/42/86. Owner company; Duphar,
- Koopman, T.S.M. and Pot, T.E. 1986: Primary irritation study of calcium chloride dihydrate to the eye of the male rabbit (study report), Testing laboratory: Duphar, Report no: 56645/43/86. Owner company; Duphar,
- Koopman, T.S.M. and Pot, T.E. 1986: Primary irritation study of calcium chloride hexahydrate to the eye of the male rabbit (study report), Testing laboratory: Duphar, Report no: 56645/44/86. Owner company; Duphar,
- Koopman, T.S.M. and Pot, T.E. 1986: Primary irritation study of calcium chloride 33% to the eye of the male rabbit. (study report), Testing laboratory: Duphar, Report no: 56645/45/86. Owner company; Duphar,
- Norris, J.M. 1971: Eye and skin irritation properties of DOWFLAKE calcium chloride (Unpublished report), Testing laboratory: Dow Chemical Company,
- Chandra, A.K., et al. 2012: Dietary calcium induced cytological and biochemical changes in thyroid (publication), Env. Toxicol. and Pharmacol., 34 (2012) 454-465.
- Pamukcu, A.M., Yalciner, S. and Bryan, G.T. 1977: Inhibition of carcinogenic effect of bracken fern (*Pteridium aquilinum*) by various chemicals (publication), Cancer, 40, 2450-2454.
- Sharpless, G.R., Sabol, M., Anthony, E.K. and Argetsinger, H.L. 1942: Goitrogenic action of calcium and vitamin D (publication), J. Nutr., 25, 119-126.
- Smith, E.R.B. 1942: A comparison of the effects of large doses of calcium gluconate-idonate, calcium gluconate, and calcium chloride. (publication), J. Lab. Clin. Med., 25, 1018-1021.
- Govan, A.D.T. and Parkes, J. 1949: Acute experimental calcium chloride acidosis (publication), Br. J. Exp. Pathol., 30, 105-114.
- El-Merhie, N., Sabry, I., Balbaa, M. 2012: Effect of calcium treatment on blood parameters, gonadal development and the structure of bone in immature female rats (study report), J. Physiol. Biochem., 2012, 68, p. 219-227.
- Ishidate, M., Jr., Sofumi, T., Yoshikawa, K., Hayashi, M., [Nohmi, T., Sawada, M. and Matsuoka, A. 1984: Primary mutagenicity screening of food additives currently used in Japan (publication), Fd Chem. Toxic., 22, 623-636.
- Fujita, H. and Sasaki, M. 1987: Mutagenicity test of food additives with *Salmonella typhimurium* TA97 and TA102 (II) (publication), Ann. Rep. Tokyo Metr. Res. Lab. P.H., 38, 423-430 (in Japanese).
- Food and Drug Research Laboratoires, Inc. 1974: Teratologic evaluation of FDA 71-87 (calcium chloride) in mice, rats and rabbits (study report), Testing laboratory: Food and Drug Research Laboratoires, Inc., Report no: FDABF-GRAS-251. NTIS PB-234 879.
- CCOSH 2010: Canadian Workplace Hazardous Materials Information System (WHMIS) (grey literature), Cited in: CHEMINFO, Chemical Profiles Created by the Canadian Centre for Occupational Safety and Health



(CCOSH), record number 726.

Mount, D.R., Gulley, D.D., Hockett, J.R., Garrison, T.D. and Evans, J.M. 1997: Statistical models to predict the toxicity of major ions to *Ceriodaphnia dubia*, *Daphnia magna* and *Pimephales promelas* (fathead minnows) (publication), *Env. Toxicol. Chem.*, 16(10), 2009-2019..

Cairns, J., Jr. and Scheier, A. 1959: The relationship of bluegill sunfish body size to tolerance for some common chemicals (publication), *Proc. 13th Ind. Waste Conf., Purdue Univ. Eng. Bull.*, 96, 243-252..

Trama, F.B. 1954: The acute toxicity of some common salts of sodium, potassium and calcium to the common bluegill (*Lepomis macrochirus Rafinesque*). (publication), *Proc. Acad. Natur. Sci. Philadelphia*, 106, 185-205..

Wallen, I.E., Greer, W.C. and Lasater, R. 1957: Toxicity to *Gambusia affinis* of certain pure chemicals in turbid waters (publication), *Sewage Ind. Wastes*, 29(6), 695-711.

William D. Hintz Rick A. Relyea 2017: Impacts of road deicing salts on the early-life growth and development of a stream salmonid: Salt type matters (publication), *Environmental Pollution* 223 (2017) 409e415. Testing laboratory: Darrin Fresh Water Institute, Department of Biological Sciences, Rensselaer Polytechnic Institute, 110, Eighth Street, Troy, NY, USA, Report date: Jan 26, 2017

de Groot, W.A. and Groeneveld, A.H.C. 1998: The acute toxicity of sodium chloride and calcium chloride to *Daphnia magna* (study report), Solvay Pharmaceuticals Study No. C.SOL.51.112/Int.. Testing laboratory: Solvay Pharmaceuticals, Report no: Doc. No. 56834/45/98.

Mount, D.R., Gulley, D.D., Hockett, J.R., Garrison, T.D. and Evans, J.M. 2009: Statistical models to predict the toxicity of major ions to *Ceriodaphnia dubia*, *Daphnia magna* and *Pimephales promelas* (fathead minnows) (publication), *Env. Toxicol. Chem.*, 16(10), 2009-2019.

Mount, D.R., Gulley, D.D., Hockett, J.R., Garrison, T.D. and Evans, J.M. 2009: Statistical models to predict the toxicity of major ions to *Ceriodaphnia dubia*, *Daphnia magna* and *Pimephales promelas* (fathead minnows) (publication), *Env. Toxicol. Chem.*, 16(10), 2009-2019.

Khengarot, B.S. and Ray, P.K. 1989: Investigation of correlation between physicochemical properties of metals and their toxicity to the water flea *Daphnia magna* Straus (publication), *Ecotoxicol. Env. Safety*, 18(2), 109-120.

Khengarot, B.S. 1991: Toxicity of metals to a freshwater tubificid worm, *Tubifex tubifex* (Muller) (publication), *Bull. Env. Contam. Toxicol.*, 46, 906-912..

Baudouin, M.F. and Scoppa, P. 1974: Acute toxicity of various metals to freshwater zooplankton (publication), *Bull. Env. Contam. Toxicol.*, 12(6), 745-751..

Baudouin, M.F. and Scoppa, P. 1974: Acute toxicity of various metals to freshwater zooplankton (publication), *Bull. Env. Contam. Toxicol.*, 12(6), 745-751.

Tatara, C.P., Newman, M.C., McCloskey, J.T. and Williams, P.L. 1997: Predicting relative metal toxicity with ion characteristics: *Caenorhabditis elegans* LC50 (publication), *Aqua. Toxicol.*, 39, 279-290.

Bengtsson, B.-E. 1978: Use of a harpacticoid copepod in toxicity tests (publication), *Mar. Pollut. Bull.*, 9, 238-241..

Biesinger, K.E. and Christensen, G.M. 1972: Effects of various metals on survival, growth, reproduction, and metabolism of *Daphnia magna* (publication), *J. Fish. Res. Bd. Canada*, 29(12), 1691-1700..

Min Jeong Baek; Tae Joong Yoon; Dong Gun Kim; Cha Young Lee; Kijong Cho; Yeon Jae Bae 2014: Effects of Road Deicer Runoff on Benthic Macroinvertebrate Communities in Korean Freshwaters with Toxicity Tests of Calcium Chloride (CaCl₂) (publication), *Water Air Soil Pollut* (2014) 225:1961. DOI 10.1007/s11270-014-1961-6. Report date: May 9, 2014

Kayla D. Coldsnow Rick A. Relyea 2018: Toxicity of Various Road-Deicing Salts to Asian Clams (*Corbicula fluminea*) (publication), *Environmental Toxicology and Chemistry—Volume 37, Number 7—pp. 1839–1845*,



2018. Testing laboratory: Department of Biological Sciences, Darrin Fresh Water Institute, Rensselaer Polytechnic Institute, Troy, New York, USA, Report date: Mar 1, 2018

Neda Mažuran, Vladimir Hršak, Goran Kovačević 2015: The effects of CaCl₂ and CaBr₂ on the reproduction of *Daphnia magna* Straus (publication), Arh Hig Rada Toksikol 2015;66:135-140. Testing laboratory: University of Zagreb, Zagreb, Croatia, Report date: May 31, 2015

de Groot, W.A. 1998: The toxicity of sodium chloride and calcium chloride to algae (*Selenastrum capricornutum*) (study report), Testing laboratory: Solvay Pharmaceuticals, Report no: Study No. C.SOL.51.113/Int.Doc. No. 56834/56/98.

Tkalec, M., Vidakovic-Cifrek, V. and Regula, I. 1998: The effect of oil industry high density brines on duckweed *Lemna minor* L (publication), Chemosphere, 37(13), 2703-2715.

MEAGAN L. HARLESS, CASEY J HUCKINS, JACQUALINE B. GRANT, THOMAS G. PYPKER 2011: Effects of six chemical deicers on larval wood frogs (*Rana sylvatica*) (publication), Environmental Toxicology and Chemistry, Vol. 30, No. 7, pp. 1637–1641, 2011. Report date: Mar 14, 2011

Jacek Patykowski, Jeremi Kołodziejek, Mateusz Wala 2018: Biochemical and growth responses of silver maple (*Acer saccharinum* L.) to sodium chloride and calcium chloride (publication), PeerJ. 2018; 6: e5958. Report date: Oct 18, 2018

Environmental Protection Service Ottawa 1984: Calcium chloride; environmental and technical information for problem spills (secondary source),

Bogemans, J., Neirinckx, L. and Stassart, J.M. 1989: Effect of deicing NaCl and CaCl₂ on spruce (*Picea abies* (L.) sp.). (publication), Plant and Soil, 120, 203-211.



2. Annex: Information on Test Material

Test material: **calcium dichloride / 10043-52-4 / 233-140-8**

Form:

Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range:
---	---	-----------------------------

Test material: **calcium dichloride / 10043-52-4 / 233-140-8**

Form:

Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range:
---	---	-----------------------------

Details on test material: - Name of test material (as cited in study report): calcium chloride - Physical state: solid in the form of grey chips, received in a plastic bottle with a screw top - Analytical purity: no data - Date of receipt: 23rd February 1987 - Storage condition of test material: in the dark at room temperature

Test material: **calcium dichloride / 10043-52-4 / 233-140-8**

Form:

Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range:
---	---	-----------------------------

Details on test material: Anhydrous calcium chloride (CaCl_2), a white powder, prepared from calcium chloride dihydrate flakes (Batch No. Solvay Couillet 8/OCT/1985 FLAKES). The test material was solid at the application time. Upon analysis sample contained: 97.0% CaCl_2 , 2.2% NaCl and 0.11% $\text{Ca}(\text{OH})_2$.

Test material: **10035-04-8 / 10035-04-8**

Form:

Composition type: Constituent	Reference substance: calcium chloride dihydrate EC no.: CAS no: 10035-04-8 IUPAC name: calcium chloride dihydrate	Concentration range:
---	---	-----------------------------

Details on test material: Calcium chloride dihydrate ($\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$), a white powder, prepared from calcium chloride dihydrate flakes (Batch No. Solvay Couillet 8/OCT/1985 FLAKES). The test sample was solid at the application time. Upon analysis sample contained: 76.7% CaCl_2 , 1.8% NaCl and 0.08% $\text{Ca}(\text{OH})_2$.

Test material: **calcium dichloride / 10043-52-4 / 233-140-8**

Form:

Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range:
---	---	-----------------------------

Details on test material: No data

Test material: **calcium dichloride / 10043-52-4 / 233-140-8**

Form:

Composition type: Constituent	Reference substance: calcium chloride	Concentration range:
---	--	-----------------------------



	EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	
--	---	--

Details on test material: No data.

Test material: **anhydrous calcium chloride**

Form: **solid: crystalline**

Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range: 97 % (w/w)
---	---	--

Composition / purity: analytical grade

Details on test material: Test substance: Anhydrous calcium chloride (CaCl₂), a white powder, prepared from calcium chloride dihydrate flakes (Batch No. Couillet 8/OCT/1985 FLAKES). The test material was solid at the application time. Upon analysis sample contained: 97.0% CaCl₂, 2.2% NaCl and 0.11% Ca(OH)₂.

Test material: **calcium dichloride dihydrate**

Form:

Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range:
---	---	-----------------------------

Test material: **calcium chloride hexahydrate**

Form:

Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range:
---	---	-----------------------------

Test material: **calcium dichloride / 10043-52-4 / 233-140-8**

Form:

Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range:
---	---	-----------------------------

Details on test material: Test substance: Calcium chloride 33%, a colorless, clear liquid (Batch No. Solvay Couillet RS1 21/FEB/1986). Upon analysis sample contained: 33.1% CaCl₂, 1.1% NaCl and 0.07% Ca(OH)₂.

Test material: **calcium dichloride / 10043-52-4 / 233-140-8**

Form:

Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range:
---	---	-----------------------------

Details on test material: Test substance: PELADOW: calcium chloride (anhydrous, 94-97%)

Test material: **calcium difluoride / 7789-75-5 / 232-188-7**

Form:

Composition type: Constituent	Reference substance: calcium fluoride EC no.:	Concentration range:
---	---	-----------------------------



	CAS no: 7789-75-5 IUPAC name: calcium difluoride	
--	---	--

Test material: **calcium dichloride / 10043-52-4 / 233-140-8**

Form: **solid: crystalline**

Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range: 97 % (w/w)
---	---	--

Details on test material: Test substance: Anhydrous calcium chloride (CaCl_2), a white powder, prepared from calcium chloride dihydrate flakes (Batch No. Solvay Couillet 8/OCT/1985 FLAKES). The test material was solid at the application time. Upon analysis sample contained: 97.0% CaCl_2 , 2.2% NaCl and 0.11% $\text{Ca}(\text{OH})_2$.

Test material: **calcium chloride dihydrate**

Form: **solid: flakes**

Composition type: Constituent	Reference substance: calcium chloride dihydrate EC no.: CAS no: 10035-04-8 IUPAC name:	Concentration range: 97 % (w/w)
---	--	--

Details on test material: Test substance: Calcium chloride dihydrate ($\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$), a white powder, prepared from calcium chloride dihydrate flakes (Batch No. Solvay Couillet 8/OCT/1985 FLAKES). The test material was solid at the application time. Upon analysis sample contained: 76.7% CaCl_2 , 1.8% NaCl and 0.08% $\text{Ca}(\text{OH})_2$.

Test material: **Calcium chloride hexahydrate**

Form: **solid: crystalline**

Composition type: Constituent	Reference substance: calcium chloride hexahydrate EC no.: CAS no: 7774-34-7 IUPAC name: calcium chloride hexahydrate	Concentration range: 98 % (w/w)
---	--	--

Details on test material: Test substance: Calcium chloride hexahydrate ($\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$), a white powder, prepared from calcium chloride dihydrate (Batch No. Solvay Couillet 8/OCT/1985 FLAKES). The test material was solid at application time. Upon analysis sample contained: 50.2% CaCl_2 , 1.2% NaCl and 0.05% $\text{Ca}(\text{OH})_2$.

Test material: **Calcium chloride, 33% aqueous solution**

Form:

Composition type: Constituent	Reference substance: calcium chloride, 33% aqueous solution EC no.: CAS no: 10043-52-4 IUPAC name:	Concentration range:
---	--	-----------------------------

Details on test material: Test substance: Calcium chloride 33%, a colorless, clear liquid (Batch No. Solvay Couillet RS1 21/FEB/1986). Upon analysis sample contained: 33.1% CaCl_2 , 1.1% NaCl and 0.07% $\text{Ca}(\text{OH})_2$.

Test material: **calcium chloride dihydrate**

Form:

Composition type: Constituent	Reference substance: calcium chloride dihydrate EC no.: CAS no: 10035-04-8 IUPAC name:	Concentration range:
---	--	-----------------------------

Details on test material: Test substance: DOWFLAKE*: calcium chloride (dihydrate)

Test material: **calcium chloride, 38% aqueous solution**

Form:



Composition type: Constituent	Reference substance: calcium chloride, 38% aqueous solution EC no.: CAS no: IUPAC name:	Concentration range:
---	---	-----------------------------

Details on test material: Test substance: LIQUIDOW*: liquid calcium chloride (38% CaCl₂ and 62% water)

Test material: **Calcium chloride**

Form:

Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range:
---	---	-----------------------------

Composition / purity: purity not specified

Test material: **Calcium chloride**

Form:

Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range: Additional information: purity unknown
---	---	---

Composition / purity: purity not specified

Details on test material: Calcium chloride was prepared from calcium oxide and hydrochloric acid.

Test material: **Calcium dichloride dihydrate**

Form: **solid: crystalline**

Composition type: Constituent	Reference substance: calcium chloride dihydrate EC no.: CAS no: 10035-04-8 IUPAC name: calcium chloride dihydrate	Concentration range:
---	---	-----------------------------

Composition / purity: purity not specified

Test material: **calcium chloride**

Form:

Composition type:	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range:
--------------------------	---	-----------------------------

Details on test material: Test substance: Supplied from the Japan Food Additives Association, Tokyo, at the request of the Ministry of Health and Welfare of Japan, where the purity and quality of the sample was checked. The purity of CaCl₂ used was 74.5%.

Test material: **calcium dichloride / 10043-52-4 / 233-140-8**

Form:

Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range:
---	---	-----------------------------

Details on test material: Test substance: Obtained from Wako Pure Chemicals Co., Japan (lot No. DCG 7053).

Test material: **calcium chloride**

Form:



Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range:
---	---	-----------------------------

Details on test material: Test substance: Fine white granular material marked with FDA 71-87.

Test material: **calcium chloride**

Form:

Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range:
---	---	-----------------------------

Details on test material: Test substance: Tine white granular material marked with FDA 71-87.

Test material: **calcium dichloride / 10043-52-4 / 233-140-8**

Form:

Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range:
---	---	-----------------------------

Details on test material: Although the purity was not specified, the OECD SIDS considered the study result reliable/acceptable, given analytical monitoring was performed, and observed toxicity very low.

Test material: **calcium dichloride / 10043-52-4 / 233-140-8**

Form:

Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range:
---	---	-----------------------------

Details on test material: Although the purity was not specified, the OECD SIDS considered the study result reliable/acceptable

Test material: **10035-04-8 / 10035-04-8**

Form:

Composition type: Constituent	Reference substance: calcium chloride dihydrate EC no.: CAS no: 10035-04-8 IUPAC name: calcium chloride dihydrate	Concentration range:
---	---	-----------------------------

Details on test material: Test substance: Dihydrate

Test material: **calcium dichloride / 10043-52-4 / 233-140-8**

Form:

Composition type: Constituent	Reference substance: calcium chloride EC no.: CAS no: 10043-52-4 IUPAC name: calcium dichloride	Concentration range:
---	---	-----------------------------

Details on test material: Test substance: no data



3. Annex: Mode of action / Human relevance Framework

Section 5.6.3: Repeated dose toxicity

Detailed information on mode of action / Human relevance framework:

Section 5.7.3: Genetic toxicity

Detailed information on mode of action / Human relevance framework:

Section 5.8.3: Carcinogenicity

Detailed information on mode of action / Human relevance framework:

Section 5.9.3: Toxicity to reproduction

Detailed information on mode of action / Human relevance framework: