

Appendix C

Flowback and Produced Water Composition

(Sources: NYSDEC, 2011, and USEPA, 2015)

Appendix C.1. Typical concentrations of flowback constituents based on limited samples in Pennsylvania and West Virginia (source: NYSDEC 2011)

Table C1.1. Typical concentrations of flowback constituents based on limited samples in Pennsylvania and West Virginia, and regulated in NY (source: NYSDEC 2011)

CAS #	Parameter name	Total no. of samples	No. of detects	Min	Median	Max	Units
00067-64-1	Acetone	3	1	681	681	681	µg/L
	Acidity, Total	4	4	101	240	874	mg/L
	Alkalinity ^a	155	155	0	153	384	mg/L
	Alkalinity, Carbonate, as CaCO ₃	164	163	0	9485	48336	mg/L
	Total Alkalinity	5	5	28	91	94	mg/L
07439-90-5	Aluminum	43	12	0.02	0.07	1.2	mg/L
	Aluminum, Dissolved	22	1	1.37	1.37	1.37	mg/L
07440-36-0	Antimony	34	1	0.26	0.26	0.26	mg/L
07664-41-7	Aqueous ammonia	48	45	11.3	44.8	382	mg/L
07440-38-2	Arsenic	43	7	0.015	0.09	0.123	mg/L
07440-39-3	Barium	48	47	0.553	1450	15700	mg/L
	Barium, Dissolved	22	22	0.313	212	19200	mg/L
00071-43-2	Benzene	35	14	15.7	479.5	1950	µg/L
07440-41-7	Beryllium	43	1	422	422	422	mg/L
	Bicarbonates	150	150	0	183	1708	mg/L
	Biochemical Oxygen Demand	38	37	3	200	4450	mg/L
00117-81-7	Bis(2-ethylhexyl)phthalate	20	2	10.3	15.9	21.5	µg/L
07440-42-8	Boron	23	9	0.539	2.06	26.8	mg/L
24959-67-9	Bromide	15	15	11.3	607	3070	mg/L
00075-25-2	Bromoform	26	2	34.8	36.65	38.5	µg/L
07440-43-9	Cadmium	43	6	0.007	0.025	1.2	mg/L
	Cadmium, Dissolved	22	2	0.017	0.026	0.035	mg/L
07440-70-2	Calcium	187	186	29.9	4241	123000	mg/L
	Calcium, Dissolved	3	3	2360	22300	31500	mg/L
	Caesium ^b	16	2	9.9	10.2	10.5	pCi/L
	Chemical Oxygen Demand	38	38	223	5645	33300	mg/L
	Chloride	193	193	287	56900	228000	mg/L
00124-48-1	Chlorodibromomethane	26	2	3.28	3.67	4.06	µg/L
07440-47-3	Chromium	43	9	0.009	0.082	760	mg/L
	Chromium (VI), dissolved	19	10	0.0126	0.539	7.81	mg/L
	Chromium, Dissolved	22	2	0.058	0.075	0.092	mg/L
07440-48-4	Cobalt	30	6	0.03	0.3975	0.62	mg/L
	Cobalt, dissolved	19	1	0.489	0.489	0.489	mg/L
	Coliform, Total	5	2	1	42	83	Col/100mL
	Color	3	3	200	1000	1250	PCU
07440-50-8	Copper	43	8	0.01	0.0245	0.157	mg/L
00057-12-5	Cyanide	7	2	0.006	0.0125	0.019	mg/L

CAS #	Parameter name	Total no. of samples	No. of detects	Min	Median	Max	Units
00075-27-4	Dichlorobromomethane	29	1	2.24	2.24	2.24	µg/L
00100-41-4	Ethyl Benzene	38	14	3.3	53.6	164	µg/L
16984-48-8	Fluoride	4	2	5.23	392.615	780	mg/L
	Heterotrophic plate count	5	3	25	50	565	CFU/mL
07439-89-6	Iron	193	168	0	29.2	810	mg/L
	Iron, Dissolved	34	26	6.75	63.25	196	mg/L
07439-92-1	Lead	43	6	0.008	0.035	27.4	mg/L
	Lithium	13	13	34.4	90.4	297	mg/L
	Lithium, Dissolved	4	4	24.5	61.35	144	mg/L
07439-95-4	Magnesium	193	180	9	177	3190	mg/L
	Magnesium, Dissolved	3	3	218	2170	3160	mg/L
	Mg as CaCO ₃	145	145	36	547	8208	mg/L
07439-96-5	Manganese	43	29	0.15	1.89	97.6	mg/L
	Manganese, Dissolved	22	12	0.401	2.975	18	mg/L
07439-97-6	Mercury	30	2	0.0006	0.295	0.59	mg/L
00074-83-9	Methyl Bromide	26	1	2.04	2.04	2.04	µg/L
00074-87-3	Methyl Chloride	26	1	15.6	15.6	15.6	µg/L
07439-98-7	Molybdenum	34	12	0.16	0.44	1.08	mg/L
00091-20-3	Naphthalene	23	1	11.3	11.3	11.3	µg/L
07440-02-0	Nickel	43	15	0.01	0.03	0.137	mg/L
	Nickel, Dissolved	22	2	0.03	0.0715	0.113	mg/L
	Nitrate, as N	1	1	0.025	0.025	0.025	mg/L
	Nitrogen, Total as N	1	1	13.4	13.4	13.4	mg/L
	Oil and Grease	39	9	5	17	1470	mg/L
	Petroleum hydrocarbons	1	1	0.21	0.21	0.21	mg/L
	pH	191	191	0	6.6	8.58	S.U.
00108-95-2	Phenol	20	1	459	459	459	µg/L
	Phenols	35	5	0.05	0.191	0.44	mg/L
57723-14-0	Phosphorus, as P	3	3	0.89	1.85	4.46	mg/L
7440-09-7	Potassium	33	17	15.5	125	7810	mg/L
	Potassium, Dissolved	3	3	84.2	327	7080	mg/L
	Scale Inhibitor	145	145	315	744	1346	mg/L
07782-49-2	Selenium	34	1	0.058	0.058	0.058	mg/L
	Selenium, Dissolved	22	1	1.06	1.06	1.06	mg/L
07440-22-4	Silver	43	3	0.129	0.204	6.3	mg/L
	Silver, Dissolved	22	2	0.056	0.0825	0.109	mg/L
07440-23-5	Sodium	42	41	83.1	23500	96700	mg/L
	Sodium, Dissolved	3	3	9290	54800	77400	mg/L
07440-24-6	Strontium	36	36	0.501	1115	5841	mg/L

CAS #	Parameter name	Total no. of samples	No. of detects	Min	Median	Max	Units
	Strontium, Dissolved	22	21	8.47	629	7290	mg/L
14808-79-8	Sulfate (as SO ₄)	193	169	0	1	1270	mg/L
	Sulfide (as S)	8	1	29.5	29.5	29.5	mg/L
14265-45-3	Sulfite (as SO ₃)	3	3	2.56	64	64	mg/L
	Surfactants ^c	12	12	0.1	0.21	0.61	mg/L
00127-18-4	Tetrachloroethylene	26	1	5.01	5.01	5.01	µg/L
07440-28-0	Thallium	34	2	0.1	0.18	0.26	mg/L
07440-32-6	Titanium	25	1	0.06	0.06	0.06	mg/L
00108-88-3	Toluene	38	15	2.3	833	3190	µg/L
	Total Dissolved Solids	193	193	1530	63800	337000	mg/L
07440-62-2	Vanadium	24	1	40.4	40.4	40.4	mg/L
	Total Kjeldahl Nitrogen	25	25	37.5	122	585	mg/L
	Total Organic Carbon	28	23	69.2	449	1080	mg/L
	Total Suspended Solids	43	43	16	129	2080	mg/L
	Xylenes	38	15	15.3	444	2670	µg/L
07440-66-6	Zinc	43	18	0.011	0.036	8570	mg/L
	Zinc, Dissolved	22	1	0.07	0.07	0.07	mg/L
	Fluid Density	145	145	1005.34	1042.48	1102.40	kg/m ³
	Hardness by Calculation	170	170	203	11354	98000	mg CaCO ₃ /L
	Salt %	145	145	0.9	5.8	13.9	%
	Specific Conductivity	15	15	1030	110000	165000	µmhos/cm
	Specific Gravity	150	154	0	1.04	1.201	
	Temperature	31	31	0	15.3	32	°C
	Temperature ^d	145	145	24.9	68	76.1	°F

^aDifferent data sources reported alkalinity in different and valid forms. Total alkalinity reported here is smaller than carbonate alkalinity because the data came from different sources

^bRegulated under beta particles

^cRegulated under foaming agents.

^dNYSDEC received lab reports from different sources; some reports had temperature in degrees Celsius while others in Fahrenheit.

Appendix C.2. USEPA Flowback and Produced Water Tables (source: (USEPA, 2015))

Table C2.1. Reported concentrations of general water quality parameters in produced water for unconventional shale and tight formations, presented as: average (minimum–maximum) or median (minimum–maximum)

Parameter	Units	Shales					Tight formations			
		Bakken ^a	Barnett ^b	Fayetteville ^c	Marcellus		Cotton Valley Group ^f	Devonian Sandstone ^g	Mesaverde ^f	Oswego ^f
States	n/a	MT, ND	TX	AR	PA ^d	PA, WV ^e	LA, TX	PA	CO, NM, UT, WY	OK
Acidity	mg/L	–	NC (ND–ND)	–	NC (<5–473)	162 (5–925)	–	–	–	–
Alkalinity	mg/L	–	725 (215–1240)	1347 (811–1896)	165 (8–577)	99.8 (7.5–577)	–	99 (43–194)	–	582 (207–1220)
Ammonium	mg/L	–	–	–	–	–	89 (40–131)	–	–	–
Bicarbonate	mg/L	291 (122–610)	–	–	–	–	–	524 (ND–8440)	2230 (1281–13,650)	–
Biochemical oxygen demand	mg/L	–	582 (101–2120)	–	–	141 (2.8–12,400)	–	–	–	–
Carbonate	mg/L	–	–	–	–	–	–	–	227 (ND–1680)	–
Chloride	mg/L	119,000 (90,000–133,000)	34,700 (9600–60,800)	9156 (5507–12,287)	57,447 (64–196,000)	49,000 (64.2–196,000)	101,332 (3167–221,498.7)	132,567 (58,900–207,000)	4260 (8–75,000)	44,567 (23,000–75,000)
Chemical oxygen demand	mg/L	–	2945 (927–3150)	–	15,358 (195–36,600)	4670 (195–36,600)	–	–	–	–
DO	mg/L	–	–	–	–	–	–	0.8 (0.2–2.5)	–	–
DOC	mg/L	–	11.2 (5.5–65.3)	–	–	117 (3.3–5960)	–	–	–	–
Hardness as CaCO ₃	mg/L	–	5800 (3500–21,000)	–	34,000 (630–95,000)	25,000 (156–106,000)	–	–	–	–

Final Report 4: Impacts and Mitigation Measures

Parameter	Units	Shales					Tight formations			
		Bakken ^a	Barnett ^b	Fayetteville ^c	Marcellus		Cotton Valley Group ^f	Devonian Sandstone ^g	Mesaverde ^f	Oswego ^f
States	n/a	MT, ND	TX	AR	PA ^d	PA, WV ^e	LA, TX	PA	CO, NM, UT, WY	OK
Oil and grease	mg/L	—	163.5 (88.2–1430)	—	74 (5–802)	16.85 (4.7–802)	—	—	—	—
pH	SU	5.87 (5.47–6.53)	7.05 (6.5–7.2)	—	6.6 (5.1–8.4)	6.5 (4.9–7.9)	—	6.3 (5.5–6.8)	8 (5.8–11.62)	6.3 (6.1–6.4)
Specific conductivity	µS/cm	213,000 (205,000–220,800)	111,500 (34,800–179,000)	—	—	183,000 (479–763,000)	—	184,800 (118,000–211,000)	—	—
Specific gravity	—	1.13 (1.0961–1.155)	—	—	—	—	—	—	—	—
TDS	mg/L	196,000 (150,000–219,000)	50,550 (16,400–97,800)	13,290 (9972–15,721)	106,390 (680–345,000)	87,800 (680–345,000)	164,683 (5241–356,666)	235,125 (106,000–354,000)	15,802 (1032–125,304)	73,082 (56,541–108,813)
Total Kjeldahl nitrogen	mg/L	—	171 (26–298)	—	—	94.9 (5.6–312)	—	—	—	—
TOC	mg/L	—	9.75 (6.2–36.2)	—	160 (1.2–1530)	89.2 (1.2–5680)	198 (184–212)	—	—	—
Total suspended solids	mg/L	—	242 (120–535)	—	352 (4–7600)	127 (6.8–3220)	—	—	—	—
Turbidity	NTU	—	239 (144–314)	—	—	126 (2.3–1540)	—	—	—	—

^aStepan *et al.* (2010). n = 3. Concentrations were calculated based on Stepan *et al.*'s raw data. Samples had charge balance errors of 1.74, –0.752, and –0.220%

^bHayes and Severin (2012b). n = 16. This data source reported concentrations without direct presentation of raw data.

^cWarner *et al.* (2013). n = 6. Concentrations were calculated based on Warner *et al.*'s raw data. Both flowback and produced water included.

^dBarbot *et al.* (2013). n = 134–159. This data source reported concentrations without direct presentation of raw data.

^eHayes (2009). n = 31–67. Concentrations were calculated based on Hayes's raw data. Both flowback and produced water included. Non-detects and contaminated blanks omitted.

^fBlondes *et al.* (2014). Cotton Valley Group, n=2; Mesa Verde, n = 1–407; Oswego, n = 4–30. Concentrations were calculated based on raw data presented in the U.S. Geological Survey (USGS) National Produced Water Database v2.0.

^gDresel and Rose (2010). n = 3–15. Concentrations were calculated based on Dresel and Rose's raw data.

Italic numbers are medians.

n/a, not applicable; NC, not calculated; ND, not detected, SU, standard units; –, no value available.

Table C2.2. Reported concentrations (mg/L) of inorganic constituents contributing to salinity in unconventional shale and tight formations produced water, presented as: average (minimum–maximum) or *median* (minimum–maximum)

Parameter	Shale					Tight formations			
	Bakken ^a	Barnett ^b	Fayetteville ^c	Marcellus		Cotton Valley Group ^f	Devonian Sandstone ^g	Mesaverde ^f	Oswego ^f
States	MT, ND	TX	AR	PA ^d	PA, WV ^e	LA, TX	PA	CO, NM, UT, WY	OK
Bromide	–	589 (117–798)	111 (96–144)	511 (0.2–1990)	512 (15.8–1990)	498 (32–1338)	1048 (349–1350)	–	–
Calcium	9680 (7540–13,500)	1600 (1110–6730)	317 (221–386)	7220 (38–41,000)	7465 (173–33,000)	19,998 (181–51,400)	20,262 (8930–34,400)	212 (1.01–4580)	5903 (3609–8662)
Chloride	119,000 (90,000–133,000)	34,700 (9600–60,800)	9156 (5507–12,287)	57,447 (64–196,000)	49,000 (64.2–196,000)	101,332 (3167–221,498.7)	132,567 (58,900–207,000)	4260 (8–75,000)	44,567 (23,000–75,000)
Fluoride	–	3.8 (3.5–12.8)	–	–	0.975 (0.077–32.9)	–	–	–	–
Iodine	–	–	–	–	–	20 (1–36)	39 (11–56)	1.01 (1.01–1.01)	–
Nitrate as N	–	–	NC (ND–ND)	–	1.7 (0.65–15.9)	–	–	0.6 (0.6–0.6)	–
Nitrite as N	–	4.7 (3.5–38.1)	–	–	11.8 (1.1–146)	–	–	–	–
Phosphorus	NC (ND–0.03)	0.395 (0.19–0.7)	–	–	0.3 (0.08–21.8)	–	–	–	–
Potassium	2970 (0–5770)	316 (80–750)	–	–	337 (38–3950)	1975 (8–7099)	858 (126–3890)	160 (4–2621)	–
Silica	7 (6.41–7)	–	52 (13–160)	–	–	4 (4–4)	–	–	–
Sodium	61,500 (47,100–74,600)	18,850 (4370–28,200)	3758 (3152–4607)	21,123 (69–117,000)	21,650 (63.8–95,500)	39,836 (1320–85,623.24)	58,160 (24,400–83,300)	5828 (132–48,817)	19,460 (13,484–31,328)

Final Report 4: Impacts and Mitigation Measures

Parameter	Shale					Tight formations			
	Bakken ^a	Barnett ^b	Fayetteville ^c	Marcellus		Cotton Valley Group ^f	Devonian Sandstone ^g	Mesaverde ^f	Oswego ^f
States	MT, ND	TX	AR	PA ^d	PA,WV ^e	LA, TX	PA	CO, NM, UT, WY	OK
Sulfate	660 (300–1000)	709 (120–1260)	NC (ND–3)	71 (0–763)	58.9 (2.4–348)	407 (ND–2200.46)	20 (1–140)	837 (ND–14,612)	183 (120–271)
Sulfide	–	NC (ND–ND)	–	–	3.2 (1.6–5.6)	–	0.7 (0.1–2.5)	–	–
Sulfite	–	–	–	–	12.4 (5.2–73.6)	–	–	–	–
TDS	196,000 (150,000–219,000)	50,550 (16,400–97,800)	13,290 (9972–15,721)	106,390 (680–345,000)	87,800 (680–345,000)	164,683 (5241–356,666)	235,125 (106,000–354,000)	15,802 (1032–125,304)	73,082 (56,541–108,813)

^aStepan *et al.* (2010). n = 3. Concentrations were calculated based on Stepan *et al.*'s raw data. Samples had charge balance errors of 1.74, –0.752, and –0.220%

^bHayes and Severin (2012b). n = 16. This data source reported concentrations without direct presentation of raw data.

^cWarner *et al.* (2013). n = 6. Concentrations were calculated based on Warner *et al.*'s raw data. Both flowback and produced water included.

^dBarbot *et al.* (2013). n = 134–159. This data source reported concentrations without direct presentation of raw data.

^eHayes (2009). n = 31–67. Concentrations were calculated based on Hayes's raw data. Both flowback and produced water included. Non-detects and contaminated blanks omitted.

^fBlondes *et al.* (2014). Cotton Valley Group, n=2; Mesa Verde, n = 1–407; Oswego, n = 4–30. Concentrations were calculated based on raw data presented in the U.S. Geological Survey (USGS) National Produced Water Database v2.0.

^gDresel and Rose (2010). n = 3–15. Concentrations were calculated based on Dresel and Rose's raw data.

Italic numbers are medians.

n/a, not applicable; NC, not calculated; ND, not detected, SU, standard units; –, no value available.

Table C2.3. Reported concentrations (mg/L) of metals and metalloids from unconventional shale and tight formation produced water, presented as: average (minimum–maximum) or *median* (minimum–maximum)

Parameter	Shale					Tight formation			
	Bakken ^a	Barnett ^b	Fayetteville ^c	Marcellus		Cotton Valley Group ^f	Devonian Sandstone ^g	Mesaverde ^f	Oswego ^f
States	MT, ND	TX	AR	PA ^d	PA, WV ^e	LA, TX	PA	CO, NM, UT, WY	OK
Aluminum	–	0.43 (0.37–2.21)	–	–	2.57 (0.22–47.2)	–	–	–	–
Antimony	–	NC (ND–ND)	–	–	0.028 (0.018–0.038)	–	–	–	–
Arsenic	–	NC (ND–ND)	–	–	0.101 (0.013–0.124)	–	–	–	–
Barium	10 (0–24.6)	3.6 (0.93–17.9)	4 (3–5)	2224 (0.24–13,800)	542.5 (2.590–13,900)	160 (ND–400.52)	1488 (7–4370)	139 (4–257)	–
Beryllium	–	NC (ND–ND)	–	–	–	–	–	–	–
Boron	116 (39.9–192)	30.3 (7.0–31.9)	4.800 (2.395–21.102)	–	12.2 (0.808–145)	37 (2–100)	–	10 (1–14.2)	–
Cadmium	–	NC (ND–ND)	–	–	–	–	–	–	–
Chromium	–	0.03 (0.01–0.12)	–	–	0.079 (0.011–0.567)	–	–	–	–
Cobalt	–	0.01 (0.01–0.01)	–	–	–	–	–	–	–
Copper	NC (ND–0.21)	0.29 (0.06–0.52)	–	–	0.506 (0.253–4.150)	0.7 (0.48–1)	0.04 (0.01–0.13)	–	–
Iron	96 (ND–120)	24.9 (12.1–93.8)	7 (1–13)	–	53.65 (2.68–574)	–	188 (90–458)	9 (1–29)	61 (41–78)
Lead	–	0.02 (0.01–0.02)	–	–	0.066 (0.003–0.970)	–	0.02 (0.01–0.04)	–	–

Final Report 4: Impacts and Mitigation Measures

Parameter	Shale					Tight formation			
	Bakken ^a	Barnett ^b	Fayetteville ^c	Marcellus		Cotton Valley Group ^f	Devonian Sandstone ^g	Mesaverde ^f	Oswego ^f
States	MT, ND	TX	AR	PA ^d	PA, WV ^e	LA, TX	PA	CO, NM, UT, WY	OK
Lithium	–	19.0 (2.56–37.4)	9.825 (2.777–28.145)	–	53.85 (3.410–323)	23 (1–53)	97.8 (20.2–315)	3 (1–33)	–
Magnesium	1270 (630–1750)	255 (149–755)	61 (47–75)	632 (17–2550)	678 (40.8–2020)	1363 (27–3712.98)	2334 (797–3140)	74 (1–2394)	753 (486–1264)
Manganese	7 (4–10.2)	0.86 (0.25–2.20)	2 (2–3)	–	2.825 (0.369–18.600)	30.33 (30.33–30.33)	19 (5.6–68)	–	–
Mercury	–	NC (ND–ND)	–	–	0.00024	–	–	–	–
Molybdenum	NC (ND–<0.2)	0.02 (0.02–0.03)	–	–	–	–	–	–	–
Nickel	–	0.04 (0.03–0.05)	–	0.1815 (0.007–0.137)	0.419 (0.068–0.769)	–	–	–	–
Selenium	–	0.03 (0.03–0.04)	–	–	0.004	–	–	–	–
Silver	–	–	–	–	4 (3–6)	–	–	–	–
Strontium	764 (518–1010)	529 (48–1550)	27 (14–49)	1695 (0.6–8460)	1240 (0.580–8020)	2312 (39–9770)	3890 (404–13,100)	–	–
Thallium	–	NC (ND–0.14)	–	–	0.168	–	–	–	–
Tin	–	NC (ND–ND)	–	–	–	–	–	–	–
Titanium	–	0.02 (0.02–0.03)	–	–	–	–	–	–	–

Final Report 4: Impacts and Mitigation Measures

Parameter	Shale					Tight formation			
	Bakken ^a	Barnett ^b	Fayetteville ^c	Marcellus		Cotton Valley Group ^f	Devonian Sandstone ^g	Mesaverde ^f	Oswego ^f
States	MT, ND	TX	AR	PA ^d	PA, WV ^e	LA, TX	PA	CO, NM, UT, WY	OK
Zinc	7 (2–11.3)	0.15 (0.10–0.36)	–	–	0.391 (0.087–247)	–	0.20 (0.03–1.26)	–	–

Note that calcium, potassium, and sodium appear in Table C1.3.

^aStepan *et al.* (2010). n = 3. Concentrations were calculated based on Stepan *et al.*'s raw data. Samples had charge balance errors of 1.74, –0.752, and –0.220%

^bHayes and Severin (2012b). n = 16. This data source reported concentrations without direct presentation of raw data.

^cWarner *et al.* (2013). n = 6. Concentrations were calculated based on Warner *et al.*'s raw data. Both flowback and produced water included.

^dBarbot *et al.* (2013). n = 134–159. This data source reported concentrations without direct presentation of raw data.

^eHayes (2009). n = 31–67. Concentrations were calculated based on Hayes's raw data. Both flowback and produced water included. Non-detects and contaminated blanks omitted.

^fBlondes *et al.* (2014). Cotton Valley Group, n=2; Mesa Verde, n = 1–407; Oswego, n = 4–30. Concentrations were calculated based on raw data presented in the U.S. Geological Survey (USGS) National Produced Water Database v2.0.

^gDresel and Rose (2010). n = 3–15. Concentrations were calculated based on Dresel and Rose's raw data.

Italic numbers are medians.

NC, not calculated; ND, not detected, SU, standard units; –, no value available.

Table C2.4. Reported concentrations (in pCi/L) of radioactive constituents in unconventional shale and sandstone produced water, presented as: average (minimum–maximum) or *median* (minimum–maximum)

Parameter	Marcellus				Devonian Sandstone ^a
States	NY, PA ^b	PA NORM STUDY (PA DEP, 2015)			PA
		Flowback ^c	Conventional Produced Water ^d	Unconventional Produced Water ^e	
Gross alpha	6845 (ND–123,000)	10,700 (288–71,000)	1835 (465–2570)	11,300 (2240–41,700)	–
Gross beta	1170 (ND–12,000)	2400 (742–21,300)	909 (402–1140)	3,445 (1.5–7600)	–
Radium-226	1869 (ND–16,920)	4500 (551–25,500)	243 (81–819)	6300 (1700–26,600)	2367 (200–5000)
Radium-228	557 (ND–2589)	633 (248–1740)	128 (26–896)	941 (366–1900)	–
Total Radium	2530 (0.192–18,045)	–	371 (107–1715)	7180 (2336–28,500)	–
Uranium ²³⁵	1 (ND–20)	–	–	–	–
Uranium ²³⁸	42 (ND–497)	–	–	–	–

Italic numbers are medians.

^aDresel and Rose (2010). *n* = 3. Concentrations presented were calculated based on Dresel and Rose's raw data.

^bRowan *et al.* (2011). *n* = 51. Concentrations presented were calculated based on Rowan *et al.*'s raw data for Marcellus samples. Uranium data from Barbot *et al.* (2013) *n* = 14.

^cPA DEP (2015). *n* = 9. Data reported in Table 3-14.

^dPA DEP (2015). *n* = 9. Values calculated from Table 3-15 for unfiltered samples.

^ePA DEP (2015). *n* = 4. Values calculated from Table 3-15 for unfiltered samples.

BDL, below detection limit ; n/a, not applicable; –, no value available.

Table C2.5. Concentrations of select organic parameters from unconventional shale, a tight formation, and coalbed produced water, presented as: average (minimum–maximum) or *median* (minimum–maximum)

Parameter	Unit	Shale			Tight Formation	Coal			
		Barnett ^a	Marcellus		Cotton Valley Group ^d	Powder River ^e	Raton ^e	San Juan ^e	Black Warrior ^f
States	n/a	TX	PA ^b	PA, WV ^c	LA, TX	MT, WY	CO, NM	AZ, CO, NM, UT	AL, MS
TOC	mg/L	9.75 (6.2–36.2)	160 (1.2–1530)	89.2 (1.2–5680)	198 (184–212)	3.52 (2.07–6.57)	1.74 (0.25–13.00)	2.91 (0.95–9.36)	6.03 (0.00–103.00)
DOC	mg/L	11.2 (5.5–65.3)	43 (5–695)	117 (3.3–5960)	–	3.18 (1.09–8.04)	1.26 (0.30–8.54)	3.21 (0.89–11.41)	3.37 (0.53–61.41)
BOD	mg/L	582 (101–2120)	–	141 (2.8–12,400)	–	–	–	–	–
Oil and grease	mg/L	163.5 (88.2–1430)	74 (5–802)	16.9 (4.7–802)	–	–	9.10 (0.60–17.6)	–	–
Benzene	µg/L	680 (49–5300)	–	220 (5.8–2000)	–	–	4.7 (BDL–220.0)	149.7 (BDL–500.0)	–
Toluene	µg/L	760 (79–8100)	–	540 (5.1–6200)	–	–	4.7 (BDL–78.0)	1.7 (BDL–6.2)	–
Ethylbenzene	µg/L	29 (2.2–670)	–	42 (7.6–650)	–	–	0.8 (BDL–18.0)	10.5 (BDL–24.0)	–
Xylenes	µg/L	360 (43–1400)	–	300 (15–6500)	–	–	9.9 (BDL–190.0)	121.2 (BDL–327.0)	–
Average total BTEX ^g	µg/L	1829	2910	1102	–	–	20.1	283.1	–

Italic numbers are medians. BDL, below detection limit; n/a, not applicable; –, no value available.

^aHayes and Severin (2012b). *n* = 16. This data source reported concentrations without presentation of raw data.

^bBarbot *et al.* (2013). *n* = 55; no presentation of raw data.

^cHayes (2009) *n* = 13–67. Concentrations were calculated based on Hayes' raw data. Both flowback and produced water included. Non-detects and contaminated blanks omitted.

^dBlondes *et al.* (2014). *n* = 2. Concentrations were calculated based on raw data presented in the USGS National Produced Water Database v2.0.

^eDahm *et al.* (2011). Powder River, *n* = 31; Raton, *n* = 40; San Juan, *n* = 20. This data source reported concentrations without presentation of raw data.

^fDOE (2014). *n* = 206. Concentrations were calculated based on the authors' raw data.

^gAverage total BTEX was calculated by summing the average/median concentrations of benzene, toluene, ethylbenzene, and xylenes for a unique formation or basin. Minimum to maximum ranges were not calculated due to inaccessible raw data.

Table C2.6. Reported concentrations (µg/L) of organic constituents in produced water for two unconventional shale formations, presented as: average (minimum–maximum) or *median* (minimum–maximum)

Parameter	Barnett ^a	Marcellus ^b
States	TX	MD, NY, OH, PA, VA, WY
Acetone	145 (27–540)	83 (14–5800)
Carbon disulfide	–	400 (19–7300)
Chloroform	–	28
Isopropylbenzene	35 (0.8–69)	120 (86–160)
Naphthalene	238 (4.8–3100)	195 (14–1400)
Phenolic compounds	119.65 (9.3–230)	–
1,2,4-Trimethylbenzene	173 (6.9–1200)	66.5 (7.7–4000)
1,3,5-Trimethylbenzene	59 (6.4–300)	33 (5.2–1900)
1,2-Diphenylhydrazine	4.2 (0.5–7.8)	–
1,4-Dioxane	6.5 (3.1–12)	–
2-Methylnaphthalene	1362 (5.4–20,000)	3.4 (2–120)
2-Methylphenol	28.3 (5.8–76)	13 (11–15)
2,4-Dichlorophenol	(ND–15)	–
2,4-Dimethylphenol	14.5 (8.3–21)	12
3-Methylphenol and 4-Methylphenol	41 (7.8–100)	11.5 (0.35–16)
Acetophenone	(ND–4.6)	13 (10–22)
Benzidine	(ND–35)	–
Benzo(a)anthracene	(ND–17.0)	–
Benzo(a)pyrene	(ND–130.0)	6.7
Benzo(b)fluoranthene	42.2 (0.5–84.0)	10
Benzo(g,h,i)perylene	42.3 (0.7–84.0)	6.9
Benzo(k)fluoranthene	32.8 (0.6–65.0)	5.9
Benzyl alcohol	81.5 (14.0–200)	41 (17–750)
Bis(2-Ethylhexyl) phthalate	210 (4.8–490)	20 (9.6–870)
Butyl benzyl phthalate	34.3 (1.9–110)	–
Chrysene	120 (0.57–240)	–
Di-n-octyl phthalate	(ND–270)	15
Di-n-butyl phthalate	41 (1.5–120)	14 (11–130)
Dibenz(a,h)anthracene	77 (3.2–150)	3.2 (2.3–11)
Diphenylamine	5.3 (0.6–10.0)	–
Fluoranthene	(ND–0.18)	6.1
Fluorene	0.8 (0.46–1.3)	8.4

Final Report 4: Impacts and Mitigation Measures

Indeno(1,2,3-cd)pyrene	71 (2.9–140)	3.1 (2.4–9.5)
N-Nitrosodiphenylamine	8.9 (7.8–10)	2.7
N-Nitrosomethylethylamine	(ND–410)	—
Phenanthrene	107 (0.52–1400)	9.75 (3–22)
Phenol	63 (17–93)	10 (2.4–21)
Pyrene	0.2 (ND–0.18)	13
Pyridine	413 (100–670)	250 (10–2600)

^aHayes and Severin (2012b). n = 16. Data from days 1–23 of flowback. This data source reported concentrations without presentation of raw data.

^bHayes (2009). n = 1–35. Data from days 1–90 of flowback. Concentrations were calculated from Hayes' raw data. Non-detects and contaminated blanks omitted.

—, no value available; ND, not detected.

Appendix D

Examples of Centralised Waste Treatment Facilities

(Source: USEPA, 2015)

Table D1.1. Examples of centralised waste treatment facilities

Facility	State	Description of unit processes	Does CWT have a NPDES permit for discharge?	Does CWT provide effluent for reuse?	Does CWT have advanced process for TDS removal?	What is the status of the facility as of January 2015?	Are effluent quality data available through literature search?
Pinedale Anticline Water Reclamation Facility ^a	WY	Oil/water separation, biological treatment, aeration, clarification, sand filtration, bioreactor, membrane bioreactor, RO, and ion exchange	No - However, facility is permitted to discharge under 40 CFR 435 Subpart E (WY0054224). Facility is permitted to discharge up to 25% of its effluent stream	Yes	Yes, RO (Boschee, 2014, 2012)	The treatment plant produces treated water for reuse and for discharge to surface water. The website indicates the facility is in operation and is recycling to support drilling operations and is discharging to the New Fork River (http://hswater.squarespace.com/pinedale-anticline/).	Yes – DMR data available on Wyoming DEQ website. Some information can also be obtained from Shafer (2011).
SEECO – Judsonia Water Reuse Recycling Facility	AR	Settling, biological treatment, induced gas flotation, and MVR	Yes - AR0052051	Yes	Yes, MVR	The treatment plant provides treated water for reuse and for discharge to surface water. Based on DMR data from late 2014-early 2015, the system is discharging treated water to a surface water body, though intermittently.	DMR data available

Final Report 4: Impacts and Mitigation Measures

Facility	State	Description of unit processes	Does CWT have a NPDES permit for discharge?	Does CWT provide effluent for reuse?	Does CWT have advanced process for TDS removal?	What is the status of the facility as of January 2015?	Are effluent quality data available through literature search?
Eureka Resources – Williamsport 2nd Street Facility	PA	Settling, oil/water separation, chemical precipitation, clarification, MVR. Can treat with or without TDS removal.	No - However, future plans to install RO for direct discharge capability	Yes	Yes, MVR	Per Ertel et al. (2013), the facility provides treatment wastewater for reuse and indirect discharge. The facility treats entirely or almost entirely hydraulic fracturing wastewater.	No
Standing Stone Facility, Bradford County	PA	Settling, oil/water separation, chemical precipitation, clarification, MVR, crystallization	Yes - PA0232351	Yes	Yes, MVR, crystallizer	The facility can provide treated wastewater for reuse and also has received an NPDES permit for direct discharge. The facility treats hydraulic fracturing wastewater.	No

Final Report 4: Impacts and Mitigation Measures

Facility	State	Description of unit processes	Does CWT have a NPDES permit for discharge?	Does CWT provide effluent for reuse?	Does CWT have advanced process for TDS removal?	What is the status of the facility as of January 2015?	Are effluent quality data available through literature search?
Wellington Water Works	CO	Dissolved air flotation, pre- filtration, microfiltration with ceramic membranes, activated carbon adsorption. Water is pumped to an aquifer storage and recovery well. Water is then extracted and treated with RO (Alzahrani et al., 2013).	Permit number issued by CO (61879)	Yes	Yes, RO but only after the water is sent to an aquifer storage and recovery well	Per Stewart (2013b), the facility is providing treated wastewater for reuse, for agricultural use, to a shallow well to augment the municipal drinking water supply, and for discharge to the Colorado River.	No
Casella Altela Regional Environmental Services (CARES) McKean Facility	McKean County, PA	Pretreatment system (not defined in literature) and thermal distillation	Yes – PA0102288	Yes	Yes – thermal distillation	The treatment plant is capable of reuse and recycle for fracturing operations and surface water discharge of excess water. However, the facility's website indicates it is only treating water for reuse/recycle as of early 2015 (http://caresforwater.com/location/cares-mckean).	No - just NPDES discharge requirements

Final Report 4: Impacts and Mitigation Measures

Facility	State	Description of unit processes	Does CWT have a NPDES permit for discharge?	Does CWT provide effluent for reuse?	Does CWT have advanced process for TDS removal?	What is the status of the facility as of January 2015?	Are effluent quality data available through literature search?
Clarion Altela Environmental Services (CAES) Facility	Clarion County, PA	Pretreatment system (not defined in literature) and thermal distillation	Yes – PA0103632	Yes	Yes – thermal distillation	The treatment plant capable of reuse and recycle for fracturing operations and surface water discharge of excess water. However, the facility's website indicates it is only treating water for reuse/recycle as of early 2015 (http://caeswater.com/technology/).	No – just NPDES discharge requirements
Terraqua Resource Management (aka. Water Tower Square Gas Well Wastewater Processing Facility)	Lycoming County, PA	Equalization tanks, oil-water separation via chemical addition (sulfuric acid, emulsion breaker), pH adjustment, coagulation, flocculation, inclined plate clarifier, sand filtration	Yes – PA0233650 Permit pending approval for discharge to stream (as of 4/17/2009)	Yes	No – However, TARM recognizes that they can't discharge, until they install TDS treatment	According to its website (last updated 2012), the facility reuses/recycles treated water for fracturing operations (http://www.tarmsolutions.com/solutions/).	No
Maggie Spain Water-Recycling Facility	Decatur, TX	Settling, flash mixer with lime and polymer addition, inclined plate clarifier, surge tank, MVR	No	Yes	Yes – MVR	A 17-month pilot study using a commercial-scale mobile treatment facility was concluded in 2011. The status is unclear as of early 2015.	Yes – Some information can be obtained from Hayes et al. (2014).

Final Report 4: Impacts and Mitigation Measures

Facility	State	Description of unit processes	Does CWT have a NPDES permit for discharge?	Does CWT provide effluent for reuse?	Does CWT have advanced process for TDS removal?	What is the status of the facility as of January 2015?	Are effluent quality data available through literature search?
Fountain Quail/NAC Services - Kenedy	Kenedy, TX	Oil-water separator, coagulation, flocculation, sedimentation, filtration, MVR.	No	Yes	Yes – MVR	According to its website, the facility reuses/recycles treated water for fracturing operations (http://www.aqua-pure.com/operations/shale/ford/ford.html).	No
Purestream - Gonzales facility	Gonzales, TX	Induced gas flotation and MVR	No	Yes	Yes - MVR	Per Dahm and Chapman (2014) commercial operations deployed March 2014 for reuse/recycle for fracturing operations.	No
LINN Energy Fyre Ranch - Granite Wash	Wheeler County, TX	Induced gas flotation and MVR	No	Yes	Yes - MVR	AVARA system installed for reuse/recycle in June 2014. http://purestream.com/index.php/water-management/vapor-recompression/photos-and-videos	No

Final Report 4: Impacts and Mitigation Measures

Facility	State	Description of unit processes	Does CWT have a NPDES permit for discharge?	Does CWT provide effluent for reuse?	Does CWT have advanced process for TDS removal?	What is the status of the facility as of January 2015?	Are effluent quality data available through literature search?
Fluid Recovery Service Josephine Facility ^b	PA	Oil-water separator, aeration, chemical precipitation with sodium sulfate, lime, and a polymer, inclined plate clarifier	Expired - PA0095273	No	No	The facility claims to have stopped accepting Marcellus wastewater September 30, 2011 (Ferrar et al., 2013). It treats conventional oil and gas wastewater. The facility will be upgrading to include evaporative technology that will enable it to attain monthly average TDS levels of 500 mg/L or less.	Yes – Some effluent results obtained from Ferrar et al. (2013) and Warner et al. (2013a). Also minimal DMR data from the EPA.
Fluid Recovery Service Franklin Facility ^b	PA	Oil-water separator, aeration, chemical precipitation with sodium sulfate, lime, and a polymer, inclined plate clarifier	Expired - PA0101508	No	No	This facility is not accepting wastewater from hydraulic fracturing operations as of January 2015. The facility will be upgrading to include evaporative technology that will enable it to attain monthly average TDS levels of 500 mg/L or less.	Minimal DMR data from the EPA.

Final Report 4: Impacts and Mitigation Measures

Facility	State	Description of unit processes	Does CWT have a NPDES permit for discharge?	Does CWT provide effluent for reuse?	Does CWT have advanced process for TDS removal?	What is the status of the facility as of January 2015?	Are effluent quality data available through literature search?
Hart Resources-Creekside Facility ^b	PA	Oil-water separator, aeration, chemical precipitation with sodium sulfate, lime, and a polymer, inclined plate clarifier	Expired - PA0095443	No	No	This facility is not accepting wastewater from hydraulic fracturing operations as of January 2015. The facility will be upgrading to include evaporative technology that will enable it to attain monthly average TDS levels of 500 mg/L or less.	Minimal DMR data from the EPA.

^aFor Pinedale Anticline Water Reclamation Facility, surface water discharges are permitted under 40 CFR 435 Subpart E (beneficial use subcategory agricultural and wildlife water) not 40 CFR 437 (the discharge permit for CWTs). For the purposes of this assessment, this facility is included with CWTs.

^bAs of May 15, 2013, these facilities are under an administrative order (AO). According to the AO, these facilities must comply with a monthly effluent limit for TDS not to exceed 500 mg/L. This will allow them to treat high-saline wastewaters typical of unconventional oil and gas operations. To meet the requirements of the AO, they have applied to PADEP for a NPDES permit and are planning to install treatment for TDS.

Appendix E

Estimated Effluent Concentrations, for example constituents based on treatment process removal efficiencies

(Source: USEPA, 2015)

Table E1.1. Estimated effluent concentrations for example constituents based on treatment process removal efficiencies

Shale/ Sandstone Play	Contaminant	MCL	Avg. influent conc.	Units	Freeze-thaw evaporation	Media filtration	Chemical precipitation	Flotation (DAF)	Electro-coagulation	Advanced oxidation and precipitation	Reverse osmosis	Membrane filtration (UF/MF)	Distillation	Ion exchange	Electrodialysis	Adsorption	Biological treatment (biodisks, BAFs)	Constructed wetland
Bakken	Barium	2	10	mg/L		1				0.44	0.8		0.1–0.3	ND–0.7				2.2
Barnett	Barium	2	3.6	mg/L		0.4				0.16	0.29		0.036–0.11	ND–0.3				0.8
Fayetteville	Barium	2	4	mg/L		0.4				0.18	0.32		0.04–0.12	ND–0.3				0.9
Marcellus	Barium	2	2200	mg/L		220				98	180		22–67	ND–160				490
Cotton Valley	Barium	2	160	mg/L		16				7	13		1.6–4.8	ND–11				35
Mesaverde	Barium	2	140	mg/L		14				6.1	11		1.4–4.2	ND–9.7				31
Marcellus	Cadmium	5	25	µg/L	2.5	2.5					13				5			15
Bakken	Strontium	—	760	mg/L		76							7.6–23	53				
Barnett	Strontium	—	530	mg/L		53							5.3–16	37				
Fayetteville	Strontium	—	27	mg/L		2.7							0.27–0.81	1.9				
Marcellus	Strontium	—	1700	mg/L		170							17–51	120				
Cotton Valley	Strontium	—	2300	mg/L		230							23–69	160				
Devonian Sandstone	Strontium	—	3900	mg/L		390							39–120	270				
Marcellus	Radium 226	—	620	pCi/L			32–440			6.2			6.2–19	44				
Devonian Sandstone	Radium 226	—	2400	pCi/L			120–1700			24			24–71	170				
Marcellus	Radium 228	—	120	pCi/L			6.2–85			1.2			1.2–3.6	8.4				
Marcellus	Total Radium	5	2500	pCi/L			130–1800			25			25–76	180				
Barnett	TOC	—	9.8	mg/L							0.2				0.98–2.9	2.1–4		1
Marcellus	TOC	—	160	mg/L							3.2				16–48	35–58		16

Final Report 4: Impacts and Mitigation Measures

Shale/ Sandstone Play	Contaminant	MCL	Avg. influent conc.	Units	Freeze-thaw evaporation	Media filtration	Chemical precipitation	Flotation (DAF)	Electro-coagulation	Advanced oxidation and precipitation	Reverse osmosis	Membrane filtration (UF/MF)	Distillation	Ion exchange	Electrodialysis	Adsorption	Biological treatment (biodisks, BAFs)	Constructed wetland
Cotton Valley	TOC	—	200	mg/L								4				20–59	44–71	20
Barnett	BOD	—	580	mg/L					58					290–440			29–87	47
Marcellus	BOD	—	40	mg/L					4					20–30			2–6	3.2
Barnett	O&G	—	160	mg/L		16						16			8	1.6	43	9.8
Marcellus	O&G	—	74	mg/L		7.4						7.4			3.7	0.74	19	4.4
Barnett	Benzene	5	680	µg/L	68							310	6.8			110		ND
Marcellus	Benzene	5	360	µg/L	36							170	3.6			58		ND
Barnett	Toluene	1,000	760	µg/L	76							350				84		ND
Marcellus	Toluene	1,000	1100	µg/L	110							510				120		ND
Barnett	Ethylbenzene	700	29	µg/L	2.9			17								3.2		ND
Marcellus	Ethylbenzene	700	150	µg/L	15			90								17		ND
Barnett	Xylenes	10,000	360	µg/L	36							170				14		ND
Marcellus	Xylenes	10,000	1300	µg/L	130							600				52		ND
Barnett	BTEX	—	1800	µg/L	180					7.3			91	270–550		3.7–91		
Marcellus	BTEX	—	2900	µg/L	290					12			150	440–870		5.8–150		
Barnett	Naphthalene	—	240	µg/L						0.95								
Marcellus	Naphthalene	—	360	µg/L						1.4								
Barnett	1,2,4- Trimethyl- benzene	—	170	µg/L						0.69								
Marcellus	1,2,4- Trimethyl- benzene	—	430	µg/L						1.7								

Final Report 4: Impacts and Mitigation Measures

Shale/ Sandstone Play	Contaminant	MCL	Avg. influent conc.	Units	Freeze-thaw evaporation	Media filtration	Chemical precipitation	Flotation (DAF)	Electro-coagulation	Advanced oxidation and precipitation	Reverse osmosis	Membrane filtration (UF/MF)	Distillation	Ion exchange	Electrodialysis	Adsorption	Biological treatment (biodisks, BAFs)	Constructed wetland
Barnett	1,2,4- Trimethyl- benzene	—	59	µg/L						0.24								
Marcellus	1,2,4- Trimethyl- benzene	—	310	µg/L						1.2								

ND, Non-detect.

Appendix F

Chemicals Database Information

Table F1.1. Chemicals used in hydraulic fracturing and hazard classifications

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Methanol	67-56-1	Dossier	Flam. Liq. 2 Acute Tox. 3 * Acute Tox. 3 * Acute Tox. 3 * STOT SE 1	H225 H331 H311 H301 H370 **	Y	N	--	N		Unknown	Non hazardous
Distillates, petroleum, hydrotreated light	64742-47-8	Dossier	Asp. Tox. 1	H304	N	N	--	N		Unknown	Unknown
Hydrochloric acid	7647-01-0	Dossier	Press. Gas Acute Tox. 3 * Skin Corr. 1A	H331 H314	Y	N	--	N		Unknown	Unknown
Water	7732-18-5	Not Registered	Not listed	Not listed	na	N	--	na		Unknown	Unknown
Isopropanol	67-63-0	Dossier	Flam. Liq. 2 Eye Irrit. 2 STOT SE 3	H225 H319 H336	N	N	--	N		Undetermined	Non hazardous
Ethylene glycol	107-21-1	Dossier	Acute Tox. 4 *	H302	Y	N	--	N		Undetermined	Non hazardous
Peroxydisulfuric acid, diammonium salt	7727-54-0	Dossier	Ox. Sol. 3 Acute Tox. 4 * Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Resp. Sens. 1 Skin Sens. 1	H272 H302 H319 H335 H315 H334 H317	Y	N	--	N		Unknown	Unknown

Final Report 4: Impacts and Mitigation Measures

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Sodium hydroxide	1310-73-2	Dossier	Skin Corr. 1A	H314	N	N	--	N		Undetermined	Unknown
Guar gum	9000-30-0	Not Registered	Not listed	Not listed	Unknown	N	--			Unknown	Unknown
Quartz	14808-60-7	Not Registered	Not listed	Not listed	na	N	--	na		Unknown	Unknown
Glutaraldehyde	111-30-8	Dossier	Acute Tox. 3 * Acute Tox. 3 * Skin Corr. 1B Resp. Sens. 1 Skin Sens. 1 Aquatic Acute 1	H331 H301 H314 H334 H317 H400	Y	N	--	N	Y	Non hazardous	Non hazardous
Propargyl alcohol	107-19-7	Dossier	Flam. Liq. 3 Acute Tox. 3 * Acute Tox. 3 * Acute Tox. 3 * Skin Corr. 1B Aquatic Chronic 2	H226 H331 H311 H301 H314 H411	Y	N	--	Y		Unknown	Unknown
Potassium hydroxide	1310-58-3	Dossier	Acute Tox. 4 * Skin Corr. 1A	H302 H314	Y	N	--	N		Undetermined	Unknown
Ethanol	64-17-5	Dossier	Flam. Liq. 2	H225	N	N	--	N		Undetermined	Non hazardous
Acetic acid	64-19-7	Dossier	Flam. Liq. 3 Skin Corr. 1A	H226 H314	N	N	--	N		Undetermined	Non hazardous
Citric acid	77-92-9	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Non hazardous

Final Report 4: Impacts and Mitigation Measures

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
2-Butoxyethanol	111-76-2	Dossier	Acute Tox. 4 * Acute Tox. 4 * Acute Tox. 4 * Eye Irrit. 2 Skin Irrit. 2	H332 H312 H302 H319 H315	Y	N	--	N		Undetermined	Non hazardous
Sodium chloride	7647-14-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Solvent naphtha, petroleum, heavy arom.	64742-94-5	Dossier	Asp. Tox. 1	H304	N	N	--	N		Unknown	Unknown
Naphthalene	91-20-3	Dossier	Carc. 2 Acute Tox. 4 * Aquatic Acute 1 Aquatic Chronic 1	H351 H302 H400 H410	Y	N	--	Y	Y	Hazardous	Hazardous
2,2-Dibromo-3-nitrilopropionamide	10222-01-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Non hazardous
Phenolic resin	9003-35-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Choline chloride	67-48-1	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Non hazardous
Methenamine	100-97-0	Dossier	Flam. Sol. 2 Resp. Sens. 1 Skin Sens. 1	H228 H334 H317	N	N	--	N		Non hazardous	Unknown
Carbonic acid, dipotassium salt	584-08-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
1,2,4-Trimethylbenzene	95-63-6	Dossier	Flam. Liq. 3 Acute Tox. 4 * Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Aquatic Chronic 2	H226 H332 H319 H335 H315 H411	Y	N	--	Y		Hazardous	Unknown
Quaternary ammonium compounds, benzyl-C12-16-alkyldimethyl, chlorides	68424-85-1	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Poly(oxy-1,2-ethanediyl)-nonylphenyl-hydroxy (mixture)	127087-87-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Formic acid	64-18-6	Dossier	Skin Corr. 1A	H314	N	N	--	N		Unknown	Non hazardous
Sodium chlorite	7758-19-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Nonyl phenol ethoxylate	9016-45-9	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Tetrakis(hydroxy methyl)phosphonium sulfate	55566-30-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Non hazardous
Polyethylene glycol	25322-68-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Final Report 4: Impacts and Mitigation Measures

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Ammonium chloride	12125-02-9	Dossier	Acute Tox. 4 * Eye Irrit. 2	H302 H319	Y	N	--	N		Unknown	Non hazardous
Sodium persulfate	7775-27-1	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Tetramethylamm onium chloride	75-57-0	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Non hazardous
N,N-Dimethylformami de	68-12-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Non hazardous
Boric acid	10043-35-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Diatomaceous earth, calcined	91053-39-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Boron sodium oxide	1330-43-4	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Non hazardous	Non hazardous
Ethoxylated propoxylated C12-14 alcohols	68439-51-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Thiourea polymer	68527-49-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Didecyl dimethyl ammonium chloride	7173-51-5	Dossier	Acute Tox. 4 * Skin Corr. 1B	H302 H314	Y	N	--	N		Unknown	Unknown
Ethoxylated C14-15 alcohols	68951-67-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Alkenes, C>10 .alpha.-	64743-02-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Sodium erythorbate	6381-77-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Non hazardous
Ethylenediamine tetraacetic acid tetrasodium salt hydrate	64-02-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Non hazardous
Fatty acids, tall-oil	61790-12-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Potassium metaborate	13709-94-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium tetraborate decahydrate	1303-96-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Phosphonic acid	13598-36-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Tri-n-butyl tetradecyl phosphonium chloride	81741-28-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Glycine, N,N-bis(carboxymethyl)-, trisodium salt	5064-31-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Non hazardous
Sodium perborate tetrahydrate	10486-00-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
2-Mercaptoethanol	60-24-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Final Report 4: Impacts and Mitigation Measures

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Benzyl chloride	100-44-7	Dossier	Carc. 1B Acute Tox. 3 * Acute Tox. 4 * STOT RE 2 * STOT SE 3 Skin Irrit. 2 Eye Dam. 1	H350 H331 H302 H373 ** H335 H315 H318	Y	N	Cat 1B	N		Hazardous	Hazardous
Glycerin, natural	56-81-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Naphtha, petroleum, hydrotreated heavy	64742-48-9	Dossier	Carc. 1B Asp. Tox. 1	H350 H304	N	N	Cat 1B	N		Unknown	Unknown
Alkylaryl sulphonic acid	27176-87-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Diethylene glycol	111-46-6	Dossier	Acute Tox. 4 *	H302	Y	N	--	N		Unknown	Unknown
Sodium hypochlorite	7681-52-9	Dossier	Skin Corr. 1B Aquatic Acute 1	H314 H400	Y	N	--	N	Y	Unknown	Unknown
Ammonium acetate	631-61-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Potassium chloride	7447-40-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Triethanolamine	102-71-6	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
1-Propanol	71-23-8	Dossier	Flam. Liq. 2 Eye Dam. 1 STOT SE 3	H225 H318 H336	N	N	--	N		Unknown	Unknown
Tetrahydro-3,5-dimethyl,2H-1,3,5-thiadiazine-2-thione	533-74-4	Not Registered	Acute Tox. 4 * Eye Irrit. 2 Aquatic Acute 1 Aquatic Chronic 1	H302 H319 H400 H410	Y	N	--	Y	Y	Non hazardous	Non hazardous
Citrus terpenes	94266-47-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Distillates, petroleum, hydrotreated light paraffinic	64742-55-8	Dossier	Carc. 1B	H350	N	N	Cat 1B	N		Unknown	Unknown
1-Benzylquinolinium chloride	15619-48-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Cinnamaldehyde (3-phenyl-2-propenal)	104-55-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Non hazardous
Sodium thiosulfate	7772-98-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Acetic anhydride	108-24-7	Dossier	Flam. Liq. 3 Acute Tox. 4 * Acute Tox. 4 * Skin Corr. 1B	H226 H332 H302 H314	Y	N	--	N		Unknown	Unknown
Tetradecyl dimethyl benzyl	139-08-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
ammonium chloride											
Hemicellulase Enzyme Concentrate	9025-56-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Terpenes and Terpenoids, sweet orange-oil	68647-72-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Calcium chloride	10043-52-4	Dossier	Eye Irrit. 2	H319	N	N	--	N		Unknown	Unknown
2-Ethylhexanol	104-76-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Non hazardous
Isotridecanol, ethoxylated	9043-30-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Cupric chloride dihydrate	10125-13-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sorbitan, mono-(9Z)-9-octadecenoate	1338-43-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Copolymer of acrylamide and sodium acrylate	25987-30-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ammonium hydroxide	1336-21-6	Dossier	Skin Corr. 1B Aquatic Acute 1	H314 H400	Y	N	--	N	Y	Unknown	Unknown
Ethoxylated C12-16 alcohols	68551-12-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Formic acid,	590-29-4	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
potassium salt											
2-Propenoic acid, polymer with 2-propenamide	9003-06-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Poly(oxy-1,2-ethanediyl), alpha-(nonylphenyl)-omega-hydroxy, branched	68412-54-4	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Copper(II) chloride	7447-39-4	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1,2-Propylene glycol	57-55-6	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Non hazardous
Tar bases, quinoline derivatives, benzyl chloride-quaternized	72480-70-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium bromate	7789-38-0	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Magnesium chloride	7786-30-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Alcohols, C12-14-secondary, ethoxylated	84133-50-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
C10-C16 ethoxylated	68002-97-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Final Report 4: Impacts and Mitigation Measures

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
alcohol											
Magnesium nitrate	10377-60-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Triethyl phosphate	78-40-0	Dossier	Acute Tox. 4 *	H302	Y	N	--	N		Unknown	Unknown
2-Methyl-3(2H)-isothiazolone	2682-20-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Non hazardous	Unknown
5-Chloro-2-methyl-3(2H)-isothiazolone	26172-55-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Hazardous	Hazardous
Poly(oxy-1,2-ethanediyl), alpha-hexyl-omega-hydroxy	31726-34-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Diethanolamine	111-42-2	Dossier	Acute Tox. 4 * STOT RE 2 * Skin Irrit. 2 Eye Dam. 1	H302 H373 ** H315 H318	Y	N	--	N		Undetermined	Unknown
White mineral oil, petroleum	8042-47-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Zirconium, acetate lactate oxo ammonium complexes	68909-34-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Cristobalite	14464-46-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Alcohols, C7-9-iso-, C8-rich, ethoxylated	78330-19-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Nonoxynolá	26027-38-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
tert-Butyl Hydroperoxide (70% Solution in Water)	75-91-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Alcohols, C9-11-iso-, C10-rich, ethoxylated	78330-20-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Coconut oil acid/Diethanola mine condensate (2:1)	68603-42-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Hydrogen peroxide	7722-84-1	Dossier	Ox. Liq. 1 Acute Tox. 4 * Acute Tox. 4 * Skin Corr. 1A	H271 H332 H302 H314	Y	N	--	N		Undetermined	Unknown
Sodium sulfate	7757-82-6	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Boric acid, dipotassium salt	1332-77-0	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Propylene pentamer	15220-87-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
diethylenetriamine	111-40-0	Dossier	Acute Tox. 4 * Acute Tox. 4 * Skin Corr. 1B Skin Sens. 1	H312 H302 H314 H317	Y	N	--	N		Unknown	Unknown
Zirconium,tetrakis[2-[bis(2-hydroxyethyl)amino-kN]ethanolato-kO]-	101033-44-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Hazardous
1-Butoxy-2-propanol	5131-66-8	Dossier	Eye Irrit. 2 Skin Irrit. 2	H319 H315	N	N	--	N		Undetermined	Unknown
Chloride	16887-00-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Magnesium oxide (MgO)	1309-48-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ethoxylated C12-14 alcohols	68439-50-9	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1,2-Ethanediaminium, N, N'-bis[2-[bis(2-hydroxyethyl)methylammonio]ethyl]-N,N'bis(2-hydroxyethyl)-N,N'-dimethyl-,tetrachloride	138879-94-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Aminotrimethylene phosphonic acid	6419-19-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Monoethanolamine borate	26038-87-9	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Calcium peroxide	1305-79-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Magnesium peroxide (Mg(O ₂))	14452-57-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium metaborate tetrahydrate	10555-76-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Nitrogen, liquid	7727-37-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Alcohols, C11-14-iso-, C13-rich, ethoxylated	78330-21-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Hemicellulase enzyme	9012-54-8	Dossier	Resp. Sens. 1	H334	N	N	--	N		Unknown	Unknown
Bronopol	52-51-7	Dossier	Acute Tox. 4 * Acute Tox. 4 * STOT SE 3 Skin Irrit. 2 Eye Dam. 1 Aquatic Acute 1	H312 H302 H335 H315 H318 H400	Y	N	--	N	Y	Hazardous	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Ethanolamine	141-43-5	Dossier	Acute Tox. 4 * Acute Tox. 4 * Acute Tox. 4 * Skin Corr. 1B	H332 H312 H302 H314	Y	N	--	N		Undetermined	Unknown
Triethanolamine polyphosphate ester	68131-71-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
(4R)-1-methyl-4-(prop-1-en-2-yl)cyclohexene	5989-27-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Talc	14807-96-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Acrylic polymers	26006-22-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Oxyalkylated nonyl phenolic resin	30846-35-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
N,N-Dimethyldecylamine oxide	2605-79-0	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Acetic acid, mercapto-, monoammonium salt	5421-46-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Quaternary ammonium compounds, benzyl-C10-16-alkyldimethyl,ác	68989-00-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
hlorides											
Glycolic acid	79-14-1	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Vinylidene chloride/methylacrylate copolymer	25038-72-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Methoxyacetic acid	625-45-6	Dossier	Repr. 1B Acute Tox. 4 * Skin Corr. 1B	H360-FD H302 H314	Y	Y	--	N		Unknown	Unknown
Quaternary ammonium compounds, (oxydi-2,1-ethanediyl)bis[co co alkyl dimethyl, dichlorides	68607-28-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Triethylene glycol	112-27-6	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Formalin	50-00-0	Dossier	Carc. 2 Acute Tox. 3 * Acute Tox. 3 * Acute Tox. 3 * Skin Corr. 1B Skin Sens. 1	H351 H331 H311 H301 H314 H317	Y	N	Cat 2	N		Non hazardous	Non hazardous
Formamide	75-12-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Pluronic F-127	9003-11-6	Not	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
		Registered									
Corn sugar gum	11138-66-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Sodium acetate	127-09-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Sodium bisulfite, mixture of NaHSO ₃ and Na ₂ S ₂ O ₅	7631-90-5	Dossier	Acute Tox. 4 *	H302	Y	N	--	N		Undetermined	Unknown
Glycolic acid sodium salt	2836-32-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sulfuric acid	7664-93-9	Dossier	Skin Corr. 1A	H314	N	N	--	N		Undetermined	Unknown
2-bromo-3-nitropropionamide	1113-55-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Trimethylamine quaternized polyepichlorohydrin	51838-31-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ammonia	7664-41-7	Dossier	Flam. Gas 2 Press. Gas Acute Tox. 3 * Skin Corr. 1B Aquatic Acute 1	H221 H331 H314 H400	Y	N	--	N	Y	Non hazardous	Non hazardous
1-Propanol, zirconium(4+) salt	23519-77-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1-Decanol	112-30-1	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
1-Octanol	111-87-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Solvent naphtha, petroleum, heavy aliph.	64742-96-7	Dossier	Asp. Tox. 1	H304	N	N	--	N		Unknown	Unknown
Propanol, 1(or 2)-(2-methoxymethylthoxy)-	34590-94-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Dibromoacetone	3252-43-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Hazardous	Non hazardous
Quaternary ammonium compounds, dicocoo alkyldimethyl, chlorides	61789-77-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1-Butanol	71-36-3	Dossier	Flam. Liq. 3 Acute Tox. 4 * STOT SE 3 Skin Irrit. 2 Eye Dam. 1 STOT SE 3	H226 H302 H335 H315 H318 H336	Y	N	--	N		Unknown	Unknown
Dodecylbenzene sulfonic acid, monoethanolamine salt	26836-07-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium carbonate	497-19-8	Dossier	Eye Irrit. 2	H319	N	N	--	N		Undetermined	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Anionic polyacrylamide	25085-02-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Stannous chloride dihydrate	10025-69-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Oils, pine	8002-09-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sulfamic acid	5329-14-6	Dossier	Eye Irrit. 2 Skin Irrit. 2 Aquatic Chronic 3	H319 H315 H412	Y	N	--	Y		Undetermined	Unknown
Attapulgate	12174-11-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Distillates, petroleum, hydrotreated middle	64742-46-7	Dossier	Carc. 1B	H350	N	N	Cat 1B	N		Unknown	Unknown
Guar gum, carboxymethyl 2-hydroxypropyl ether, sodium salt	68130-15-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Benzylhexadecyl dimethylammonium chloride	122-18-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Thiocyanic acid, ammonium salt	1762-95-4	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Sorbitan, monooctadecenoate, poly(oxy-1,2-ethanediyl) derivis.	9005-67-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ethoxylated C9-11 alcohols	68439-46-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Non hazardous
Potassium acetate	127-08-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, chlorides	68391-01-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Magnesium hydroxide	1309-42-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Phosphoric acid Divosan X-Tend formulation	7664-38-2	Dossier	Skin Corr. 1B	H314	N	N	--	N		Non hazardous	Non hazardous
Carboxymethyl guar gum, sodium salt (GW-45)	39346-76-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Raffinates, petroleum, sorption process	64741-85-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Chlorine dioxide	10049-04-4	Dossier	Ox. Gas 1 Press. Gas Acute Tox. 2 * Skin Corr. 1B Aquatic Acute 1	H270 H330 H314 H400	Y	N	--	N	Y	Unknown	Unknown
Triisopropanolamine	122-20-3	Dossier	Eye Irrit. 2 Aquatic Chronic 3	H319 H412	Y	N	--	Y		Unknown	Unknown
2-Amino-2-methylpropan-1-ol	124-68-5	Dossier	Eye Irrit. 2 Skin Irrit. 2 Aquatic Chronic 3	H319 H315 H412	Y	N	--	Y		Unknown	Unknown
3,4,4-Trimethyloxazolidine	75673-43-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
4,4-Dimethyloxazolidine	51200-87-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Trimethyl borate	121-43-7	Dossier	Flam. Liq. 3 Acute Tox. 4 *	H226 H312	Y	N	--	N		Unknown	Unknown
Alkyl* dimethylethylbenzyl ammonium chloride *(50%C12, 30%C14, 17%C16, 3%C18)	85409-23-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Final Report 4: Impacts and Mitigation Measures

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Decyldimethyl amine	1120-24-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Benzyl dimethyl dodecyl ammonium chloride	139-07-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1-(Phenylmethyl)pyridinium Et Me derivs., chlorides	68909-18-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ulexite	1319-33-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Calcium hydroxide	1305-62-0	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Zirconium, hydroxylactate sodium complexes	113184-20-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Non hazardous
Acrylamide	79-06-1	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Hazardous
Xylenes	1330-20-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Hazardous	Hazardous
Quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with bentonite	68953-58-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Boric oxide	1303-86-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Antimony potassium oxide	29638-69-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Trisodium ethylenediamine tetraacetate	150-38-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Glycine, N,N'-1,2-ethanediylbis[N-(carboxymethyl)-], disodium salt	139-33-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Navy fuels JP-5	8008-20-6	Dossier	Asp. Tox. 1	H304	N	N	--	N		Hazardous	Unknown
2-(2-Ethoxyethoxy)ethyl acetate	112-15-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sulfur dioxide	7446-09-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Glyoxal	107-22-2	Dossier	Muta. 2 Acute Tox. 4 * Eye Irrit. 2 Skin Irrit. 2 Skin Sens. 1	H341 H332 H319 H315 H317	Y	N	--	N		Unknown	Unknown
Carbonic acid calcium salt (1:1)	471-34-1	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Benzene, 1,1'-oxybis-, tetrapropylene derivs., sulfonated	119345-03-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Ammonium bisulfite	10192-30-0	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Benzenesulfonic acid, dodecyl-, compd. with N1-(2-aminoethyl)-1,2-ethanediamine (1:?)	40139-72-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Polyethylene glycol tridecyl ether phosphate	9046-01-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Silica, amorphous precipitated	67762-90-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Isopropylamine	75-31-0	Dossier	Flam. Liq. 1 Eye Irrit. 2 STOT SE 3 Skin Irrit. 2	H224 H319 H335 H315	N	N	--	N		Unknown	Unknown
Undecane	1120-21-4	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Formaldehyde, polymer with N1-(2-aminoethyl)-1,2-ethanediamine, benzylated	70750-07-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Adipic acid	124-04-9	Dossier	Eye Irrit. 2	H319	N	N	--	N		Unknown	Unknown
Fumaric acid	110-17-8	Dossier	Eye Irrit. 2	H319	N	N	--	N		Unknown	Unknown

Final Report 4: Impacts and Mitigation Measures

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Toluene	108-88-3	Dossier	Flam. Liq. 2 Repr. 2 Asp. Tox. 1 STOT RE 2 * Skin Irrit. 2 STOT SE 3	H225 H361d *** H304 H373 ** H315 H336	N	Y	--	N		Hazardous	Hazardous
Sodium metaborate tetrahydrate	35585-58-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Solvent naphtha, petroleum, light arom	64742-95-6	Dossier	Carc. 1B Asp. Tox. 1	H350 H304	N	N	Cat 1B	N		Unknown	Unknown
Peracetic acid	79-21-0	Dossier	Flam. Liq. 3 Org. Perox. D **** Acute Tox. 4 * Acute Tox. 4 * Acute Tox. 4 * Skin Corr. 1A Aquatic Acute 1	H226 H242 H332 H312 H302 H314 H400	Y	N	--	N	Y	Non hazardous	Non hazardous
Poly(oxy-1,2-ethanediyl), .alpha.,.alpha.'-[[[(9Z)-9-octadecenylimino]di-2,1-ethanediyl]bis[.o	26635-93-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
mega.-hydroxy-											
Trisodium phosphate	7601-54-9	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Non hazardous	Unknown
Ammonium acrylate-acrylamide polymer	26100-47-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ozone	10028-15-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Boron sodium oxide pentahydrate	12179-04-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Diethylene glycol monobutyl ether	112-34-5	Dossier	Eye Irrit. 2	H319	N	N	--	N		Undetermined	Unknown
Sodium formate	141-53-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Trisodium ethylenediamine triacetate	19019-43-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Disodium ethylenediamine diacetate	38011-25-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Silica	61790-53-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Sodium polyacrylate	9003-04-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Residues, petroleum, catalytic reformer fractionator	64741-67-9	Dossier	Carc. 1B	H350	N	N	Cat 1B	N		Unknown	Unknown
Ammonium sulfate	7783-20-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ethanaminium, n,n,n-trimethyl-2-[(1-oxo-2-propenyl)oxy]-,chloride, polymer with 2-propenamide	69418-26-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Calcium carbonate (Limestone)	1317-65-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Nitrilotriacetic acid trisodium monohydrate	18662-53-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium bromide	7647-15-6	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Dimethyl polysiloxane	63148-62-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Goethite	1310-14-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Benzene, C10-16-alkyl derivs.	68648-87-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Poly(oxy-1,2-ethanediyl), .alpha.-[(9Z)-1-oxo-9-octadecenyl]-.omega.-hydroxy-	9004-96-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Carbon dioxide	124-38-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Synthetic organic polymer	9051-89-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Phosphonic acid, [nitrilotris(methylene)]tris-, pentasodium salt	2235-43-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Thioglycolic acid	68-11-1	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Non hazardous
Bisphenol A/Epichlorohydrin resin	25068-38-6	Dossier	Eye Irrit. 2 Skin Irrit. 2 Skin Sens. 1 Aquatic Chronic 2	H319 H315 H317 H411	Y	N	--	Y		Unknown	Unknown
Stoddard solvent IIC	64742-88-7	Dossier	Asp. Tox. 1	H304	N	N	--	N		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Ammonium acrylate	10604-69-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Poly(oxy-1,2-ethanediyl), a-hydro-w-hydroxy-, ether with D-glucitol (2:1), tetra-(9Z)-9-octadecenoate	61723-83-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Thiourea	62-56-6	Dossier	Carc. 2 Repr. 2 Acute Tox. 4 * Aquatic Chronic 2	H351 H361d *** H302 H411	Y	N	--	Y		Unknown	Unknown
Tryptone	73049-73-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Yeast extract	8013-01-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Tridecane	629-50-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Dodecane	112-40-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Hydrogen fluoride (Hydrofluoric acid)	7664-39-3	Dossier	Acute Tox. 2 * Acute Tox. 1 Acute Tox. 2 * Skin Corr. 1A	H330 H310 H300 H314	Y	N	--	N		Unknown	Unknown
alpha-C11-15-sec-alkyl-omega-hydroxypoly(oxy	68131-40-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
-1,2-ethanediyl)											
Glassy calcium magnesium phosphate	65997-17-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Edifas B	9004-32-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Starch	9005-25-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Phenol	108-95-2	Dossier	Muta. 2 Acute Tox. 3 * Acute Tox. 3 * Acute Tox. 3 * STOT RE 2 * Skin Corr. 1B	H341 H331 H311 H301 H373 ** H314	Y	N	--	N		Non hazardous	Non hazardous
Ammonium C6-C10 alcohol ethoxysulfate	68187-17-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Potassium iodide	7681-11-0	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Aluminum chloride	7446-70-0	Dossier	Skin Corr. 1B	H314	N	N	--	N		Unknown	Unknown
Butyl glycidyl ether	2426-08-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Saturated sucrose	57-50-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Ferric chloride	7705-08-0	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Polyacrylamide	9003-05-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Non hazardous
Antimony pentoxide	1314-60-9	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
N-Lauryl-2-pyrrolidone	2687-96-9	Dossier	Skin Corr. 1B Skin Sens. 1 Aquatic Acute 1 Aquatic Chronic 1	H314 H317 H400 H410	Y	N	--	Y	Y	Unknown	Unknown
1-(1-Naphthylmethyl) quinolinium chloride	65322-65-8	Not Registered	Carc. 2 Muta. 2 Acute Tox. 4 * Skin Irrit. 2 Eye Dam. 1 Aquatic Chronic 3	H351 H341 H302 H315 H318 H412	Y	N	--	Y		Unknown	Unknown
Ethoxylated C12-13 alcohols	66455-14-9	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Phosphonic acid, [[[phosphonomethyl]imino]bis[6,1-hexanediyl]nitrilobis(methylene)]]tetrakis-, sodium salt	35657-77-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Distillates, petroleum, hydrotreated light naphthenic	64742-53-6	Dossier	Carc. 1B	H350	N	N	Cat 1B	N		Unknown	Unknown
1,2,4-Butanetricarboxylic acid, 2-phosphono-	37971-36-1	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Polysorbate 20	9005-64-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Aziridine, polymer with 2-methyloxirane	31974-35-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Morpholinium, 4-ethyl-4-hexadecyl-, ethyl sulfate	78-21-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1,2-Benzisothiazolin-3-one	2634-33-5	Not Registered	Acute Tox. 4 * Skin Irrit. 2 Eye Dam. 1 Skin Sens. 1 Aquatic Acute 1	H302 H315 H318 H317 H400	Y	N	--	N	Y	Unknown	Unknown
2-Propenoic acid, 2-ethylhexyl ester, polymer with 2-hydroxyethyl 2-propenoate	36089-45-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Amines, tallow	61790-33-8	Not	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
alkyl		Registered									
Ethanol, 2,2'-iminobis-, N-tallow alkyl derivs.	61791-44-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ethoxylated C6-12 alcohols	68439-45-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Fatty acids, C18-unsatd., dimers, ethoxylated propoxylated	68308-89-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Polysorbate 80	9005-65-6	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Siloxanes and Silicones, di-Me, 3-hydroxypropyl Me, ethoxylated propoxylated	68937-55-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium nitrite	7632-00-0	Dossier	Ox. Sol. 3 Acute Tox. 3 * Aquatic Acute 1	H272 H301 H400	Y	N	--	N	Y	Unknown	Unknown
Sorbitan, monooctadecanoate	1338-41-6	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ethyl acetate	141-78-6	Dossier	Flam. Liq. 2 Eye Irrit. 2 STOT SE 3	H225 H319 H336	N	N	--	N		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Ammonium hydrogen difluoride	1341-49-7	Dossier	Acute Tox. 3 * Skin Corr. 1B	H301 H314	Y	N	--	N		Unknown	Unknown
Poly-(oxy-1,2-ethanediyl)-alpha-undecyl-omega-hydroxy	34398-01-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Non hazardous
Ethoxylated C10-14 alcohols	66455-15-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ethylbenzene	100-41-4	Dossier	Flam. Liq. 2 Acute Tox. 4 *	H225 H332	Y	N	--	N		Hazardous	Hazardous
Acrylic acid, with sodium-2-acrylamido-2-methyl-1-propanesulfonate and sodium phosphinate	110224-99-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Hydroxylamine hydrochloride	5470-11-1	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivs. residues	68909-77-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium bromosulfamate	1004542-84-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Final Report 4: Impacts and Mitigation Measures

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
2-Propenoic acid, polymer with sodium phosphinate (1:1), sodium salt	129898-01-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Rutile titanium dioxide (nanoscale material)	1317-80-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Tetradecane	629-59-4	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
2-Methyl-1-propanol	78-83-1	Dossier	Flam. Liq. 3 STOT SE 3 Skin Irrit. 2 Eye Dam. 1 STOT SE 3	H226 H335 H315 H318 H336	N	N	--	N		Unknown	Unknown
4-Methyl-2-pentanone	108-10-1	Dossier	Flam. Liq. 2 Acute Tox. 4 * Eye Irrit. 2 STOT SE 3	H225 H332 H319 H335	Y	N	--	N		Unknown	Unknown
Ammonium fluoride	12125-01-8	Dossier	Acute Tox. 3 * Acute Tox. 3 * Acute Tox. 3 *	H331 H311 H301	Y	N	--	N		Unknown	Unknown
4-Ethyl-1-yn-3-ol	5877-42-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
2-Propenoic acid, 2-methyl-, polymer with 2-propenoic acid,	28205-96-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
sodium salt											
D-Glucitol	50-70-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Polyphosphoric acids, esters with triethanolamine, sodium salts	68131-72-6	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Docusate sodium	577-11-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Oleic acid	112-80-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Phenol, 4,4'-(1-methylethylidene)No Recordis-, polymer with 2-(chloromethyl)oxirane, 2-methyloxirane and oxirane	68123-18-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Potassium oleate	143-18-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Butyl lactate	138-22-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
EO - Dodecyl Alcohol Ammonium	32612-48-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Final Report 4: Impacts and Mitigation Measures

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Sulfate											
Distillates, petroleum, straight-run middle	64741-44-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1,3,5-Triazine-1,3,5(2H,4H,6H)-triethanol	4719-04-4	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Propylene carbonate	108-32-7	Dossier	Eye Irrit. 2	H319	N	N	--	N		Unknown	Unknown
Sodium borate	1333-73-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Frits, chemicals	65997-18-4	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
N-Methyl-2-pyrrolidone	872-50-4	Dossier	Eye Irrit. 2 Skin Irrit. 2	H319 H315	N	N	--	N		Unknown	Unknown
Polyvinylidene chloride	9002-85-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1-Propanaminium, N-(3-aminopropyl)-2-hydroxy-N,N-dimethyl-3-sulfo-, N-coco acyl derivs., inner salts	68139-30-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Acetone	67-64-1	Dossier	Flam. Liq. 2 Eye Irrit. 2 STOT SE 3	H225 H319 H336	N	N	--	N		Undetermined	Unknown
Linseed oil	8001-26-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium ethasulfate	126-92-1	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Aluminosilicate	1327-36-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Petroleum distillates	8002-05-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Hazardous	Hazardous
Acrylamide-sodium-2-acrylamido-2-methylpropane sulfonate copolymer	38193-60-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1-(Alkyl* amino)-3-aminopropane *(42%C12, 26%C18, 15%C14, 8%C16, 5%C10, 4%C8)	68155-37-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Acetic acid, cobalt(2+) salt	71-48-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Collagen (Gelatin)	9000-70-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Zirconium	7699-43-6	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
oxychloride											
Alkylbenzenesulfonate, linear	42615-29-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Poly(oxy-1,2-ethanediyl), alpha-isodecyl-omega-hydroxy-	61827-42-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Polypropylene glycol	25322-69-4	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Potassium persulfate	7727-21-1	Dossier	Ox. Sol. 3 Acute Tox. 4 * Eye Irrit. 2 STOT SE 3 Skin Irrit. 2 Resp. Sens. 1 Skin Sens. 1	H272 H302 H319 H335 H315 H334 H317	Y	N	--	N		Unknown	Unknown
Sulfonic acids, C14-16-alkane hydroxy and C14-16-alkene, sodium salts	68439-57-6	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Amines, N-tallow alkyltrimethylene di-, ethoxylated	61790-85-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Lactic acid	50-21-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Triphosphoric acid, pentasodium	7758-29-4	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Non hazardous	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
salt											
Sodium xylene sulfonate	1300-72-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Stoddard solvent	8052-41-3	Not Registered	Carc. 1B Asp. Tox. 1	H350 H304	N	N	Cat 1B	N		Unknown	Unknown
Fuels, diesel, no. 2	68476-34-6	Dossier	Carc. 2	H351	N	N	Cat 2	N		Unknown	Unknown
Choline bicarbonate	78-73-9	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Phosphonic acid, [[[phosphonomet hyl)imino]bis[2, 1 - ethanediyl]nitrilob is(methylene)]]te trakis-	15827-60-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Polyethylene glycol monobutyl ether	9004-77-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium iodide	7681-82-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Boron sodium oxide tetrahydrate	12280-03-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Iron(II) sulfate heptahydrate	7782-63-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Distillates, petroleum, solvent-dewaxed heavy paraffinic	64742-65-0	Dossier	Carc. 1B	H350	N	N	Cat 1B	N		Unknown	Unknown
1,4-Dioxane	123-91-1	Dossier	Flam. Liq. 2 Carc. 2 Eye Irrit. 2 STOT SE 3	H225 H351 H319 H335	N	N	Cat 2	N		Unknown	Unknown
Epoxy Resin	25085-99-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
N,N,N-Trimethyloctadecan-1-aminium chloride	112-03-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Illite	12173-60-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ilmenite (FeTiO ₃), conc.	98072-94-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1,3,5-Trimethylbenzene	108-67-8	Dossier	Flam. Liq. 3 STOT SE 3 Aquatic Chronic 2	H226 H335 H411	Y	N	--	Y		Hazardous	Unknown
Deuterium oxide	7789-20-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium hydroxymethane sulfonate	870-72-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Tallow alkyl	61790-60-1	Not	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Final Report 4: Impacts and Mitigation Measures

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
amines acetate		Registered									
Urea	57-13-6	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Acetaldehyde	75-07-0	Dossier	Flam. Liq. 1 Carc. 2 Eye Irrit. 2 STOT SE 3	H224 H351 H319 H335	N	N	Cat 2	N		Unknown	Non hazardous
L-Glutamic acid	56-86-0	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium bicarbonate	144-55-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Distillates, petroleum, catalytic reformer fractionator residue, low-boiling	68477-31-6	Not Registered	Carc. 1B	H350	N	N	Cat 1B	N		Unknown	Unknown
Heptene, hydroformylation products, high-boiling	68526-88-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Kerosine, petroleum, hydrosulfurized	64742-81-0	Dossier	Asp. Tox. 1	H304	N	N	--	N		Unknown	Unknown
Castor oil	8001-79-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Quaternary ammonium compounds (2-ethylhexyl) hydrogenated tallow alkyl)dimethyl, methyl sulfates	308074-31-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1-Octadecanamine, acetate (1:1)	2190-04-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Benzenesulfonic acid, C10-16-alkyl derivs.	68584-22-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Tricalcium phosphate	7758-87-4	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Cumene	98-82-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Hazardous	Unknown
Diethylbenzene	25340-17-4	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Naphtha, petroleum, heavy catalytic reformed	64741-68-0	Dossier	Carc. 1B Asp. Tox. 1	H350 H304	N	N	Cat 1B	N		Unknown	Unknown
Poly(oxy-1,2-ethanediyl), .alpha.-(dinonylphenyl)-.omega.-hydroxy-	9014-93-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
2-Heptanone,	19549-80-5	Not	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
4,6-dimethyl-		Registered									
Bis(2-chloroethyl) ether	111-44-4	Dossier	Carc. 2 Acute Tox. 2 * Acute Tox. 1 Acute Tox. 2 *	H351 H330 H310 H300	Y	N	Cat 2	N		Unknown	Unknown
Calcium fluoride	7789-75-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Diisobutyl ketone	108-83-8	Dossier	Flam. Liq. 3 STOT SE 3	H226 H335	N	N	--	N		Unknown	Unknown
Rosin	8050-09-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Oxirane, methyl-, polymer with oxirane, mono-C10-16-alkyl ethers, phosphates	68649-29-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Oxirane, 2-methyl-, polymer with oxirane, monodecyl ether	37251-67-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Quinaldine	91-63-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
2-Propenoic acid, 2-methyl-, polymer with sodium 2-methyl-2-((1-oxo-2-propen-1-yl)amino)-1-	136793-29-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
propanesulfonate (1:1)											
Alcohols (C13-C15), ethoxylated	64425-86-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Octamethylcyclotetrasiloxane	556-67-2	Dossier	Repr. 2 Aquatic Chronic 4	H361f *** H413	Y	N	--	Y		Unknown	Unknown
Decamethylcyclopentasiloxane	541-02-6	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Non hazardous	Unknown
Dodecamethylcyclohexasiloxane	540-97-6	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ethanol, 2-[2-(tridecyloxy)ethoxy]ethoxy]-, hydrogen sulfate, sodium salt	25446-78-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Petroleum distillate hydrotreated light	6742-47-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium peroxometaborate	7632-04-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Final Report 4: Impacts and Mitigation Measures

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Cuprous chloride	7758-89-6	Dossier	Acute Tox. 4 * Aquatic Acute 1 Aquatic Chronic 1	H302 H400 H410	Y	N	--	Y	Y	Unknown	Unknown
Sand	308075-07-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
?-[3.5-dimethyl-1-(2-methylpropyl)hexyl]-w-hydroxy-poly(oxy-1,2-ethandiyl)	60828-78-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Amines, coco alkyldimethyl	61788-93-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Dimethyl glutarate	1119-40-0	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ethylene oxide	75-21-8	Dossier	Flam. Gas 1 Press. Gas Carc. 1B Muta. 1B Acute Tox. 3 * Eye Irrit. 2 STOT SE 3 Skin Irrit. 2	H220 H350 H340 H331 H319 H335 H315	Y	N	Cat 1B	N		Unknown	Unknown
Isoquinoline	119-65-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Phosphonic acid, [[[phosphonomet hyl)imino]bis[2, 1 - ethanediyl]nitrilob is(methylene)]]tetraakis-, sodium salt	22042-96-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Distillates, petroleum, hydrotreated heavy paraffinic	64742-54-7	Dossier	Carc. 1B	H350	N	N	Cat 1B	N		Unknown	Unknown
2-Phosphonobutane-1,2,4-tricarboxylic acid, potassium salt	93858-78-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
4-Nonylphenol	104-40-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ammonium C8-C10 alkyl ether sulfate	68891-29-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Poly(oxy-1,2-ethanediyl), alpha-hydro-omega-hydroxy-, ether with alpha-fluoro-omega-(2-hydroxyethyl)pol	65545-80-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
y(difluoromethylene) (1:1)											
Quaternary amine compounds	61789-18-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Non hazardous	Unknown
Sodium metaborate	7775-19-1	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Zirconium, 1,1'-((2-((2-hydroxyethyl)(2-hydroxypropyl)amino)ethyl)imino)bis(2-propanol) complexes	197980-53-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
2-Propenoic, Polymer with Sodium Phosphinate, Sodium Salt	71050-62-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
3-(Dimethylamino) propylamine	109-55-7	Dossier	Flam. Liq. 3 Acute Tox. 4 * Skin Corr. 1B Skin Sens. 1	H226 H302 H314 H317	Y	N	--	N		Unknown	Unknown
Amides, coco, N-[3-(dimethylamino)	68140-01-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Final Report 4: Impacts and Mitigation Measures

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
propyl]											
Benzyltrimethylammonium chloride	56-93-9	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
3-Hydroxybutanal	107-89-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Amines, coco alkyl	61788-46-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Amines, dicoco alkyl	61789-76-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Crotonaldehyde	123-73-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Paraffin waxes and Hydrocarbon waxes	8002-74-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Hazardous	Unknown
Nylon fibers	25038-54-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Benzoic acid	65-85-0	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Boron	7440-42-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Non hazardous	Hazardous
Poly (acrylamide-co-acrylic acid), partial sodium salt	62649-23-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Styrene acrylic acid copolymer	25085-34-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Alkanes, C13-16-iso-	68551-20-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Benzene, 1,1'-oxybis-, sec-hexyl derivs., sulfonated, sodium salts	147732-60-3	Not Registered	Eye Irrit. 2 Aquatic Chronic 2	H319 H411	Y	N	--	Y		Unknown	Unknown
Poly(tetrafluoroethylene)	9002-84-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1-Amino-2-propanol	78-96-6	Dossier	Skin Corr. 1B	H314	N	N	--	N		Unknown	Unknown
2-Propenoic acid, polymer with ethene, zinc salt	28208-80-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ammonium citrate (2:1)	3012-65-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Benzenesulfonic acid, C10-16-alkyl derivs., potassium salts	68584-27-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Fatty acid, tall oil, hexa esters with sorbitol, ethoxylated	61790-90-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ferric sulfate	10028-22-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Propane	74-98-6	Dossier	Flam. Gas 1 Press. Gas	H220	N	N	--	N		Unknown	Unknown
Sorbitan, tri-(9Z)-9-octadecenoate	26266-58-0	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
2,6,8-Trimethyl-4-nonanol	123-17-1	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
D-Gluconic acid	526-95-4	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Ethanaminium, N,N,N-trimethyl-2-[(2-methyl-1-oxo-2-propenyl)oxy]-, methyl sulfate, homopolymer	27103-90-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, 2-methyloxirane and oxirane	30704-64-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Polyvinylpyrrolidone	9003-39-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Isooctanol	26952-21-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Acetophenone	98-86-2	Dossier	Acute Tox. 4 * Eye Irrit. 2	H302 H319	Y	N	--	N		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Ethanol, 2-amino-, reaction products with ammonia, by-products from, phosphonomethylated	68649-44-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Isobutane	75-28-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1,2,3-Trimethylbenzene	526-73-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
2-Aminoethanol hydrochloride	2002-24-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Alcohols, C12-14-secondary	126950-60-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Butyryl trihexyl citrate	82469-79-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Dipropylene glycol	25265-71-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Methanamine, N,N-dimethyl-, hydrochloride	593-81-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Polyquaternium 15	35429-19-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sulfan blue	129-17-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
1-Propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl-, N-coco acyl derivs., inner salts	61789-40-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Butane	106-97-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Diethylene glycol monomethyl ether	111-77-3	Dossier	Repr. 2	H361d ***	N	Y	--	N		Unknown	Unknown
Maleic acid homopolymer	26099-09-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Alkenes, C24-25 alpha-, polymers with maleic anhydride, docosyl esters	68607-07-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Formaldehyde polymer with methyl oxirane, 4-nonylphenol and oxirane	63428-92-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, 2-methyloxirane, 4-nonylphenol and oxirane	68188-99-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Iridium oxide	12030-49-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium zirconium lactate	15529-67-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Aniline	62-53-3	Dossier	Carc. 2 Muta. 2 Acute Tox. 3 * Acute Tox. 3 * Acute Tox. 3 * STOT RE 1 Eye Dam. 1 Skin Sens. 1 Aquatic Acute 1	H351 H341 H331 H311 H301 H372 ** H318 H317 H400	Y	N	--	N	Y	Non hazardous	Unknown
Hydrocarbons, terpene processing by-products	68956-56-9	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Isoascorbic acid	89-65-6	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Non hazardous

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Mineral oil - includes paraffin oil	8012-95-1	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Hazardous	Hazardous
Poly(oxy-1,2-ethanediyl), alpha-hydro-omega-hydroxy-, mono-C10-14-alkyl ethers, phosphates	68585-36-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Scandium oxide	12060-08-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium nitrate	7631-99-4	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
1-Hexanol	111-27-3	Dossier	Acute Tox. 4 *	H302	Y	N	--	N		Unknown	Unknown
2-Methyl-2,4-pentanediol	107-41-5	Dossier	Eye Irrit. 2 Skin Irrit. 2	H319 H315	N	N	--	N		Undetermined	Unknown
Amides, tallow, n-[3-(dimethylamino)propyl],n-oxides	68647-77-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
C8-10 Alcohols	85566-12-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Disodium octaborate	12008-41-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Erucic amidopropyl dimethyl detaine	149879-98-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Isopropanolamine dodecylbenzene	42504-46-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Quinoline	91-22-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sorbitan, (9Z)-9-octadecenoate (2:3)	8007-43-0	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1-Propanaminium, N-(carboxymethyl)-N,N-dimethyl-3-[(1-oxooctyl)amino]-, inner salt	73772-46-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1,3-Dichloropropene	542-75-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Amorphous silica	99439-28-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Aromatic ketones	224635-63-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Benzenesulfonic acid, C10-16-alkyl derivs., compds. with triethanolamine	68584-25-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Dichloromethane	75-09-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Hazardous	Hazardous

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Dodecylbenzene sulfonic acid salts	68648-81-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
N-(3-Chloroallyl)hexamium chloride	4080-31-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Oxyalkylated alcohols	228414-35-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium metabisulfite	7681-57-4	Dossier	Acute Tox. 4 * Eye Dam. 1	H302 H318	Y	N	--	N		Undetermined	Unknown
Triton X-100	9002-93-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1-Pentanol	71-41-0	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Aluminum oxide [NF]	90669-62-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Antimony trioxide	1309-64-4	Dossier	Carc. 2	H351	N	N	Cat 2	N		Unknown	Unknown
Benzenesulfonic acid, (1-methylethyl)-, sodium salt	28348-53-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Bicine	150-25-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Final Report 4: Impacts and Mitigation Measures

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Copper sulfate	7758-98-7	Dossier	Acute Tox. 4 * Eye Irrit. 2 Skin Irrit. 2 Aquatic Acute 1 Aquatic Chronic 1	H302 H319 H315 H400 H410	Y	N	--	Y	Y	Non hazardous	Non hazardous
Dapsone	80-08-0	Dossier	Acute Tox. 4 *	H302	Y	N	--	N		Unknown	Unknown
Glycine, N-(hydroxymethyl)-, monosodium salt	70161-44-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Hexane	110-54-3	Dossier	Flam. Liq. 2 Repr. 2 Asp. Tox. 1 STOT RE 2 * Skin Irrit. 2 STOT SE 3 Aquatic Chronic 2	H225 H361f *** H304 H373 ** H315 H336 H411	Y	N	--	Y		Unknown	Unknown
Coconut oil	8001-31-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Epichlorohydrin	106-89-8	Dossier	Flam. Liq. 3 Carc. 1B Acute Tox. 3 * Acute Tox. 3 * Acute Tox. 3 * Skin Corr. 1B Skin Sens. 1	H226 H350 H331 H311 H301 H314 H317	Y	N	Cat 1B	N		Hazardous	Hazardous
Fuels, diesel	68334-30-5	Dossier	Carc. 2	H351	N	N	Cat 2	N		Unknown	Unknown
Pentane	109-66-0	Dossier	Flam. Liq. 2 Asp. Tox. 1 STOT SE 3 Aquatic Chronic 2	H225 H304 H336 H411	Y	N	--	Y		Unknown	Unknown
Poly(oxy-1,2-ethanediyl), ?-sulfo-?- (hexyloxy)-, C6-10-alkyl ethers, ammonium salts	68037-05-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Poly(oxy-1,2-ethanediyl), alpha-hydro-omega-hydroxy-, mono-C8-10-alkyl ethers, phosphates	68130-47-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Poly(sodium-p-styrenesulfonate)	25704-18-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Poly(vinyl alcohol)	25213-24-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Polyvinyl acetate, partially hydrolyzed	304443-60-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Pyridinium, 1-(phenylmethyl)-, alkyl derivs., chlorides	100765-57-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium chloroacetate	3926-62-3	Dossier	Acute Tox. 3 * Skin Irrit. 2 Aquatic Acute 1	H301 H315 H400	Y	N	--	N	Y	Non hazardous	Non hazardous
Spirit of ammonia, aromatic	8013-59-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1-Propene	115-07-1	Dossier	Flam. Gas 1 Press. Gas	H220	N	N	--	N		Unknown	Unknown
1,3-Butadiene	106-99-0	Dossier	Flam. Gas 1 Press. Gas Carc. 1A Muta. 1B	H220 H350 H340	N	N	Cat 1A	N		Unknown	Unknown
2-Propen-1-aminium, N,N-dimethyl-N-2-propenyl-, chloride	7398-69-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
2-Propen-1-aminium, N,N-dimethyl-N-2-propenyl-, chloride, homopolymer	26062-79-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
3-Methoxypropylamine	5332-73-0	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Aliphatic alcohol polyglycol ether	68015-67-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Alkyl* dimethyl benzyl ammonium chloride *(61% C12, 23% C14, 11% C16, 2.5% C18 2.5% C10 and trace of C8)	61789-71-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Non hazardous	Unknown
Benzenesulfonic acid, dodecyl-, branched, compds. with 2-propanamine	90218-35-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Bio-Perge	55965-84-9	Not Registered	Acute Tox. 3 * Acute Tox. 3 * Acute Tox. 3 * Skin Corr. 1B Skin Sens. 1 Aquatic Acute 1 Aquatic Chronic 1	H331 H311 H301 H314 H317 H400 H410	Y	N	--	Y	Y	Unknown	Unknown
Boric acid, potassium salt	20786-60-1	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Butene	25167-67-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Calcium oxide	1305-78-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Dimethyl adipate	627-93-0	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Dimethyl succinate	106-65-0	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Dodecylbenzene sulphonic acid, morpholine salt	12068-08-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Ethoxylated undecyl alcohol	127036-24-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Hydroxyethylcellulose	9004-62-0	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Lactic acid; dl form Na salt	72-17-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Methyl cellulose	9004-67-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Morpholine	110-91-8	Dossier	Flam. Liq. 3 Acute Tox. 4 * Acute Tox. 4 * Acute Tox. 4 * Skin Corr. 1B	H226 H332 H312 H302 H314	Y	N	--	N		Unknown	Unknown
Nitrilotriacetic acid	139-13-9	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Pentaethylenehexamine	4067-16-7	Dossier	Skin Corr. 1B Skin Sens. 1 Aquatic Acute 1 Aquatic Chronic 1	H314 H317 H400 H410	Y	N	--	Y	Y	Unknown	Unknown
Polyacrylamide	25038-45-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Polyoxylated fatty amine salt	61791-26-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium diacetate	126-96-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium sulfite	7757-83-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium thiosulfate, pentahydrate	10102-17-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Tall oil, ethoxylated	65071-95-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Final Report 4: Impacts and Mitigation Measures

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Tetraethylenepe ntamine	112-57-2	Not Registered	Acute Tox. 4 * Acute Tox. 4 * Skin Corr. 1B Skin Sens. 1 Aquatic Chronic 2	H312 H302 H314 H317 H411	Y	N	--	Y		Unknown	Unknown
Triethylenetetra mine	112-24-3	Not Registered	Acute Tox. 4 * Skin Corr. 1B Skin Sens. 1 Aquatic Chronic 3	H312 H314 H317 H412	Y	N	--	Y		Unknown	Unknown
Undecanol, Branched and linear	128973-77-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
1,2-Ethanediamine, polymer with 2-methyloxirane	25214-63-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
2-(Thiocyanomethylthio)benzothiaz ole	21564-17-0	Not Registered	Acute Tox. 2 * Acute Tox. 4 * Eye Irrit. 2 Skin Irrit. 2 Skin Sens. 1 Aquatic Acute 1 Aquatic Chronic 1	H330 H302 H319 H315 H317 H400 H410	Y	N	--	Y	Y	Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
2-Methylbutane	78-78-4	Dossier	Flam. Liq. 1 Asp. Tox. 1 STOT SE 3 Aquatic Chronic 2	H224 H304 H336 H411	Y	N	--	Y		Unknown	Unknown
4-Methyl-2-pentanol	108-11-2	Dossier	Flam. Liq. 3 STOT SE 3	H226 H335	N	N	--	N		Unknown	Unknown
Alkanes, C12-14-iso-	68551-19-9	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Benzene	71-43-2	Dossier	Flam. Liq. 2 Carc. 1A Muta. 1B STOT RE 1 Asp. Tox. 1 Eye Irrit. 2 Skin Irrit. 2	H225 H350 H340 H372 ** H304 H319 H315	N	N	Cat 1A	N		Hazardous	Hazardous
Distillates, petroleum, hydrotreated heavy naphthenic	64742-52-5	Dossier	Carc. 1B	H350	N	N	Cat 1B	N		Unknown	Unknown
Ethane	74-84-0	Dossier	Flam. Gas 1 Press. Gas	H220	N	N	--	N		Unknown	Unknown
Fumes, silica	69012-64-2	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Hydroxypropyl guar gum	39421-75-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Methane	74-82-8	Dossier	Flam. Gas 1 Press. Gas	H220	N	N	--	N		Unknown	Unknown
Methylene bis(thiocyanate)	6317-18-6	Not Registered	Acute Tox. 2 * Acute Tox. 3 * Skin Corr. 1B Skin Sens. 1 Aquatic Acute 1	H330 H301 H314 H317 H400	Y	N	--	N	Y	Unknown	Unknown
Orange terpenes	8028-48-6	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Phosphonic acid, [[[phosphonomethyl]imino]bis[6,1-hexanediylnitrilobis(methylene)]]tetrakis-	34690-00-1	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium dodecyl sulfate	151-21-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Non hazardous
Tin(II) chloride	7772-99-8	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
(13Z)-N,N-bis(2-hydroxyethyl)-N-methyldocos-13-en-1-aminium chloride	120086-58-0	Not Registered	Skin Corr. 1B Aquatic Acute 1 Aquatic Chronic 1	H314 H400 H410	Y	N	--	Y	Y	Unknown	Unknown
1-tert-Butoxy-2-propanol	57018-52-7	Not Registered	Flam. Liq. 3 Eye Dam. 1	H226 H318	N	N	--	N		Unknown	Unknown
1,3,5-Triazine	290-87-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Alkyl* dimethyl ethylbenzyl ammonium chloride *(60%C14, 30%C16, 5%C12, 5%C18)	68956-79-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Aluminum	7429-90-5	Dossier	Water-react. 2 Pyr. Sol. 1	H261 H250	N	N	--	N		Unknown	Unknown
Aluminum chloride hydroxide sulfate	39290-78-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Aluminum chloride, basic	1327-41-9	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Aluminum sulfate	10043-01-3	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Non hazardous	Non hazardous
Benzene, ethenyl-, polymer with 2-methyl-1,3-No Recordutadiene, hydrogenated	68648-89-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Calcium hypochlorite	7778-54-3	Dossier	Ox. Sol. 2 Acute Tox. 4 * Skin Corr. 1B Aquatic Acute 1	H272 H302 H314 H400	Y	N	--	N	Y	Non hazardous	Unknown
Carboxymethyl	9000-11-7	Not	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
cellulose		Registered									
Copper(I) iodide	7681-65-4	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Cyclohexane	110-82-7	Dossier	Flam. Liq. 2 Asp. Tox. 1 Skin Irrit. 2 STOT SE 3 Aquatic Acute 1 Aquatic Chronic 1	H225 H304 H315 H336 H400 H410	Y	N	--	Y	Y	Unknown	Unknown
Ethoxylated C12-15 alcohols	68131-39-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Ethylene	74-85-1	Dossier	Flam. Gas 1 Press. Gas STOT SE 3	H220 H336	N	N	--	N		Undetermined	Unknown
Fats and Glyceridic oils, vegetable, hydrogenated	68334-28-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Fatty acids, coco, reaction products with diethylenetriamine and soya fatty acids, ethoxylated, chloromethane-quaternized	68604-75-1	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Furfural	98-01-1	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Gilsonite	12002-43-6	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Hydrazine	302-01-2	Dossier	Flam. Liq. 3 Carc. 1B Acute Tox. 3 * Acute Tox. 3 * Acute Tox. 3 * Skin Corr. 1B Skin Sens. 1 Aquatic Acute 1 Aquatic Chronic 1	H226 H350 H331 H311 H301 H314 H317 H400 H410	Y	N	--	Y	Y	Hazardous	Unknown
Hypochlorous acid	7790-92-3	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Naphthenic acid ethoxylate	68410-62-8	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Oxirane, 2-methyl-, polymer with oxirane, mono(2-ethylhexyl) ether	64366-70-7	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Paraformaldehyde	30525-89-4	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Perboric acid, sodium salt, monohydrate	10332-33-9	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Chemical identification		REACH registered	CLP hazard classification							WFD classifications	
Chemical name	CAS number	REACH dossier	Hazard classification	Hazard code	Health hazard – acutely toxic (H300, H301, H302, H310, H311, H312, H330, H331, H332)	Health hazard – reproductive toxicity (H360-H361)	Health hazard – carcinogenic (H350, H351)	Environmental hazard – chronic (H410-H413)	Environmental hazard – acute (H400)	EPA hazardous substance	JAGDAG hazardous substance
Polyethylene glycol mono(1,1,3,3-tetramethylbutyl) phenyl ether	9036-19-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Undetermined	Unknown
Siloxanes and Silicones, di-Me, Me hydrogen	68037-59-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Sodium trimetaphosphate [USAN]	7785-84-4	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
tert-Butyl perbenzoate	614-45-9	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Tetraethylene glycol	112-60-7	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Tetrasodium pyrophosphate	7722-88-5	Dossier	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Titanium(4+) 2-[bis(2-hydroxyethyl)amino]ethanolate propan-2-olate (1:2:2)	36673-16-2	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown
Triethanolamine hydroxyacetate	68299-02-5	Not Registered	Not listed	Not listed	Unknown	N	--	Unknown		Unknown	Unknown

Table F1.1. (continued) Chemicals used in hydraulic fracturing maximum concentrations

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Methanol	67-56-1	24,753	72.1%	0.0092%	0.0001%	0.1151%	45,556	7.5%	30.0%	0.4%	100.0%
Distillates, petroleum, hydrotreated light	64742-47-8	22,463	65.4%	0.0249%	0.0013%	0.3547%	30,284	5.0%	30.0%	0.7%	70.0%
Hydrochloric acid	7647-01-0	22,380	65.2%	0.1455%	0.0083%	1.3323%	25,571	4.2%	15.0%	2.8%	60.0%
Water	7732-18-5	16,536	48.1%	0.5280%	0.0007%	82.0747%	41,030	6.7%	65.0%	5.0%	100.0%
Isopropanol	67-63-0	16,039	46.7%	0.0038%	0.0000%	0.1482%	22,301	3.7%	20.0%	0.3%	100.0%
Ethylene glycol	107-21-1	15,800	46.0%	0.0157%	0.0003%	0.1148%	20,014	3.3%	30.0%	0.6%	60.0%
Peroxydisulfuric acid, diammonium salt	7727-54-0	14,968	43.6%	0.0069%	0.0001%	0.0639%	19,125	3.1%	100.0%	0.1%	100.0%
Sodium hydroxide	1310-73-2	13,265	38.6%	0.0092%	0.0000%	0.0772%	15,942	2.6%	10.0%	0.1%	51.5%
Guar gum	9000-30-0	12,696	37.0%	0.1584%	0.0019%	0.4184%	13,018	2.1%	50.0%	1.6%	100.0%
Quartz	14808-60-7	12,335	35.9%	0.0033%	0.0000%	11.8343%	17,365	2.9%	2.0%	0.1%	96.7%
Glutaraldehyde	111-30-8	11,562	33.7%	0.0072%	0.0004%	0.0229%	12,038	2.0%	27.0%	0.0%	60.0%
Propargyl alcohol	107-19-7	11,410	33.2%	0.0002%	0.0000%	0.0028%	12,092	2.0%	8.0%	0.0%	30.0%
Potassium hydroxide	1310-58-3	10,049	29.3%	0.0070%	0.0000%	0.0533%	11,223	1.8%	15.0%	0.1%	50.0%
Ethanol	64-17-5	9,861	28.7%	0.0034%	0.0001%	0.0984%	11,240	1.8%	30.0%	1.0%	60.0%
Acetic acid	64-19-7	8,186	23.8%	0.0033%	0.0000%	0.0374%	9,330	1.5%	50.0%	1.0%	90.0%
Citric acid	77-92-9	8,142	23.7%	0.0027%	0.0001%	0.0170%	8,376	1.4%	60.0%	7.0%	100.0%
2-Butoxyethanol	111-76-2	7,347	21.4%	0.0047%	0.0000%	0.1405%	9,282	1.5%	10.0%	0.3%	60.0%
Sodium chloride	7647-14-5	7,300	21.3%	0.0083%	0.0000%	0.1425%	8,621	1.4%	30.0%	0.0%	50.0%
Solvent naphtha, petroleum, heavy	64742-94-5	7,108	20.7%	0.0051%	0.0000%	0.0347%	7,879	1.3%	10.0%	0.0%	30.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
arom.											
Naphthalene	91-20-3	6,354	18.5%	0.0014%	0.0000%	0.0055%	6,588	1.1%	5.0%	0.0%	5.0%
2,2-Dibromo-3-nitrilopropionamide	10222-01-2	5,656	16.5%	0.0019%	0.0000%	0.0225%	5,786	1.0%	97.6%	10.0%	100.0%
Phenolic resin	9003-35-4	4,961	14.4%	0.1154%	0.0046%	1.1267%	5,137	0.8%	5.0%	0.8%	20.0%
Choline chloride	67-48-1	4,741	13.8%	0.0623%	0.0007%	0.1355%	4,805	0.8%	75.0%	0.8%	80.0%
Methenamine	100-97-0	4,693	13.7%	0.0104%	0.0000%	0.2068%	4,821	0.8%	1.0%	0.0%	2.0%
Carbonic acid, dipotassium salt	584-08-7	4,556	13.3%	0.0391%	0.0000%	0.1475%	4,614	0.8%	60.0%	30.0%	60.0%
1,2,4-Trimethylbenzene	95-63-6	4,347	12.7%	0.0007%	0.0000%	0.0068%	4,380	0.7%	1.0%	0.0%	20.0%
Quaternary ammonium compounds, benzyl-C12-16-alkyldimethyl, chlorides	68424-85-1	4,258	12.4%	0.0019%	0.0000%	0.0041%	4,352	0.7%	7.0%	3.0%	10.0%
Poly(oxy-1,2-ethanediyl)-nonylphenyl-hydroxy (mixture)	127087-87-0	4,123	12.0%	0.0025%	0.0000%	0.0089%	4,141	0.7%	5.0%	5.0%	10.0%
Formic acid	64-18-6	4,066	11.8%	0.0021%	0.0000%	0.0303%	4,536	0.7%	60.0%	0.1%	98.0%
Sodium chlorite	7758-19-2	3,803	11.1%	0.0040%	0.0002%	0.0374%	3,869	0.6%	10.0%	5.0%	30.0%
Nonyl phenol ethoxylate	9016-45-9	3,793	11.0%	0.0088%	0.0000%	0.0852%	4,456	0.7%	10.0%	5.0%	54.0%
Tetrakis(hydroxymethyl)phosphonium sulfate	55566-30-8	3,775	11.0%	0.0113%	0.0003%	0.0653%	3,904	0.6%	60.0%	0.0%	100.0%
Polyethylene glycol	25322-68-3	3,721	10.8%	0.0035%	0.0000%	0.0385%	3,758	0.6%	20.0%	0.0%	70.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Ammonium chloride	12125-02-9	3,491	10.2%	0.0025%	0.0003%	0.0215%	3,578	0.6%	10.0%	1.5%	30.0%
Sodium persulfate	7775-27-1	3,488	10.2%	0.0017%	0.0000%	0.0219%	3,504	0.6%	100.0%	100.0%	100.0%
Tetramethylammonium chloride	75-57-0	3,286	9.6%	0.0612%	0.0004%	0.1600%	3,290	0.5%	15.0%	0.3%	60.0%
N,N-Dimethylformamide	68-12-2	3,147	9.2%	0.0003%	0.0000%	0.0025%	3,151	0.5%	13.0%	10.0%	40.0%
Boric acid	10043-35-3	3,118	9.1%	0.0138%	0.0002%	0.1146%	3,133	0.5%	25.0%	15.0%	60.0%
Diatomaceous earth, calcined	91053-39-3	3,108	9.0%	0.0169%	0.0006%	0.0643%	4,320	0.7%	100.0%	60.0%	100.0%
Boron sodium oxide	1330-43-4	3,040	8.9%	0.0140%	0.0000%	0.0487%	3,043	0.5%	30.0%	0.0%	30.0%
Ethoxylated propoxylated C12-14 alcohols	68439-51-0	2,966	8.6%	0.0059%	0.0004%	0.0168%	3,097	0.5%	2.0%	2.0%	2.5%
Thiourea polymer	68527-49-1	2,905	8.5%	0.0003%	0.0000%	0.0040%	2,909	0.5%	30.0%	0.0%	30.0%
Didecyl dimethyl ammonium chloride	7173-51-5	2,808	8.2%	0.0026%	0.0000%	0.0055%	2,816	0.5%	10.0%	3.0%	100.0%
Ethoxylated C14-15 alcohols	68951-67-7	2,784	8.1%	0.0006%	0.0000%	0.0056%	2,789	0.5%	30.0%	0.0%	30.0%
Alkenes, C>10 .alpha.-	64743-02-8	2,696	7.8%	0.0001%	0.0000%	0.0006%	2,701	0.4%	5.0%	0.0%	5.0%
Sodium erythorbate	6381-77-7	2,385	6.9%	0.0006%	0.0000%	0.0059%	2,386	0.4%	100.0%	0.0%	100.0%
Ethylenediaminetetraacetic acid tetrasodium salt hydrate	64-02-8	2,349	6.8%	0.0032%	0.0000%	0.0723%	2,350	0.4%	0.1%	0.0%	100.0%
Fatty acids, tall-oil	61790-12-3	2,303	6.7%	0.0004%	0.0001%	0.0031%	2,308	0.4%	10.0%	0.0%	30.0%
Potassium metaborate	13709-94-9	2,302	6.7%	0.0180%	0.0000%	0.0591%	2,306	0.4%	60.0%	20.0%	60.0%

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Sodium tetraborate decahydrate	1303-96-4	2,299	6.7%	0.0269%	0.0000%	0.0649%	2,309	0.4%	30.0%	0.2%	30.0%
Phosphonic acid	13598-36-2	2,271	6.6%	0.0002%	0.0000%	0.0006%	2,336	0.4%	1.0%	1.0%	3.0%
Tri-n-butyl tetradecyl phosphonium chloride	81741-28-8	2,211	6.4%	0.0023%	0.0000%	0.0180%	2,285	0.4%	10.0%	5.0%	10.0%
Glycine, N,N-bis(carboxymethyl)-, trisodium salt	5064-31-3	2,196	6.4%	0.0002%	0.0000%	0.0020%	2,200	0.4%	1.0%	0.0%	40.0%
Sodium perborate tetrahydrate	10486-00-7	2,187	6.4%	0.0055%	0.0001%	0.1350%	2,197	0.4%	100.0%	15.0%	100.0%
2-Mercaptoethanol	60-24-2	2,118	6.2%	0.0049%	0.0000%	0.0293%	2,258	0.4%	100.0%	75.0%	100.0%
Benzyl chloride	100-44-7	1,992	5.8%	0.0000%	0.0000%	0.0183%	2,015	0.3%	1.0%	0.0%	1.0%
Glycerin, natural	56-81-5	1,979	5.8%	0.0088%	0.0004%	0.0432%	1,982	0.3%	30.0%	0.1%	40.0%
Naphtha, petroleum, hydrotreated heavy	64742-48-9	1,842	5.4%	0.0665%	0.0000%	0.3934%	1,852	0.3%	60.0%	1.0%	70.0%
Alkylaryl sulphonic acid	27176-87-0	1,806	5.3%	0.0010%	0.0000%	0.0134%	1,854	0.3%	5.0%	2.0%	100.0%
Diethylene glycol	111-46-6	1,806	5.3%	0.0008%	0.0000%	0.0220%	1,817	0.3%	5.0%	0.0%	10.0%
Sodium hypochlorite	7681-52-9	1,798	5.2%	0.0130%	0.0000%	0.0343%	2,034	0.3%	30.0%	12.5%	30.0%
Ammonium acetate	631-61-8	1,756	5.1%	0.0106%	0.0000%	0.0888%	1,765	0.3%	100.0%	6.0%	100.0%
Potassium chloride	7447-40-7	1,723	5.0%	0.0033%	0.0000%	3.2216%	1,732	0.3%	10.0%	2.1%	100.0%
Triethanolamine	102-71-6	1,645	4.8%	0.0458%	0.0000%	0.1155%	1,790	0.3%	65.0%	0.2%	100.0%
1-Propanol	71-23-8	1,643	4.8%	0.0095%	0.0002%	0.0267%	1,648	0.3%	30.0%	0.3%	30.0%
Tetrahydro-3,5-dimethyl,2H-1,3,5-thiadiazine-2-thione	533-74-4	1,604	4.7%	0.0057%	0.0000%	0.0126%	1,610	0.3%	24.0%	0.0%	98.0%
Citrus terpenes	94266-47-4	1,559	4.5%	0.0247%	0.0000%	0.0791%	1,563	0.3%	30.0%	5.0%	60.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Distillates, petroleum, hydrotreated light paraffinic	64742-55-8	1,527	4.4%	0.1146%	0.0276%	0.4200%	1,529	0.3%	30.0%	30.0%	60.0%
1-Benzylquinolinium chloride	15619-48-4	1,522	4.4%	0.0001%	0.0000%	0.0013%	1,523	0.3%	10.0%	10.0%	10.0%
Cinnamaldehyde (3-phenyl-2-propenal)	104-55-2	1,489	4.3%	0.0002%	0.0000%	0.0015%	1,489	0.2%	5.0%	5.0%	30.0%
Sodium thiosulfate	7772-98-7	1,471	4.3%	0.0739%	0.0001%	0.3355%	1,476	0.2%	30.0%	0.2%	60.0%
Acetic anhydride	108-24-7	1,424	4.1%	0.0042%	0.0003%	0.0409%	1,439	0.2%	100.0%	30.0%	100.0%
Tetradecyl dimethyl benzyl ammonium chloride	139-08-2	1,420	4.1%	0.0012%	0.0004%	0.0053%	1,424	0.2%	5.0%	2.5%	10.0%
Hemicellulase Enzyme Concentrate	9025-56-3	1,397	4.1%	0.0014%	0.0000%	0.0038%	1,407	0.2%	3.0%	0.1%	3.0%
Terpenes and Terpenoids, sweet orange-oil	68647-72-3	1,390	4.0%	0.0063%	0.0007%	0.0329%	1,406	0.2%	5.0%	5.0%	30.0%
Calcium chloride	10043-52-4	1,341	3.9%	0.0040%	0.0003%	0.1053%	1,419	0.2%	5.0%	0.0%	100.0%
2-Ethylhexanol	104-76-7	1,340	3.9%	0.0036%	0.0000%	0.0083%	1,372	0.2%	7.0%	0.0%	40.0%
Isotridecanol, ethoxylated	9043-30-5	1,339	3.9%	0.0105%	0.0000%	0.0256%	1,354	0.2%	5.0%	0.1%	5.0%
Cupric chloride dihydrate	10125-13-0	1,335	3.9%	0.0006%	0.0000%	0.0125%	1,462	0.2%	7.0%	5.0%	100.0%
Sorbitan, mono-(9Z)-9-octadecenoate	1338-43-8	1,280	3.7%	0.0015%	0.0000%	0.0049%	1,293	0.2%	5.0%	0.0%	100.0%
Copolymer of acrylamide and	25987-30-8	1,246	3.6%	0.0157%	0.0000%	0.0417%	1,247	0.2%	40.0%	10.0%	100.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
sodium acrylate											
Ammonium hydroxide	1336-21-6	1,218	3.5%	0.0003%	0.0001%	0.0033%	1,234	0.2%	5.0%	5.0%	12.0%
Ethoxylated C12-16 alcohols	68551-12-2	1,218	3.5%	0.0034%	0.0005%	0.0163%	1,222	0.2%	7.0%	4.0%	40.0%
Formic acid, potassium salt	590-29-4	1,215	3.5%	0.0451%	0.0012%	0.1072%	1,218	0.2%	60.0%	30.0%	60.0%
2-Propenoic acid, polymer with 2-propenamide	9003-06-9	1,176	3.4%	0.0108%	0.0006%	0.0408%	1,187	0.2%	32.0%	28.0%	70.0%
Poly(oxy-1,2-ethanediyl), alpha-(nonylphenyl)-omega-hydroxy-, branched	68412-54-4	1,175	3.4%	0.0001%	0.0000%	0.0008%	1,175	0.2%	5.0%	5.0%	13.0%
Copper(II) chloride	7447-39-4	1,160	3.4%	0.0003%	0.0001%	0.0046%	1,172	0.2%	5.0%	0.0%	100.0%
1,2-Propylene glycol	57-55-6	1,147	3.3%	0.0181%	0.0000%	0.0539%	1,726	0.3%	30.0%	2.6%	70.0%
Tar bases, quinoline derivatives, benzyl chloride-quaternized	72480-70-7	1,146	3.3%	0.0002%	0.0000%	0.0013%	1,146	0.2%	10.0%	2.6%	13.0%
Sodium bromate	7789-38-0	1,135	3.3%	0.0055%	0.0000%	0.0562%	1,171	0.2%	0.1%	0.0%	100.0%
Magnesium chloride	7786-30-3	1,130	3.3%	0.0001%	0.0000%	0.0015%	1,132	0.2%	5.0%	0.3%	10.0%
Alcohols, C12-14-secondary, ethoxylated	84133-50-6	1,128	3.3%	0.0031%	0.0000%	0.1209%	1,137	0.2%	60.0%	1.0%	70.0%
C10-C16 ethoxylated alcohol	68002-97-1	1,117	3.3%	0.0006%	0.0000%	0.0046%	1,117	0.2%	0.0%	0.0%	30.0%
Magnesium nitrate	10377-60-3	1,103	3.2%	0.0003%	0.0000%	0.0007%	1,104	0.2%	10.0%	10.0%	10.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Triethyl phosphate	78-40-0	1,089	3.2%	0.0001%	0.0000%	0.0004%	1,089	0.2%	3.0%	2.5%	7.0%
2-Methyl-3(2H)-isothiazolone	2682-20-4	1,083	3.2%	0.0001%	0.0000%	0.0004%	1,084	0.2%	5.0%	5.0%	5.0%
5-Chloro-2-methyl-3(2H)-isothiazolone	26172-55-4	1,081	3.1%	0.0003%	0.0000%	0.0008%	1,082	0.2%	10.0%	10.0%	10.0%
Poly(oxy-1,2-ethanediyl), alpha-hexyl-omega-hydroxy	31726-34-8	1,064	3.1%	0.0085%	0.0034%	0.0215%	1,064	0.2%	0.1%	0.0%	13.0%
Diethanolamine	111-42-2	1,041	3.0%	0.0033%	0.0000%	0.0151%	1,449	0.2%	5.0%	2.0%	30.0%
White mineral oil, petroleum	8042-47-5	1,041	3.0%	0.0315%	0.0022%	0.1299%	1,077	0.2%	91.0%	30.0%	100.0%
Zirconium, acetate lactate oxo ammonium complexes	68909-34-2	1,031	3.0%	0.0128%	0.0016%	0.1164%	1,032	0.2%	60.0%	30.0%	60.0%
Cristobalite	14464-46-1	966	2.8%	0.0000%	0.0000%	0.0001%	966	0.2%	1.0%	1.0%	1.0%
Alcohols, C7-9-iso-, C8-rich, ethoxylated	78330-19-5	939	2.7%	0.0058%	0.0000%	0.0567%	943	0.2%	0.1%	0.0%	5.0%
Nonoxynolá	26027-38-3	890	2.6%	0.0005%	0.0000%	0.1829%	1,138	0.2%	10.0%	0.0%	60.0%
tert-Butyl Hydroperoxide (70% Solution in Water)	75-91-2	890	2.6%	0.0014%	0.0000%	0.0141%	905	0.1%	15.0%	5.0%	70.0%
Alcohols, C9-11-iso-, C10-rich, ethoxylated	78330-20-8	885	2.6%	0.0057%	0.0000%	0.0125%	893	0.1%	0.1%	0.0%	5.0%
Coconut oil acid/Diethanolamine condensate (2:1)	68603-42-9	875	2.5%	0.0075%	0.0000%	0.0246%	913	0.2%	20.0%	2.0%	30.0%
Hydrogen peroxide	7722-84-1	875	2.5%	0.0011%	0.0001%	0.0096%	875	0.1%	7.0%	0.0%	30.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Sodium sulfate	7757-82-6	844	2.5%	0.0000%	0.0000%	0.0017%	844	0.1%	2.0%	0.1%	2.0%
Boric acid, dipotassium salt	1332-77-0	836	2.4%	0.0059%	0.0000%	0.1160%	836	0.1%	14.0%	0.2%	60.0%
Propylene pentamer	15220-87-8	831	2.4%	0.0869%	0.0024%	0.2758%	1,133	0.2%	60.0%	15.0%	100.0%
Diethylenetriamine	111-40-0	827	2.4%	0.0032%	0.0000%	0.0064%	833	0.1%	60.0%	5.0%	60.0%
Zirconium,tetrakis[2-[bis(2-hydroxyethyl)amino-kN]ethanolato-kO]-	101033-44-7	804	2.3%	0.0280%	0.0074%	0.0561%	807	0.1%	100.0%	60.0%	100.0%
1-Butoxy-2-propanol	5131-66-8	795	2.3%	0.0140%	0.0034%	0.0275%	796	0.1%	5.0%	5.0%	5.0%
Chloride	16887-00-6	793	2.3%	0.0321%	0.0000%	0.0471%	796	0.1%	30.0%	30.0%	30.0%
Magnesium oxide (MgO)	1309-48-4	787	2.3%	0.0029%	0.0000%	0.0153%	792	0.1%	60.0%	0.6%	60.0%
Ethoxylated C12-14 alcohols	68439-50-9	767	2.2%	0.0016%	0.0002%	0.0053%	768	0.1%	5.0%	4.0%	5.0%
1,2-Ethanediaminium, N, N'-bis[2-[bis(2-hydroxyethyl)methyl ammonio]ethyl]-N,N'bis(2-hydroxyethyl)-N,N'-dimethyl-,tetrachloride	138879-94-4	763	2.2%	0.0339%	0.0002%	0.0705%	768	0.1%	60.0%	60.0%	60.0%
Aminotrimethylene phosphonic acid	6419-19-8	759	2.2%	0.0056%	0.0010%	0.0208%	760	0.1%	30.0%	30.0%	30.0%
Monoethanolamine borate	26038-87-9	754	2.2%	0.0562%	0.0111%	0.1542%	756	0.1%	100.0%	60.0%	100.0%
Calcium peroxide	1305-79-9	747	2.2%	0.0012%	0.0000%	0.0099%	748	0.1%	15.0%	8.0%	30.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Magnesium peroxide (Mg(O ₂))	14452-57-4	745	2.2%	0.0020%	0.0000%	0.0039%	769	0.1%	30.0%	0.3%	40.0%
Sodium metaborate tetrahydrate	10555-76-7	733	2.1%	0.0068%	0.0000%	0.1495%	734	0.1%	25.0%	24.0%	100.0%
Nitrogen, liquid	7727-37-9	728	2.1%	15.4437 %	1.3566%	29.0288%	728	0.1%	100.0%	24.9%	100.0%
Alcohols, C11-14-iso-, C13-rich, ethoxylated	78330-21-9	714	2.1%	0.0033%	0.0000%	0.0067%	714	0.1%	0.0%	0.0%	0.1%
Hemicellulase enzyme	9012-54-8	713	2.1%	0.0001%	0.0000%	0.0280%	715	0.1%	15.0%	15.0%	15.0%
Bronopol	52-51-7	700	2.0%	0.0015%	0.0000%	0.0074%	702	0.1%	100.0%	100.0%	100.0%
Ethanolamine	141-43-5	700	2.0%	0.0011%	0.0000%	0.0074%	702	0.1%	7.0%	5.0%	10.0%
Triethanolamine polyphosphate ester	68131-71-5	695	2.0%	0.0026%	0.0017%	0.0044%	695	0.1%	7.0%	7.0%	15.0%
(4R)-1-methyl-4-(prop-1-en-2-yl)cyclohexene	5989-27-5	667	1.9%	0.0085%	0.0000%	0.1319%	668	0.1%	20.0%	10.0%	100.0%
Talc	14807-96-6	666	1.9%	0.0001%	0.0000%	0.0071%	666	0.1%	0.0%	0.0%	10.0%
Acrylic polymers	26006-22-4	661	1.9%	0.0009%	0.0003%	0.0059%	664	0.1%	50.0%	50.0%	60.0%
Oxyalkylated nonyl phenolic resin	30846-35-6	639	1.9%	0.0053%	0.0001%	0.0102%	639	0.1%	0.0%	0.0%	0.1%
N,N-Dimethyldecylamine oxide	2605-79-0	638	1.9%	0.0186%	0.0095%	0.0283%	638	0.1%	0.1%	0.1%	10.0%
Acetic acid, mercapto-, monoammonium salt	5421-46-5	621	1.8%	0.0315%	0.0083%	0.0778%	621	0.1%	0.2%	0.1%	100.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Quaternary ammonium compounds, benzyl-C10-16-alkyldimethyl, áchlorides	68989-00-4	608	1.8%	0.0035%	0.0000%	0.0069%	608	0.1%	0.0%	0.0%	0.1%
Glycolic acid	79-14-1	596	1.7%	0.0011%	0.0006%	0.0103%	596	0.1%	15.0%	15.0%	100.0%
Vinylidene chloride/methylacrylate copolymer	25038-72-6	594	1.7%	0.0022%	0.0002%	0.0155%	594	0.1%	0.0%	0.0%	20.0%
Methoxyacetic acid	625-45-6	585	1.7%	0.0004%	0.0002%	0.0100%	585	0.1%	5.0%	5.0%	100.0%
Quaternary ammonium compounds, (oxydi-2,1-ethanediy)bis[cocoalkyldimethyl, dichlorides	68607-28-3	537	1.6%	0.0023%	0.0000%	0.0040%	537	0.1%	30.0%	5.0%	60.0%
Triethylene glycol	112-27-6	533	1.6%	0.0257%	0.0079%	10.0000%	545	0.1%	20.0%	1.0%	20.0%
Formalin	50-00-0	532	1.5%	0.0000%	0.0000%	0.0016%	533	0.1%	0.1%	0.0%	10.0%
Formamide	75-12-7	526	1.5%	0.0008%	0.0000%	0.5485%	528	0.1%	30.0%	30.0%	30.0%
Pluronic F-127	9003-11-6	503	1.5%	0.0163%	0.0001%	0.0300%	533	0.1%	30.0%	0.0%	30.0%
Corn sugar gum	11138-66-2	497	1.4%	0.0095%	0.0000%	0.0163%	533	0.1%	0.1%	0.0%	37.0%
Sodium acetate	127-09-3	497	1.4%	0.0064%	0.0004%	0.0337%	497	0.1%	5.0%	4.4%	20.0%
Sodium bisulfite, mixture of NaHSO3 and Na2S2O5	7631-90-5	494	1.4%	0.0005%	0.0000%	0.0186%	618	0.1%	64.0%	1.0%	64.0%
Glycolic acid sodium salt	2836-32-0	485	1.4%	0.0001%	0.0001%	0.0013%	485	0.1%	0.0%	0.0%	3.5%
Sulfuric acid	7664-93-9	463	1.3%	0.0000%	0.0000%	0.0003%	510	0.1%	0.0%	0.0%	1.5%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
2-bromo-3-nitrilopropionamide	1113-55-9	460	1.3%	0.0000%	0.0000%	0.0008%	462	0.1%	5.0%	5.0%	5.0%
Trimethylamine quaternized polyepichlorohydrin	51838-31-4	449	1.3%	0.0268%	0.0056%	0.0610%	449	0.1%	60.0%	60.0%	60.0%
Ammonia	7664-41-7	445	1.3%	0.0013%	0.0001%	0.0044%	446	0.1%	5.0%	5.0%	10.0%
1-Propanol, zirconium(4+) salt	23519-77-9	443	1.3%	0.0127%	0.0001%	0.0227%	443	0.1%	18.0%	0.3%	30.0%
1-Decanol	112-30-1	441	1.3%	0.0001%	0.0000%	0.0006%	441	0.1%	7.0%	5.0%	10.0%
1-Octanol	111-87-5	438	1.3%	0.0001%	0.0000%	0.0004%	438	0.1%	7.0%	2.5%	7.0%
Solvent naphtha, petroleum, heavy aliph.	64742-96-7	427	1.2%	0.0753%	0.0033%	0.4498%	439	0.1%	65.0%	48.0%	100.0%
Propanol, 1(or 2)-(2-methoxymethylethoxy)-	34590-94-8	418	1.2%	0.0108%	0.0000%	0.1919%	457	0.1%	60.0%	0.0%	100.0%
Dibromoacetonitrile	3252-43-5	417	1.2%	0.0011%	0.0000%	0.0030%	422	0.1%	5.0%	3.0%	5.0%
Quaternary ammonium compounds, dicoco alkyldimethyl, chlorides	61789-77-3	416	1.2%	0.0004%	0.0002%	0.0009%	416	0.1%	0.0%	0.0%	0.0%
1-Butanol	71-36-3	412	1.2%	0.0696%	0.0374%	0.1328%	412	0.1%	0.2%	0.1%	0.5%
Dodecylbenzenesulfonic acid, monoethanolamine salt	26836-07-7	405	1.2%	0.0089%	0.0000%	0.0142%	406	0.1%	13.0%	13.0%	15.0%
Sodium carbonate	497-19-8	402	1.2%	0.0022%	0.0000%	0.0930%	402	0.1%	100.0%	0.0%	100.0%
Anionic polyacrylamide	25085-02-3	399	1.2%	0.0130%	0.0011%	0.0368%	410	0.1%	0.2%	0.0%	0.7%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Stannous chloride dihydrate	10025-69-1	392	1.1%	0.0030%	0.0000%	0.0090%	393	0.1%	60.0%	10.0%	60.0%
Oils, pine	8002-09-3	390	1.1%	0.0002%	0.0000%	0.0914%	391	0.1%	5.0%	5.0%	5.0%
Sulfamic acid	5329-14-6	390	1.1%	0.0000%	0.0000%	0.0142%	391	0.1%	15.0%	4.0%	100.0%
Attapulgit	12174-11-7	385	1.1%	0.0021%	0.0001%	0.0089%	386	0.1%	5.0%	5.0%	5.0%
Distillates, petroleum, hydrotreated middle	64742-46-7	376	1.1%	0.0001%	0.0000%	0.2686%	378	0.1%	5.0%	5.0%	60.0%
Guar gum, carboxymethyl 2-hydroxypropyl ether, sodium salt	68130-15-4	375	1.1%	0.2413%	0.0173%	0.5852%	376	0.1%	60.0%	1.1%	100.0%
Benzylhexadecyldimethylammonium chloride	122-18-9	367	1.1%	0.0005%	0.0002%	0.0006%	367	0.1%	5.0%	1.3%	5.0%
Thiocyanic acid, ammonium salt	1762-95-4	360	1.0%	0.0003%	0.0000%	0.0010%	360	0.1%	0.0%	0.0%	0.0%
Sorbitan, monooctadecenoate, poly(oxy-1,2-ethanediyl) derivis.	9005-67-8	358	1.0%	0.0003%	0.0000%	0.0009%	358	0.1%	0.0%	0.0%	0.0%
Ethoxylated C9-11 alcohols	68439-46-3	350	1.0%	0.0043%	0.0015%	0.0089%	461	0.1%	10.0%	0.0%	10.0%
Potassium acetate	127-08-2	348	1.0%	0.0000%	0.0000%	0.0006%	348	0.1%	7.0%	0.0%	7.0%
Quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, chlorides	68391-01-5	347	1.0%	0.0034%	0.0016%	0.0200%	347	0.1%	10.0%	10.0%	40.0%
Magnesium	1309-42-8	346	1.0%	0.0026%	0.0001%	0.0058%	346	0.1%	5.0%	5.0%	60.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
hydroxide											
Phosphoric acid Divosan X-Tend formulation	7664-38-2	341	1.0%	0.0003%	0.0000%	0.0266%	396	0.1%	1.0%	1.0%	100.0%
Carboxymethyl guar gum, sodium salt (GW-45)	39346-76-4	340	1.0%	0.1748%	0.1119%	0.2636%	340	0.1%	40.0%	40.0%	50.0%
Raffinates, petroleum, sorption process	64741-85-1	339	1.0%	0.0992%	0.0000%	0.5550%	465	0.1%	60.0%	60.0%	100.0%
Chlorine dioxide	10049-04-4	337	1.0%	0.0006%	0.0000%	0.0014%	337	0.1%	100.0%	0.0%	100.0%
Triisopropanolamine	122-20-3	335	1.0%	0.0012%	0.0000%	0.0121%	335	0.1%	7.0%	0.1%	30.0%
2-Amino-2- methylpropan-1-ol	124-68-5	322	0.9%	0.0002%	0.0001%	0.0002%	324	0.1%	1.0%	0.5%	1.0%
3,4,4- Trimethyloxazolidine	75673-43-7	322	0.9%	0.0009%	0.0005%	0.0009%	322	0.1%	5.0%	4.5%	5.0%
4,4- Dimethyloxazolidine	51200-87-4	322	0.9%	0.0138%	0.0111%	0.0145%	322	0.1%	78.0%	78.0%	95.0%
Trimethyl borate	121-43-7	319	0.9%	0.0031%	0.0000%	0.0167%	330	0.1%	30.0%	0.3%	30.0%
Alkyl* dimethyl ethylbenzyl ammonium chloride (50%C12, 30%C14, 17%C16, 3%C18)	85409-23-0	314	0.9%	0.0031%	0.0017%	0.0052%	314	0.1%	10.0%	10.0%	10.0%
Decyldimethyl amine	1120-24-7	313	0.9%	0.0001%	0.0001%	0.0003%	313	0.1%	0.0%	0.0%	0.0%
Benzyl dimethyldodecyl ammonium chloride	139-07-1	309	0.9%	0.0033%	0.0011%	0.0034%	309	0.1%	30.0%	7.5%	30.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
1-(Phenylmethyl)pyridinium Et Me derivs., chlorides	68909-18-2	304	0.9%	0.0002%	0.0000%	0.0191%	304	0.0%	13.0%	10.0%	30.0%
Ulexite	1319-33-1	303	0.9%	0.0246%	0.0000%	0.1700%	304	0.0%	60.0%	40.0%	60.0%
Calcium hydroxide	1305-62-0	299	0.9%	0.0012%	0.0000%	0.0083%	306	0.1%	5.0%	2.0%	15.0%
Zirconium, hydroxylactate sodium complexes	113184-20-6	299	0.9%	0.0066%	0.0000%	0.0504%	299	0.0%	60.0%	0.3%	60.0%
Acrylamide	79-06-1	294	0.9%	0.0001%	0.0000%	0.0006%	294	0.0%	0.1%	0.0%	2.0%
Xylenes	1330-20-7	293	0.9%	0.0000%	0.0000%	0.4323%	355	0.1%	100.0%	1.0%	100.0%
Quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with bentonite	68953-58-2	291	0.8%	0.0111%	0.0002%	0.0272%	328	0.1%	0.3%	0.0%	5.0%
Boric oxide	1303-86-2	287	0.8%	0.0031%	0.0004%	0.0156%	289	0.0%	20.0%	20.0%	90.0%
Antimony potassium oxide	29638-69-5	286	0.8%	0.0012%	0.0000%	0.0066%	286	0.0%	60.0%	30.0%	70.0%
Trisodium ethylenediaminetetraacetate	150-38-9	280	0.8%	0.0001%	0.0000%	0.0005%	280	0.0%	0.0%	0.0%	0.0%
Glycine, N,N'-1,2-ethanediylbis[N-(carboxymethyl)-, disodium salt	139-33-3	279	0.8%	0.0001%	0.0000%	0.0005%	279	0.0%	0.0%	0.0%	0.0%
Navy fuels JP-5	8008-20-6	278	0.8%	0.0002%	0.0000%	0.0004%	278	0.0%	6.0%	5.0%	6.0%
2-(2-Ethoxyethoxy)ethyl	112-15-2	273	0.8%	0.0469%	0.0092%	0.2047%	274	0.0%	55.0%	55.0%	55.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
acetate											
Sulfur dioxide	7446-09-5	272	0.8%	0.0000%	0.0000%	0.0000%	319	0.1%	0.0%	0.0%	0.0%
Glyoxal	107-22-2	269	0.8%	0.0120%	0.0071%	0.0664%	271	0.0%	10.0%	10.0%	30.0%
Carbonic acid calcium salt (1:1)	471-34-1	268	0.8%	0.0164%	0.0001%	0.0319%	268	0.0%	1.0%	1.0%	15.0%
Benzene, 1,1'-oxybis-, tetrapropylene derivs., sulfonated	119345-03-8	267	0.8%	0.0083%	0.0007%	0.0100%	267	0.0%	10.0%	10.0%	10.0%
Ammonium bisulfite	10192-30-0	266	0.8%	0.0018%	0.0000%	0.0127%	305	0.1%	55.0%	10.0%	75.0%
Benzenesulfonic acid, dodecyl-, compd. with N1-(2-aminoethyl)-1,2-ethanediamine (1:?)	40139-72-8	265	0.8%	0.0249%	0.0020%	0.0300%	265	0.0%	30.0%	30.0%	30.0%
Polyethylene glycol tridecyl ether phosphate	9046-01-9	265	0.8%	0.0004%	0.0002%	0.0015%	265	0.0%	5.5%	5.5%	5.5%
Silica, amorphous precipitated	67762-90-7	264	0.8%	0.0000%	0.0000%	0.0026%	264	0.0%	0.0%	0.0%	30.0%
Isopropylamine	75-31-0	260	0.8%	0.0053%	0.0000%	0.0074%	261	0.0%	100.0%	10.0%	100.0%
Undecane	1120-21-4	253	0.7%	0.0058%	0.0000%	0.1088%	253	0.0%	60.0%	1.0%	100.0%
Formaldehyde, polymer with N1-(2-aminoethyl)-1,2-ethanediamine, benzylated	70750-07-1	245	0.7%	0.0295%	0.0000%	0.0676%	245	0.0%	60.0%	0.6%	60.0%
Adipic acid	124-04-9	238	0.7%	0.0000%	0.0000%	0.0111%	362	0.1%	5.0%	5.0%	7.0%
Fumaric acid	110-17-8	237	0.7%	0.0000%	0.0000%	0.0013%	238	0.0%	100.0%	0.0%	100.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Toluene	108-88-3	235	0.7%	0.0000%	0.0000%	0.0050%	236	0.0%	100.0%	1.0%	100.0%
Sodium metaborate tetrahydrate	35585-58-1	234	0.7%	0.0051%	0.0000%	0.0199%	235	0.0%	30.0%	20.0%	30.0%
Solvent naphtha, petroleum, light arom	64742-95-6	231	0.7%	0.0036%	0.0000%	0.0320%	231	0.0%	10.0%	1.0%	30.0%
Peracetic acid	79-21-0	225	0.7%	0.0039%	0.0009%	0.0115%	228	0.0%	17.0%	1.0%	30.0%
Poly(oxy-1,2-ethanediyl), .alpha.,.alpha.'-[[[(9Z)-9-octadecenylimino]di-2,1-ethanediyl]bis[.omega.-hydroxy-	26635-93-8	225	0.7%	0.0028%	0.0005%	0.0068%	225	0.0%	5.0%	5.0%	5.0%
Trisodium phosphate	7601-54-9	218	0.6%	0.0013%	0.0004%	0.0017%	218	0.0%	0.0%	0.0%	10.0%
Ammonium acrylate-acrylamide polymer	26100-47-0	211	0.6%	0.0243%	0.0002%	0.0474%	211	0.0%	25.0%	21.0%	60.0%
Ozone	10028-15-6	211	0.6%	0.0006%	0.0004%	0.0009%	211	0.0%	100.0%	100.0%	100.0%
Boron sodium oxide pentahydrate	12179-04-3	209	0.6%	0.0290%	0.0030%	0.0444%	209	0.0%	30.0%	30.0%	30.0%
Diethylene glycol monobutyl ether	112-34-5	204	0.6%	0.0002%	0.0001%	0.0010%	257	0.0%	50.0%	0.0%	66.0%
Sodium formate	141-53-7	204	0.6%	0.0000%	0.0000%	0.0000%	204	0.0%	1.0%	1.0%	1.0%
Trisodium ethylenediaminetriacetate	19019-43-3	204	0.6%	0.0001%	0.0001%	0.0002%	204	0.0%	5.0%	5.0%	5.0%
Disodium ethylenediaminediac	38011-25-5	203	0.6%	0.0001%	0.0000%	0.0001%	203	0.0%	2.0%	2.0%	2.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
etate											
Silica	61790-53-2	202	0.6%	0.0000%	0.0000%	0.0331%	203	0.0%	60.0%	30.0%	60.0%
Sodium polyacrylate	9003-04-7	201	0.6%	0.0079%	0.0004%	0.0115%	202	0.0%	100.0%	30.0%	100.0%
Residues, petroleum, catalytic reformer fractionator	64741-67-9	200	0.6%	0.0003%	0.0000%	0.0086%	200	0.0%	70.0%	1.0%	70.0%
Ammonium sulfate	7783-20-2	194	0.6%	0.0207%	0.0069%	0.0360%	195	0.0%	30.0%	0.0%	30.0%
Ethanaminium, n,n,n-trimethyl-2-[(1-oxo-2-propenyl)oxy]-,chloride, polymer with 2-propenamide	69418-26-4	194	0.6%	0.0000%	0.0000%	0.0605%	195	0.0%	70.0%	40.0%	70.0%
Calcium carbonate (Limestone)	1317-65-3	190	0.6%	0.0005%	0.0000%	0.0063%	190	0.0%	10.0%	1.8%	10.0%
Nitrilotriacetic acid trisodium monohydrate	18662-53-8	186	0.5%	0.0008%	0.0001%	0.0170%	186	0.0%	40.0%	40.0%	60.0%
Sodium bromide	7647-15-6	184	0.5%	0.0006%	0.0001%	0.0028%	189	0.0%	4.0%	4.0%	15.0%
Dimethyl polysiloxane	63148-62-9	181	0.5%	0.0001%	0.0000%	0.0002%	181	0.0%	0.0%	0.0%	0.0%
Goethite	1310-14-1	180	0.5%	0.0025%	0.0015%	0.0063%	180	0.0%	0.1%	0.1%	0.1%
Benzene, C10-16-alkyl derivs.	68648-87-3	173	0.5%	0.0000%	0.0000%	0.0004%	178	0.0%	0.0%	0.0%	5.0%
Poly(oxy-1,2-ethanediyl), .alpha.-[(9Z)-1-oxo-9-octadecenyl]-.omega.-hydroxy-	9004-96-0	173	0.5%	0.0026%	0.0000%	0.0033%	173	0.0%	3.0%	0.0%	3.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Carbon dioxide	124-38-9	164	0.5%	32.1104 %	0.0000%	63.8114%	164	0.0%	100.0%	100.0%	100.0%
Synthetic organic polymer	9051-89-2	162	0.5%	0.1115%	0.0000%	1.1493%	166	0.0%	1.2%	0.5%	100.0%
Phosphonic acid, [nitrilotris(methylene)]tris-, pentasodium salt	2235-43-0	158	0.5%	0.0080%	0.0000%	0.0802%	158	0.0%	30.0%	30.0%	100.0%
Thioglycolic acid	68-11-1	157	0.5%	0.0008%	0.0001%	0.0231%	157	0.0%	5.0%	2.0%	100.0%
Bisphenol A/Epichlorohydrin resin	25068-38-6	152	0.4%	0.0042%	0.0017%	0.0584%	152	0.0%	30.0%	30.0%	60.0%
Stoddard solvent IIC	64742-88-7	150	0.4%	0.0000%	0.0000%	0.0524%	151	0.0%	15.0%	15.0%	25.0%
Ammonium acrylate	10604-69-0	149	0.4%	0.0005%	0.0000%	0.0007%	149	0.0%	0.5%	0.0%	0.5%
Poly(oxy-1,2-ethanediyl), a-hydro-w-hydroxy-, ether with D-glucitol (2:1), tetra-(9Z)-9-octadecenoate	61723-83-9	148	0.4%	0.0018%	0.0000%	0.0021%	148	0.0%	2.0%	0.0%	2.0%
Thiourea	62-56-6	145	0.4%	0.0000%	0.0000%	0.0004%	146	0.0%	11.0%	11.0%	15.0%
Tryptone	73049-73-7	143	0.4%	0.0031%	0.0000%	0.0070%	143	0.0%	5.0%	0.1%	5.0%
Yeast extract	8013-01-2	143	0.4%	0.0031%	0.0000%	0.0070%	143	0.0%	5.0%	0.1%	5.0%
Tridecane	629-50-5	142	0.4%	0.0129%	0.0000%	0.0710%	142	0.0%	100.0%	0.2%	100.0%
Dodecane	112-40-3	141	0.4%	0.0133%	0.0000%	0.0711%	141	0.0%	100.0%	0.2%	100.0%
Hydrogen fluoride (Hydrofluoric acid)	7664-39-3	140	0.4%	0.0143%	0.0013%	0.0997%	144	0.0%	1.5%	1.5%	7.5%
alpha-C11-15-sec-alkyl-omega-hydroxypoly(oxy-	68131-40-8	136	0.4%	0.0012%	0.0000%	0.0150%	136	0.0%	5.0%	0.0%	5.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
1,2-ethanediyl)											
Glassy calcium magnesium phosphate	65997-17-3	136	0.4%	0.0097%	0.0023%	0.1206%	136	0.0%	100.0%	100.0%	100.0%
Edifas B	9004-32-4	133	0.4%	0.0000%	0.0000%	0.0441%	133	0.0%	0.0%	0.0%	50.0%
Starch	9005-25-8	133	0.4%	0.0000%	0.0000%	0.0068%	134	0.0%	60.0%	60.0%	60.0%
Phenol	108-95-2	132	0.4%	0.0002%	0.0000%	0.0027%	133	0.0%	0.0%	0.0%	0.1%
Ammonium C6-C10 alcohol ethoxysulfate	68187-17-7	128	0.4%	0.0000%	0.0000%	0.0000%	129	0.0%	30.0%	30.0%	30.0%
Potassium iodide	7681-11-0	128	0.4%	0.0001%	0.0000%	0.0065%	128	0.0%	1.0%	1.0%	68.5%
Aluminum chloride	7446-70-0	127	0.4%	0.0000%	0.0000%	0.0000%	128	0.0%	60.0%	60.0%	60.0%
Butyl glycidyl ether	2426-08-6	126	0.4%	0.0081%	0.0004%	30.0000%	126	0.0%	30.0%	5.0%	100.0%
Saturated sucrose	57-50-1	126	0.4%	0.0004%	0.0002%	0.0016%	126	0.0%	46.0%	46.0%	50.0%
Ferric chloride	7705-08-0	125	0.4%	0.0000%	0.0000%	0.0000%	126	0.0%	60.0%	60.0%	60.0%
Polyacrylamide	9003-05-8	124	0.4%	0.0458%	0.0015%	0.0600%	124	0.0%	60.0%	31.0%	100.0%
Antimony pentoxide	1314-60-9	123	0.4%	0.0000%	0.0000%	0.0000%	124	0.0%	30.0%	30.0%	30.0%
N-Lauryl-2-pyrrolidone	2687-96-9	122	0.4%	0.0028%	0.0001%	0.0033%	122	0.0%	7.0%	7.0%	7.0%
1-(1-Naphthylmethyl)quinolinium chloride	65322-65-8	121	0.4%	0.0003%	0.0001%	0.0038%	121	0.0%	40.0%	0.0%	40.0%
Ethoxylated C12-13 alcohols	66455-14-9	121	0.4%	0.0027%	0.0000%	0.0043%	121	0.0%	0.0%	0.0%	0.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Phosphonic acid, [[[phosphonomethyl) imino]bis[6, 1-hexanediyl]nitrilobis(methylene)]]tetrakis-, sodium salt	35657-77-3	121	0.4%	0.0471%	0.0006%	0.0749%	122	0.0%	15.0%	15.0%	60.0%
Distillates, petroleum, hydrotreated light naphthenic	64742-53-6	120	0.3%	0.0166%	0.0000%	0.1379%	120	0.0%	80.0%	60.0%	80.0%
1,2,4-Butanetricarboxylic acid, 2-phosphono-	37971-36-1	119	0.3%	0.0011%	0.0003%	0.0033%	119	0.0%	10.0%	10.0%	10.0%
Polysorbate 20	9005-64-5	118	0.3%	0.0006%	0.0002%	0.0061%	118	0.0%	0.0%	0.0%	0.0%
Aziridine, polymer with 2-methyloxirane	31974-35-3	117	0.3%	0.0000%	0.0000%	0.0001%	117	0.0%	10.0%	10.0%	10.0%
Morpholinium, 4-ethyl-4-hexadecyl-, ethyl sulfate	78-21-7	117	0.3%	0.0000%	0.0000%	0.0004%	117	0.0%	0.0%	0.0%	0.0%
1,2-Benzisothiazolin-3-one	2634-33-5	116	0.3%	0.0000%	0.0000%	0.0000%	116	0.0%	0.0%	0.0%	0.0%
2-Propenoic acid, 2-ethylhexyl ester, polymer with 2-hydroxyethyl 2-propenoate	36089-45-9	116	0.3%	0.0000%	0.0000%	0.0000%	116	0.0%	0.0%	0.0%	0.0%
Amines, tallow alkyl	61790-33-8	116	0.3%	0.0000%	0.0000%	0.0000%	117	0.0%	10.0%	10.0%	100.0%
Ethanol, 2,2'-iminobis-, N-tallow alkyl derivs.	61791-44-4	116	0.3%	0.0000%	0.0000%	0.0000%	117	0.0%	10.0%	10.0%	100.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Ethoxylated C6-12 alcohols	68439-45-2	116	0.3%	0.0128%	0.0027%	0.0407%	116	0.0%	30.0%	9.0%	40.0%
Fatty acids, C18-unsatd., dimers, ethoxylated propoxylated	68308-89-4	116	0.3%	0.0000%	0.0000%	0.0000%	116	0.0%	0.0%	0.0%	0.0%
Polysorbate 80	9005-65-6	116	0.3%	0.0000%	0.0000%	0.0000%	116	0.0%	0.0%	0.0%	0.0%
Siloxanes and Silicones, di-Me, 3-hydroxypropyl Me, ethoxylated propoxylated	68937-55-3	116	0.3%	0.0000%	0.0000%	0.0000%	116	0.0%	0.0%	0.0%	0.0%
Sodium nitrite	7632-00-0	116	0.3%	0.0000%	0.0000%	0.0000%	116	0.0%	0.0%	0.0%	0.0%
Sorbitan, monooctadecanoate	1338-41-6	116	0.3%	0.0000%	0.0000%	0.0000%	116	0.0%	0.0%	0.0%	0.0%
Ethyl acetate	141-78-6	115	0.3%	0.0000%	0.0000%	0.0000%	116	0.0%	10.0%	10.0%	20.0%
Ammonium hydrogen difluoride	1341-49-7	113	0.3%	0.0151%	0.0017%	0.1866%	113	0.0%	5.0%	0.0%	95.0%
Poly-(oxy-1,2-ethanediyl)-alpha-undecyl-omega-hydroxy	34398-01-1	113	0.3%	0.0068%	0.0000%	0.0151%	113	0.0%	0.1%	0.0%	11.0%
Ethoxylated C10-14 alcohols	66455-15-0	108	0.3%	0.0023%	0.0000%	0.0033%	108	0.0%	0.0%	0.0%	3.0%
Ethylbenzene	100-41-4	105	0.3%	0.0000%	0.0000%	0.0264%	109	0.0%	10.0%	0.0%	30.0%
Acrylic acid, with sodium-2-acrylamido-2-methyl-1-propanesulfonate and sodium	110224-99-2	103	0.3%	0.0008%	0.0007%	0.0108%	103	0.0%	30.0%	30.0%	60.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
phosphinate											
Hydroxylamine hydrochloride	5470-11-1	100	0.3%	0.0003%	0.0002%	0.0025%	100	0.0%	60.0%	60.0%	60.0%
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivs. residues	68909-77-3	99	0.3%	0.0002%	0.0000%	0.0002%	99	0.0%	5.0%	5.0%	5.0%
Sodium bromosulfamate	1004542-84-0	98	0.3%	0.0010%	0.0005%	0.0048%	98	0.0%	17.0%	17.0%	25.0%
2-Propenoic acid, polymer with sodium phosphinate (1:1), sodium salt	129898-01-7	96	0.3%	0.0161%	0.0037%	0.0467%	96	0.0%	0.1%	0.0%	0.4%
Rutile titanium dioxide (nanoscale material)	1317-80-2	95	0.3%	0.0375%	0.0000%	0.2103%	95	0.0%	0.0%	0.0%	5.0%
Tetradecane	629-59-4	95	0.3%	0.0077%	0.0000%	0.0506%	95	0.0%	20.0%	0.2%	100.0%
2-Methyl-1-propanol	78-83-1	93	0.3%	0.0242%	0.0081%	0.0280%	93	0.0%	30.0%	30.0%	30.0%
4-Methyl-2-pentanone	108-10-1	93	0.3%	0.5000%	0.0009%	0.5000%	120	0.0%	0.0%	0.0%	0.5%
Ammonium fluoride	12125-01-8	93	0.3%	0.0008%	0.0001%	0.0014%	93	0.0%	5.0%	0.0%	5.0%
4-Ethyl-1-oct-3-yn-3-ol	5877-42-9	92	0.3%	0.0001%	0.0000%	0.0002%	92	0.0%	5.0%	1.0%	5.0%
2-Propenoic acid, 2-methyl-, polymer with 2-propenoic acid, sodium salt	28205-96-1	88	0.3%	0.0038%	0.0000%	0.0940%	88	0.0%	5.0%	5.0%	13.3%
D-Glucitol	50-70-4	88	0.3%	0.0219%	0.0050%	0.2676%	88	0.0%	2.3%	0.0%	10.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Polyphosphoric acids, esters with triethanolamine, sodium salts	68131-72-6	88	0.3%	0.0019%	0.0000%	0.0940%	88	0.0%	5.0%	5.0%	11.5%
Docusate sodium	577-11-7	86	0.3%	0.0011%	0.0006%	0.0016%	86	0.0%	0.0%	0.0%	0.0%
Oleic acid	112-80-1	86	0.3%	0.0000%	0.0000%	0.0000%	86	0.0%	0.0%	0.0%	0.0%
Phenol, 4,4'-(1-methylethylidene)No Recordis-, polymer with 2-(chloromethyl)oxirane, 2-methyloxirane and oxirane	68123-18-2	86	0.3%	0.0073%	0.0052%	0.0100%	86	0.0%	0.1%	0.0%	0.1%
Potassium oleate	143-18-0	86	0.3%	0.0000%	0.0000%	0.0000%	86	0.0%	0.0%	0.0%	0.0%
Butyl lactate	138-22-7	84	0.2%	0.0097%	0.0016%	0.0283%	84	0.0%	10.0%	10.0%	10.0%
EO - Dodecyl Alcohol Ammonium Sulfate	32612-48-9	83	0.2%	0.0473%	0.0065%	0.1000%	83	0.0%	30.0%	30.0%	30.0%
Distillates, petroleum, straight-run middle	64741-44-2	81	0.2%	0.0208%	0.0068%	0.2923%	86	0.0%	30.0%	30.0%	100.0%
1,3,5-Triazine-1,3,5(2H,4H,6H)-triethanol	4719-04-4	80	0.2%	0.0283%	0.0000%	0.4388%	80	0.0%	60.0%	60.0%	60.0%
Propylene carbonate	108-32-7	79	0.2%	0.0035%	0.0007%	0.0400%	95	0.0%	0.2%	0.0%	5.0%
Sodium borate	1333-73-9	78	0.2%	0.0225%	0.0000%	0.1500%	78	0.0%	30.0%	0.0%	30.0%
Frits, chemicals	65997-18-4	76	0.2%	0.0023%	0.0004%	0.0056%	76	0.0%	0.0%	0.0%	0.1%
N-Methyl-2-pyrrolidone	872-50-4	75	0.2%	0.0114%	0.0101%	0.0144%	75	0.0%	30.0%	30.0%	30.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Polyvinylidene chloride	9002-85-1	74	0.2%	0.0009%	0.0001%	0.0110%	74	0.0%	0.0%	0.0%	0.1%
1-Propanaminium, N-(3-aminopropyl)-2-hydroxy-N,N-dimethyl-3-sulfo-, N-coco acyl derivs., inner salts	68139-30-0	73	0.2%	0.0003%	0.0000%	0.0101%	73	0.0%	40.0%	7.6%	40.0%
Acetone	67-64-1	73	0.2%	0.0002%	0.0000%	0.0096%	73	0.0%	40.0%	10.0%	40.0%
Linseed oil	8001-26-1	73	0.2%	0.0001%	0.0000%	0.0002%	73	0.0%	10.0%	10.0%	10.0%
Sodium ethasulfate	126-92-1	73	0.2%	0.0002%	0.0000%	0.0022%	73	0.0%	60.0%	60.0%	60.0%
Aluminosilicate	1327-36-2	71	0.2%	1.8448%	0.0096%	9.0818%	73	0.0%	85.0%	65.0%	85.0%
Petroleum distillates	8002-05-9	71	0.2%	0.0000%	0.0000%	51.0748%	71	0.0%	100.0%	100.0%	100.0%
Acrylamide-sodium-2-acrylamido-2-methylpropane sulfonate copolymer	38193-60-1	69	0.2%	0.0148%	0.0004%	0.1106%	82	0.0%	0.2%	0.0%	40.0%
1-(Alkyl* amino)-3-aminopropane *(42%C12, 26%C18, 15%C14, 8%C16, 5%C10, 4%C8)	68155-37-3	68	0.2%	0.0112%	0.0038%	0.0156%	68	0.0%	30.1%	30.0%	30.1%
Acetic acid, cobalt(2+) salt	71-48-7	67	0.2%	0.0047%	0.0010%	0.0098%	67	0.0%	10.0%	10.0%	10.0%
Collagen (Gelatin)	9000-70-8	65	0.2%	0.0038%	0.0005%	0.0179%	65	0.0%	100.0%	100.0%	100.0%
Zirconium oxychloride	7699-43-6	65	0.2%	0.0071%	0.0001%	0.0299%	65	0.0%	0.0%	0.0%	0.1%
Alkylbenzenesulfonate, linear	42615-29-2	64	0.2%	0.0003%	0.0000%	0.0169%	78	0.0%	25.0%	25.0%	25.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Poly(oxy-1,2-ethanediyl), alpha-isodecyl-omega-hydroxy-	61827-42-7	64	0.2%	0.0230%	0.0000%	5.0000%	64	0.0%	30.0%	0.3%	100.0%
Polypropylene glycol	25322-69-4	64	0.2%	0.0003%	0.0001%	0.0079%	64	0.0%	0.0%	0.0%	100.0%
Potassium persulfate	7727-21-1	64	0.2%	0.0078%	0.0004%	0.0573%	64	0.0%	100.0%	0.9%	100.0%
Sulfonic acids, C14-16-alkane hydroxy and C14-16-alkene, sodium salts	68439-57-6	61	0.2%	0.0491%	0.0154%	0.0714%	61	0.0%	30.0%	30.0%	40.0%
Amines, N-tallow alkyltrimethylenedi-, ethoxylated	61790-85-0	60	0.2%	0.0000%	0.0000%	0.0000%	60	0.0%	7.0%	7.0%	7.0%
Lactic acid	50-21-5	60	0.2%	0.0116%	0.0046%	0.0367%	60	0.0%	30.0%	30.0%	30.0%
Triphosphoric acid, pentasodium salt	7758-29-4	57	0.2%	0.2790%	0.2790%	0.2790%	57	0.0%	93.0%	93.0%	93.0%
Sodium xylene sulfonate	1300-72-7	56	0.2%	0.0615%	0.0210%	0.1711%	56	0.0%	40.0%	10.0%	40.0%
Stoddard solvent	8052-41-3	56	0.2%	0.0075%	0.0001%	0.7025%	56	0.0%	10.0%	10.0%	10.0%
Fuels, diesel, no. 2	68476-34-6	55	0.2%	0.0250%	0.0038%	0.4400%	55	0.0%	70.0%	60.0%	70.0%
Choline bicarbonate	78-73-9	53	0.2%	80.0000 %	0.0394%	80.0000%	53	0.0%	60.0%	50.0%	60.0%
Phosphonic acid, [[[phosphonomethyl) imino]bis[2,1-ethanediyl]nitrilobis(methylene)]]tetrakis-	15827-60-8	52	0.2%	0.0010%	0.0004%	0.0070%	52	0.0%	0.0%	0.0%	32.0%
Polyethylene glycol	9004-77-7	52	0.2%	0.0357%	0.0182%	0.0630%	53	0.0%	50.0%	40.8%	50.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
monobutyl ether											
Sodium iodide	7681-82-5	52	0.2%	0.0002%	0.0000%	0.0003%	52	0.0%	5.0%	5.0%	5.0%
Boron sodium oxide tetrahydrate	12280-03-4	50	0.1%	30.0000 %	30.0000%	30.0000%	50	0.0%	10.0%	10.0%	10.0%
Iron(II) sulfate heptahydrate	7782-63-0	49	0.1%	0.0000%	0.0000%	0.0076%	49	0.0%	20.0%	17.0%	30.0%
Distillates, petroleum, solvent-dewaxed heavy paraffinic	64742-65-0	47	0.1%	0.0053%	0.0009%	0.0084%	47	0.0%	0.1%	0.0%	8.0%
1,4-Dioxane	123-91-1	45	0.1%	0.0001%	0.0000%	0.0082%	46	0.0%	1.1%	0.0%	75.5%
Epoxy Resin	25085-99-8	45	0.1%	0.0807%	0.0060%	0.3147%	47	0.0%	1.0%	1.0%	4.7%
N,N,N-Trimethyloctadecan-1-aminium chloride	112-03-8	45	0.1%	0.0556%	0.0192%	0.1005%	45	0.0%	40.0%	40.0%	40.0%
Illite	12173-60-3	44	0.1%	0.0048%	0.0022%	0.0127%	44	0.0%	1.0%	1.0%	1.0%
Ilmenite (FeTiO ₃), conc.	98072-94-7	44	0.1%	0.0018%	0.0008%	0.0047%	44	0.0%	0.1%	0.1%	0.1%
1,3,5-Trimethylbenzene	108-67-8	43	0.1%	0.0000%	0.0000%	0.0133%	43	0.0%	1.0%	1.0%	16.0%
Deuterium oxide	7789-20-0	42	0.1%	0.0479%	0.0047%	0.0533%	42	0.0%	50.0%	50.0%	100.0%
Sodium hydroxymethanesulfonate	870-72-4	42	0.1%	0.0002%	0.0001%	0.0004%	42	0.0%	1.0%	1.0%	1.0%
Tallow alkyl amines acetate	61790-60-1	41	0.1%	0.0027%	0.0016%	0.0100%	41	0.0%	0.1%	0.0%	60.0%
Urea	57-13-6	41	0.1%	0.0007%	0.0005%	0.4025%	41	0.0%	0.0%	0.0%	60.0%
Acetaldehyde	75-07-0	40	0.1%	0.0004%	0.0000%	0.0108%	41	0.0%	1.0%	1.0%	2.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
L-Glutamic acid	56-86-0	40	0.1%	0.0098%	0.0032%	0.0147%	40	0.0%	0.1%	0.0%	0.1%
Sodium bicarbonate	144-55-8	40	0.1%	0.0029%	0.0000%	0.3373%	40	0.0%	100.0%	0.6%	100.0%
Distillates, petroleum, catalytic reformer fractionator residue, low-boiling	68477-31-6	39	0.1%	0.0023%	0.0003%	0.0094%	39	0.0%	30.0%	19.0%	30.0%
Heptene, hydroformylation products, high-boiling	68526-88-5	38	0.1%	0.0054%	0.0040%	0.0074%	38	0.0%	100.0%	100.0%	100.0%
Kerosine, petroleum, hydrodesulfurized	64742-81-0	38	0.1%	0.0000%	0.0000%	0.0007%	38	0.0%	5.0%	5.0%	5.0%
Castor oil	8001-79-4	37	0.1%	0.1837%	0.0710%	1.7744%	38	0.0%	5.0%	4.0%	5.0%
Quaternary ammonium compounds (2-ethylhexyl) hydrogenated tallow alkyl)dimethyl, methyl sulfates	308074-31-9	37	0.1%	0.0001%	0.0001%	0.0002%	37	0.0%	44.0%	44.0%	44.0%
1-Octadecanamine, acetate (1:1)	2190-04-7	36	0.1%	0.0000%	0.0000%	0.0000%	36	0.0%	0.3%	0.0%	0.3%
Benzenesulfonic acid, C10-16-alkyl derivs.	68584-22-5	36	0.1%	0.0045%	0.0001%	0.0380%	36	0.0%	95.5%	10.5%	100.0%
Tricalcium phosphate	7758-87-4	36	0.1%	0.0000%	0.0000%	0.0000%	36	0.0%	1.0%	0.0%	1.0%
Cumene	98-82-8	34	0.1%	0.0000%	0.0000%	0.0000%	34	0.0%	1.0%	1.0%	1.0%
Diethylbenzene	25340-17-4	34	0.1%	0.0000%	0.0000%	0.0000%	34	0.0%	1.0%	1.0%	1.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Naphtha, petroleum, heavy catalytic reformed	64741-68-0	34	0.1%	0.0000%	0.0000%	0.0001%	34	0.0%	10.0%	10.0%	10.0%
Poly(oxy-1,2-ethanediyl), .alpha.-(dinonylphenyl)-.omega.-hydroxy-	9014-93-1	34	0.1%	0.0150%	0.0001%	0.0235%	34	0.0%	25.0%	25.0%	25.0%
2-Heptanone, 4,6-dimethyl-	19549-80-5	33	0.1%	0.0001%	0.0000%	0.0042%	33	0.0%	10.0%	5.0%	10.0%
Bis(2-chloroethyl) ether	111-44-4	33	0.1%	0.0363%	0.0004%	0.2751%	33	0.0%	50.0%	50.0%	50.0%
Calcium fluoride	7789-75-5	33	0.1%	0.0044%	0.0003%	0.0152%	33	0.0%	90.0%	90.0%	90.0%
Diisobutyl ketone	108-83-8	33	0.1%	0.0003%	0.0002%	0.0254%	33	0.0%	60.0%	30.0%	60.0%
Rosin	8050-09-7	33	0.1%	0.0007%	0.0001%	0.0025%	33	0.0%	15.0%	15.0%	15.0%
Oxirane, methyl-, polymer with oxirane, mono-C10-16-alkyl ethers, phosphates	68649-29-6	32	0.1%	0.0012%	0.0000%	0.0149%	32	0.0%	10.0%	5.0%	10.0%
Oxirane, 2-methyl-, polymer with oxirane, monodecyl ether	37251-67-5	31	0.1%	0.0061%	0.0002%	0.0086%	31	0.0%	1.5%	1.5%	1.5%
Quinaldine	91-63-4	31	0.1%	0.0000%	0.0000%	0.0001%	31	0.0%	5.0%	3.0%	5.0%
2-Propenoic acid, 2-methyl-, polymer with sodium 2-methyl-2-((1-oxo-2-propen-1-yl)amino)-1-propanesulfonate (1:1)	136793-29-8	30	0.1%	0.0011%	0.0008%	0.0022%	30	0.0%	0.0%	0.0%	0.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Alcohols (C13-C15), ethoxylated	64425-86-1	28	0.1%	0.0006%	0.0004%	0.0076%	56	0.0%	5.5%	3.0%	8.0%
Octamethylcyclotetrasiloxane	556-67-2	28	0.1%	0.0000%	0.0000%	0.0000%	28	0.0%	0.0%	0.0%	0.0%
Decamethylcyclotetrasiloxane	541-02-6	27	0.1%	0.0000%	0.0000%	0.0000%	27	0.0%	0.0%	0.0%	0.0%
Dodecamethylcyclotetrasiloxane	540-97-6	27	0.1%	0.0000%	0.0000%	0.0000%	27	0.0%	0.0%	0.0%	0.0%
Ethanol, 2-[2-(2-(tridecyloxy)ethoxy)ethoxy]-, hydrogen sulfate, sodium salt	25446-78-0	27	0.1%	0.0589%	0.0253%	0.1386%	27	0.0%	0.2%	0.1%	0.4%
Petroleum distillate hydrotreated light	6742-47-8	27	0.1%	0.0138%	0.0001%	0.0138%	27	0.0%	26.0%	26.0%	26.0%
Sodium peroxometaborate	7632-04-4	27	0.1%	0.0029%	0.0007%	0.0046%	27	0.0%	100.0%	98.0%	100.0%
Cuprous chloride	7758-89-6	26	0.1%	0.0005%	0.0004%	0.0457%	26	0.0%	100.0%	100.0%	100.0%
Sand	308075-07-2	26	0.1%	11.7943%	9.7638%	13.7728%	26	0.0%	100.0%	100.0%	100.0%
?-[3,5-dimethyl-1-(2-methylpropyl)hexyl]-w-hydroxy-poly(oxy-1,2-ethandiyl)	60828-78-6	24	0.1%	0.0001%	0.0000%	0.0088%	24	0.0%	0.0%	0.0%	10.0%
Amines, coco alkyldimethyl	61788-93-0	24	0.1%	0.0527%	0.0430%	0.0804%	24	0.0%	91.0%	91.0%	91.0%
Dimethyl glutarate	1119-40-0	24	0.1%	0.0029%	0.0003%	0.0503%	24	0.0%	65.0%	40.0%	65.0%
Ethylene oxide	75-21-8	24	0.1%	0.0000%	0.0000%	0.0029%	25	0.0%	2.0%	0.1%	2.0%
Isoquinoline	119-65-3	24	0.1%	0.0000%	0.0000%	0.0000%	24	0.0%	5.0%	1.6%	5.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Phosphonic acid, [[[phosphonomethyl) imino]bis[2,1-ethanediyl]nitro]bis(methylene)]tetrakis-, sodium salt	22042-96-2	24	0.1%	0.0022%	0.0006%	0.0024%	24	0.0%	20.0%	20.0%	20.0%
Distillates, petroleum, hydrotreated heavy paraffinic	64742-54-7	23	0.1%	0.0593%	0.0000%	0.1275%	23	0.0%	100.0%	0.0%	100.0%
2-Phosphonobutane-1,2,4-tricarboxylic acid, potassium salt	93858-78-7	22	0.1%	0.0039%	0.0018%	0.0052%	22	0.0%	15.0%	15.0%	15.0%
4-Nonylphenol	104-40-5	22	0.1%	0.0050%	0.0010%	0.0100%	22	0.0%	10.0%	10.0%	10.0%
Ammonium C8-C10 alkyl ether sulfate	68891-29-2	22	0.1%	0.0619%	0.0187%	0.1862%	22	0.0%	40.0%	40.0%	40.0%
Poly(oxy-1,2-ethanediyl), alpha-hydro-omega-hydroxy-, ether with alpha-fluoro-omega-(2-hydroxyethyl)poly(di fluoromethylene) (1:1)	65545-80-4	22	0.1%	0.0006%	0.0003%	0.0008%	22	0.0%	1.0%	1.0%	1.0%
Quaternary amine compounds	61789-18-2	22	0.1%	0.0328%	0.0259%	0.0488%	22	0.0%	78.0%	78.0%	78.0%
Sodium metaborate	7775-19-1	22	0.1%	0.0001%	0.0000%	0.0001%	22	0.0%	2.0%	2.0%	2.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Zirconium, 1,1'-((2-((2-hydroxyethyl)(2-hydroxypropyl)amino)ethyl)imino)bis(2-propanol) complexes	197980-53-3	22	0.1%	0.0150%	0.0003%	0.0410%	22	0.0%	10.0%	5.0%	97.3%
2-Propenoic, Polymer with Sodium Phosphinate, Sodium Salt	71050-62-9	21	0.1%	0.0049%	0.0000%	0.0050%	21	0.0%	55.0%	55.0%	55.0%
3-(Dimethylamino)propylamine	109-55-7	21	0.1%	0.0010%	0.0000%	0.0010%	21	0.0%	1.0%	1.0%	1.0%
Amides, coco, N-[3-(dimethylamino)propyl]	68140-01-2	21	0.1%	0.0049%	0.0000%	0.0052%	21	0.0%	5.0%	2.0%	5.0%
Benzyltrimethylammonium chloride	56-93-9	21	0.1%	0.0116%	0.0000%	0.0679%	21	0.0%	100.0%	13.0%	100.0%
3-Hydroxybutanal	107-89-1	20	0.1%	0.0262%	0.0222%	0.6666%	20	0.0%	60.0%	60.0%	60.0%
Amines, coco alkyl	61788-46-3	20	0.1%	0.0001%	0.0000%	0.0065%	20	0.0%	5.0%	5.0%	5.0%
Amines, dicoco alkyl	61789-76-2	20	0.1%	0.0001%	0.0000%	0.0065%	20	0.0%	5.0%	5.0%	5.0%
Crotonaldehyde	123-73-9	20	0.1%	0.0009%	0.0007%	0.0222%	20	0.0%	2.0%	2.0%	2.0%
Paraffin waxes and Hydrocarbon waxes	8002-74-2	20	0.1%	0.1123%	0.0001%	0.2606%	20	0.0%	100.0%	10.0%	100.0%
Nylon fibers	25038-54-4	19	0.1%	0.1670%	0.0010%	0.3835%	19	0.0%	4.7%	0.0%	10.0%
Benzoic acid	65-85-0	18	0.1%	0.0035%	0.0000%	0.0721%	18	0.0%	100.0%	100.0%	100.0%
Boron	7440-42-8	18	0.1%	0.0004%	0.0000%	0.0025%	18	0.0%	15.0%	15.0%	15.1%
Poly (acrylamide-co-acrylic acid), partial	62649-23-4	18	0.1%	0.0124%	0.0011%	0.0262%	18	0.0%	35.0%	35.0%	35.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
sodium salt											
Styrene acrylic acid copolymer	25085-34-1	18	0.1%	0.0160%	0.0127%	0.0535%	18	0.0%	40.0%	40.0%	40.0%
Alkanes, C13-16-iso-	68551-20-2	17	0.0%	0.0209%	0.0021%	0.0881%	17	0.0%	100.0%	94.0%	100.0%
Benzene, 1,1'-oxybis-, sec-hexyl derivs., sulfonated, sodium salts	147732-60-3	17	0.0%	0.0015%	0.0001%	0.0020%	17	0.0%	13.0%	0.6%	13.0%
Poly(tetrafluoroethylene)	9002-84-0	17	0.0%	0.0030%	0.0018%	0.0048%	17	0.0%	1.0%	1.0%	1.0%
1-Amino-2-propanol	78-96-6	16	0.0%	0.1379%	0.1255%	3.4350%	16	0.0%	15.0%	15.0%	15.0%
2-Propenoic acid, polymer with ethene, zinc salt	28208-80-2	16	0.0%	0.1055%	0.0012%	0.4788%	16	0.0%	2.3%	0.0%	8.0%
Ammonium citrate (2:1)	3012-65-5	16	0.0%	0.1379%	0.1255%	3.4350%	16	0.0%	15.0%	15.0%	15.0%
Benzenesulfonic acid, C10-16-alkyl derivs., potassium salts	68584-27-0	16	0.0%	0.0003%	0.0003%	0.0070%	16	0.0%	5.0%	5.0%	5.0%
Fatty acid, tall oil, hexa esters with sorbitol, ethoxylated	61790-90-7	16	0.0%	0.0059%	0.0053%	0.1400%	16	0.0%	100.0%	100.0%	100.0%
Ferric sulfate	10028-22-5	16	0.0%	0.3651%	0.3189%	0.8423%	16	0.0%	40.0%	40.0%	40.0%
Propane	74-98-6	16	0.0%	59.1459%	1.3114%	77.8690%	17	0.0%	99.0%	2.0%	100.0%
Sorbitan, tri-(9Z)-9-octadecenoate	26266-58-0	16	0.0%	0.0128%	0.0029%	0.0178%	30	0.0%	2.0%	2.0%	5.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
2,6,8-Trimethyl-4-nonanol	123-17-1	15	0.0%	0.0001%	0.0000%	0.0002%	15	0.0%	0.0%	0.0%	0.0%
D-Gluconic acid	526-95-4	15	0.0%	0.0007%	0.0004%	0.0010%	15	0.0%	10.0%	10.0%	10.0%
Ethanaminium, N,N,N-trimethyl-2-[(2-methyl-1-oxo-2-propenyl)oxy]-, methyl sulfate, homopolymer	27103-90-8	15	0.0%	0.0000%	0.0000%	0.0059%	15	0.0%	0.0%	0.0%	0.0%
Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, 2-methyloxirane and oxirane	30704-64-4	15	0.0%	0.0228%	0.0079%	0.0262%	15	0.0%	30.0%	30.0%	30.0%
Polyvinylpyrrolidone	9003-39-8	15	0.0%	0.0013%	0.0000%	0.0030%	15	0.0%	0.0%	0.0%	0.1%
Isooctanol	26952-21-6	14	0.0%	0.0016%	0.0000%	0.0036%	14	0.0%	20.0%	5.0%	30.0%
Acetophenone	98-86-2	13	0.0%	0.0001%	0.0000%	0.0003%	13	0.0%	0.0%	0.0%	0.0%
Ethanol, 2-amino-, reaction products with ammonia, by-products from, phosphonomethylated	68649-44-5	13	0.0%	0.0004%	0.0004%	0.0017%	13	0.0%	25.0%	20.0%	25.0%
Isobutane	75-28-5	12	0.0%	29.4579%	7.9992%	52.0172%	13	0.0%	50.0%	10.0%	100.0%
1,2,3-Trimethylbenzene	526-73-8	11	0.0%	0.0022%	0.0006%	0.0232%	11	0.0%	5.0%	5.0%	16.0%
2-Aminoethanol hydrochloride	2002-24-6	11	0.0%	0.0007%	0.0003%	0.0631%	11	0.0%	10.0%	10.0%	10.0%
Alcohols, C12-14-secondary	126950-60-5	11	0.0%	0.0001%	0.0000%	0.0024%	11	0.0%	5.0%	5.0%	5.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Butyryl trihexyl citrate	82469-79-2	11	0.0%	0.0352%	0.0279%	0.0479%	11	0.0%	100.0%	100.0%	100.0%
Dipropylene glycol	25265-71-8	11	0.0%	0.0080%	0.0035%	0.0096%	11	0.0%	60.0%	60.0%	60.0%
Methanamine, N,N-dimethyl-, hydrochloride	593-81-7	11	0.0%	0.0073%	0.0049%	0.0092%	11	0.0%	5.0%	5.0%	5.0%
Polyquaternium 15	35429-19-7	11	0.0%	0.0001%	0.0001%	0.0474%	11	0.0%	0.0%	0.0%	0.5%
Sulfan blue	129-17-9	11	0.0%	13.7518 %	3.4380%	61.8832%	11	0.0%	1.0%	1.0%	1.0%
1-Propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl-, N-coco acyl derivs., inner salts	61789-40-0	10	0.0%	25.0000 %	0.1680%	25.0000%	10	0.0%	5.0%	5.0%	85.0%
Butane	106-97-8	10	0.0%	2.1702%	1.4738%	59.1062%	11	0.0%	80.0%	36.3%	100.0%
Diethylene glycol monomethyl ether	111-77-3	10	0.0%	0.0118%	0.0000%	0.0467%	11	0.0%	30.0%	4.0%	30.0%
Maleic acid homopolymer	26099-09-2	10	0.0%	0.0005%	0.0005%	0.0005%	10	0.0%	5.0%	5.0%	5.0%
Alkenes, C24-25 alpha-, polymers with maleic anhydride, docosyl esters	68607-07-8	9	0.0%	0.0082%	0.0028%	0.0248%	9	0.0%	30.0%	30.0%	30.0%
Formaldehyde polymer with methyl oxirane, 4-nonylphenol and oxirane	63428-92-2	9	0.0%	0.0023%	0.0011%	0.0227%	9	0.0%	0.0%	0.0%	0.2%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Formaldehyde, polymer with 4-(1,1-dimethylethyl)pheno l, 2-methyloxirane, 4-nonylphenol and oxirane	68188-99-8	9	0.0%	0.0001%	0.0001%	0.0012%	9	0.0%	0.0%	0.0%	0.0%
Iridium oxide	12030-49-8	9	0.0%	0.0001%	0.0000%	0.0016%	9	0.0%	100.0%	100.0%	100.0%
Sodium zirconium lactate	15529-67-6	9	0.0%	0.0700%	0.0088%	0.0846%	9	0.0%	0.3%	0.0%	0.3%
Aniline	62-53-3	8	0.0%	0.0005%	0.0002%	0.0005%	8	0.0%	1.0%	1.0%	1.0%
Hydrocarbons, terpene processing by-products	68956-56-9	8	0.0%	0.5010%	0.0034%	2.0795%	8	0.0%	100.0%	50.0%	100.0%
Isoascorbic acid	89-65-6	8	0.0%	0.0031%	0.0004%	0.0254%	8	0.0%	100.0%	100.0%	100.0%
Mineral oil - includes paraffin oil	8012-95-1	8	0.0%	0.0746%	0.0577%	0.1213%	8	0.0%	100.0%	100.0%	100.0%
Poly(oxy-1,2-ethanediyl), alpha-hydro-omega-hydroxy-, mono-C10-14-alkyl ethers, phosphates	68585-36-4	8	0.0%	0.0004%	0.0001%	0.0011%	8	0.0%	2.0%	2.0%	2.0%
Scandium oxide	12060-08-1	8	0.0%	0.0001%	0.0000%	0.0002%	8	0.0%	100.0%	100.0%	100.0%
Sodium nitrate	7631-99-4	8	0.0%	0.0780%	0.0745%	0.0841%	8	0.0%	40.0%	40.0%	53.0%
1-Hexanol	111-27-3	7	0.0%	0.0644%	0.0002%	0.0675%	7	0.0%	10.0%	5.0%	10.0%
2-Methyl-2,4-pentanediol	107-41-5	7	0.0%	0.0108%	0.0103%	0.0833%	7	0.0%	30.0%	30.0%	30.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Amides, tallow, n-[3-(dimethylamino)propyl],n-oxides	68647-77-8	7	0.0%	0.2501%	0.2340%	0.6175%	7	0.0%	65.0%	65.0%	65.0%
C8-10 Alcohols	85566-12-7	7	0.0%	0.0003%	0.0001%	0.0003%	7	0.0%	10.0%	6.5%	10.0%
Disodium octaborate	12008-41-2	7	0.0%	0.0023%	0.0000%	0.0491%	9	0.0%	100.0%	100.0%	100.0%
Erucic amidopropyl dimethyl detaine	149879-98-1	7	0.0%	0.1313%	0.0052%	0.5058%	7	0.0%	0.3%	0.0%	2.9%
Isopropanolamine dodecylbenzene	42504-46-1	7	0.0%	0.0008%	0.0001%	0.0064%	7	0.0%	7.0%	7.0%	60.0%
Quinoline	91-22-5	7	0.0%	0.0001%	0.0000%	0.0001%	7	0.0%	2.0%	2.0%	4.1%
Sorbitan, (9Z)-9-octadecenoate (2:3)	8007-43-0	7	0.0%	0.0042%	0.0037%	0.0070%	7	0.0%	4.0%	4.0%	4.0%
1-Propanaminium, N-(carboxymethyl)-N,N-dimethyl-3-[(1-oxooctyl)amino]-, inner salt	73772-46-0	6	0.0%	10.0000 %	10.0000%	10.0000%	6	0.0%	1.0%	1.0%	1.0%
1,3-Dichloropropene	542-75-6	6	0.0%	0.0000%	0.0000%	0.0000%	6	0.0%	0.3%	0.3%	0.3%
Amorphous silica	99439-28-8	6	0.0%	0.7057%	0.6267%	0.9588%	6	0.0%	10.0%	10.0%	77.1%
Aromatic ketones	224635-63-6	6	0.0%	0.0013%	0.0009%	0.0016%	6	0.0%	0.0%	0.0%	0.1%
Benzenesulfonic acid, C10-16-alkyl derivs., compds. with triethanolamine	68584-25-8	6	0.0%	0.0107%	0.0077%	0.0112%	6	0.0%	13.0%	13.0%	13.0%
Dichloromethane	75-09-2	6	0.0%	0.0000%	0.0000%	0.0001%	6	0.0%	0.3%	0.3%	0.3%
Dodecylbenzene sulfonic acid salts	68648-81-7	6	0.0%	0.0181%	0.0124%	0.0226%	6	0.0%	25.0%	20.0%	30.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
N-(3-Chloroallyl)hexamine chloride	4080-31-3	6	0.0%	0.0082%	0.0065%	0.0106%	6	0.0%	64.0%	64.0%	64.0%
Oxyalkylated alcohols	228414-35-5	6	0.0%	0.0251%	0.0001%	0.0344%	6	0.0%	0.4%	0.0%	0.7%
Sodium metabisulfite	7681-57-4	6	0.0%	0.0009%	0.0000%	0.0109%	6	0.0%	1.0%	0.3%	52.8%
Triton X-100	9002-93-1	6	0.0%	0.0011%	0.0002%	0.0022%	6	0.0%	5.0%	5.0%	5.0%
1-Pentanol	71-41-0	5	0.0%	0.0654%	0.0629%	0.0677%	5	0.0%	10.0%	10.0%	10.0%
Aluminum oxide [NF]	90669-62-8	5	0.0%	6.1084%	5.8822%	8.2046%	5	0.0%	85.0%	85.0%	85.0%
Antimony trioxide	1309-64-4	5	0.0%	0.0001%	0.0000%	0.0002%	5	0.0%	100.0%	100.0%	100.0%
Benzenesulfonic acid, (1-methylethyl)-, sodium salt	28348-53-0	5	0.0%	0.0921%	0.0887%	0.0954%	5	0.0%	10.0%	10.0%	10.0%
Bicine	150-25-4	5	0.0%	0.0066%	0.0013%	0.0132%	5	0.0%	10.0%	2.1%	10.0%
Copper sulfate	7758-98-7	5	0.0%	0.0113%	0.0022%	0.0397%	7	0.0%	16.0%	3.0%	100.0%
Dapsone	80-08-0	5	0.0%	0.1128%	0.0676%	0.4257%	5	0.0%	60.0%	60.0%	60.0%
Glycine, N-(hydroxymethyl)-, monosodium salt	70161-44-3	5	0.0%	0.0002%	0.0000%	0.0134%	5	0.0%	0.5%	0.5%	40.1%
Hexane	110-54-3	5	0.0%	13.7064%	2.2228%	14.9723%	5	0.0%	20.0%	7.6%	20.0%
Coconut oil	8001-31-8	4	0.0%	0.0009%	0.0000%	0.0018%	4	0.0%	2.0%	2.0%	2.0%
Epichlorohydrin	106-89-8	4	0.0%	0.0005%	0.0000%	0.0009%	4	0.0%	1.0%	1.0%	1.0%
Fuels, diesel	68334-30-5	4	0.0%	0.3750%	0.2093%	0.3750%	4	0.0%	60.0%	60.0%	60.0%
Pentane	109-66-0	4	0.0%	9.8386%	5.8253%	13.8681%	4	0.0%	13.0%	10.0%	18.6%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Poly(oxy-1,2-ethanediyl), ?-sulfo-?--(hexyloxy)-, C6-10-alkyl ethers, ammonium salts	68037-05-8	4	0.0%	0.0059%	0.0001%	0.0120%	4	0.0%	13.0%	13.0%	13.0%
Poly(oxy-1,2-ethanediyl), alpha-hydro-omega-hydroxy-, mono-C8-10-alkyl ethers, phosphates	68130-47-2	4	0.0%	0.0009%	0.0000%	0.0018%	4	0.0%	2.0%	2.0%	2.0%
Poly(sodium-p-styrenesulfonate)	25704-18-1	4	0.0%	0.0136%	0.0105%	0.5348%	4	0.0%	0.0%	0.0%	3.3%
Poly(vinyl alcohol)	25213-24-5	4	0.0%	0.0013%	0.0010%	0.0506%	4	0.0%	0.0%	0.0%	0.3%
Polyvinyl acetate, partially hydrolyzed	304443-60-5	4	0.0%	0.0003%	0.0002%	0.0007%	4	0.0%	0.0%	0.0%	0.0%
Pyridinium, 1-(phenylmethyl)-, alkyl derivs., chlorides	100765-57-9	4	0.0%	0.0021%	0.0015%	0.0027%	4	0.0%	60.0%	60.0%	60.0%
Sodium chloroacetate	3926-62-3	4	0.0%	0.0028%	0.0017%	0.0072%	4	0.0%	0.0%	0.0%	0.0%
Spirit of ammonia, aromatic	8013-59-0	4	0.0%	0.0016%	0.0008%	0.0022%	4	0.0%	20.0%	20.0%	20.0%
1-Propene	115-07-1	3	0.0%	1.5740%	0.8251%	4.6574%	4	0.0%	3.0%	1.0%	5.0%
1,3-Butadiene	106-99-0	3	0.0%	0.1929%	0.0747%	0.3795%	3	0.0%	0.5%	0.3%	0.5%
2-Propen-1-aminium, N,N-dimethyl-N-2-propenyl-, chloride	7398-69-8	3	0.0%	0.0001%	0.0000%	0.0001%	3	0.0%	5.0%	5.0%	5.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
2-Propen-1-aminium, N,N-dimethyl-N-2-propenyl-, chloride, homopolymer	26062-79-3	3	0.0%	0.0001%	0.0001%	0.0102%	3	0.0%	20.0%	20.0%	20.0%
3-Methoxypropylamine	5332-73-0	3	0.0%	0.0128%	0.0068%	0.0181%	3	0.0%	60.0%	60.0%	60.0%
Aliphatic alcohol polyglycol ether	68015-67-8	3	0.0%	0.0002%	0.0001%	0.0002%	3	0.0%	0.0%	0.0%	0.0%
Alkyl* dimethyl benzyl ammonium chloride *(61% C12, 23% C14, 11% C16, 2.5% C18 2.5% C10 and trace of C8)	61789-71-7	3	0.0%	0.0051%	0.0007%	0.0052%	3	0.0%	5.0%	5.0%	5.0%
Benzenesulfonic acid, dodecyl-, branched, compds. with 2-propanamine	90218-35-2	3	0.0%	0.0022%	0.0012%	0.0023%	3	0.0%	10.0%	10.0%	10.0%
Bio-Perge	55965-84-9	3	0.0%	0.0001%	0.0000%	0.0002%	3	0.0%	1.3%	1.3%	1.3%
Boric acid, potassium salt	20786-60-1	3	0.0%	0.0000%	0.0000%	0.0073%	3	0.0%	20.0%	20.0%	20.0%
Butene	25167-67-3	3	0.0%	25.0827%	8.0512%	49.3308%	3	0.0%	65.0%	33.5%	65.0%
Calcium oxide	1305-78-8	3	0.0%	0.0011%	0.0005%	0.0358%	3	0.0%	1.5%	1.5%	4.7%
Dimethyl adipate	627-93-0	3	0.0%	0.0130%	0.0104%	0.0132%	3	0.0%	10.0%	10.0%	10.0%
Dimethyl succinate	106-65-0	3	0.0%	0.0169%	0.0135%	0.0171%	3	0.0%	13.0%	13.0%	13.0%
Dodecylbenzenesulfonic acid, morpholine salt	12068-08-5	3	0.0%	0.0272%	0.0242%	0.0280%	3	0.0%	60.0%	60.0%	60.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Ethoxylated undecyl alcohol	127036-24-2	3	0.0%	0.1286%	0.0572%	0.1510%	6	0.0%	0.1%	0.0%	0.3%
Hydroxyethylcellulose	9004-62-0	3	0.0%	0.0244%	0.0033%	0.0403%	3	0.0%	100.0%	100.0%	100.0%
Lactic acid; dl form Na salt	72-17-3	3	0.0%	0.0226%	0.0041%	0.0445%	3	0.0%	40.0%	40.0%	40.0%
Methyl cellulose	9004-67-5	3	0.0%	0.0005%	0.0001%	0.0007%	3	0.0%	5.0%	5.0%	5.0%
Morpholine	110-91-8	3	0.0%	0.0023%	0.0020%	0.0023%	3	0.0%	5.0%	5.0%	5.0%
Nitrilotriacetic acid	139-13-9	3	0.0%	0.0015%	0.0005%	0.0055%	3	0.0%	45.0%	45.0%	45.0%
Pentaethylenehexamine	4067-16-7	3	0.0%	0.0071%	0.0070%	0.0083%	3	0.0%	0.1%	0.1%	0.1%
Polyacrylamide	25038-45-3	3	0.0%	0.0280%	0.0205%	0.0339%	3	0.0%	40.0%	40.0%	40.0%
Polyoxylated fatty amine salt	61791-26-2	3	0.0%	0.0012%	0.0012%	0.0012%	3	0.0%	0.0%	0.0%	0.0%
Sodium diacetate	126-96-5	3	0.0%	0.0031%	0.0031%	0.0031%	3	0.0%	0.0%	0.0%	0.0%
Sodium sulfite	7757-83-7	3	0.0%	0.0055%	0.0005%	0.0056%	3	0.0%	1.0%	1.0%	1.0%
Sodium thiosulfate, pentahydrate	10102-17-7	3	0.0%	0.3361%	0.3283%	0.4841%	3	0.0%	60.0%	60.0%	60.0%
Tall oil, ethoxylated	65071-95-6	3	0.0%	0.0001%	0.0000%	0.0001%	3	0.0%	0.0%	0.0%	0.0%
Tetraethylenepentamine	112-57-2	3	0.0%	0.1096%	0.1069%	0.1266%	3	0.0%	0.8%	0.8%	0.9%
Triethylenetetramine	112-24-3	3	0.0%	0.0024%	0.0023%	0.0027%	3	0.0%	0.0%	0.0%	0.0%
Undecanol, Branched and linear	128973-77-3	3	0.0%	0.0068%	0.0030%	0.0080%	3	0.0%	0.0%	0.0%	0.0%
1,2-Ethanediamine, polymer with 2-methyloxirane	25214-63-5	2	0.0%	0.0023%	0.0003%	0.0044%	2	0.0%	5.0%	5.0%	5.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
2-(Thiocyanomethylthio)benzothiazole	21564-17-0	2	0.0%	0.0000%	0.0000%	0.0000%	2	0.0%	8.0%	8.0%	8.0%
2-Methylbutane	78-78-4	2	0.0%	16.2786%	14.0724%	18.4849%	2	0.0%	25.0%	25.0%	25.0%
4-Methyl-2-pentanol	108-11-2	2	0.0%	0.0019%	0.0002%	0.0035%	2	0.0%	5.1%	0.6%	9.5%
Alkanes, C12-14-iso-	68551-19-9	2	0.0%	0.0477%	0.0432%	0.0522%	2	0.0%	15.0%	15.0%	15.0%
Benzene	71-43-2	2	0.0%	3.2577%	2.8147%	3.7008%	2	0.0%	5.0%	5.0%	5.0%
Distillates, petroleum, hydrotreated heavy naphthenic	64742-52-5	2	0.0%	0.0117%	0.0055%	0.0180%	2	0.0%	45.0%	31.5%	58.5%
Ethane	74-84-0	2	0.0%	2.3224%	1.5744%	3.0705%	3	0.0%	2.0%	2.0%	9.2%
Fumes, silica	69012-64-2	2	0.0%	0.2504%	0.0251%	0.4758%	2	0.0%	1.5%	0.2%	2.9%
Hydroxypropyl guar gum	39421-75-5	2	0.0%	0.0005%	0.0003%	0.0007%	2	0.0%	95.0%	95.0%	95.0%
Methane	74-82-8	2	0.0%	1.6712%	0.8348%	2.5076%	3	0.0%	1.0%	1.0%	9.1%
Methylene bis(thiocyanate)	6317-18-6	2	0.0%	0.0000%	0.0000%	0.0000%	2	0.0%	8.0%	8.0%	8.0%
Orange terpenes	8028-48-6	2	0.0%	0.0058%	0.0040%	0.0077%	2	0.0%	7.5%	5.3%	9.8%
Phosphonic acid, [[[phosphonomethyl)imino]bis[6,1-hexanediyl]nitro]bis(methylene)]tetrakis-	34690-00-1	2	0.0%	0.0275%	0.0181%	0.0370%	2	0.0%	100.0%	100.0%	100.0%
Sodium dodecyl sulfate	151-21-3	2	0.0%	0.0285%	0.0114%	0.0457%	2	0.0%	20.0%	11.0%	29.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Tin(II) chloride	7772-99-8	2	0.0%	0.0013%	0.0013%	0.0013%	2	0.0%	60.0%	60.0%	60.0%
(13Z)-N,N-bis(2-hydroxyethyl)-N-methyldocos-13-en-1-aminium chloride	120086-58-0	1	0.0%	0.1324%	0.1324%	0.1324%	1	0.0%	0.8%	0.8%	0.8%
1-tert-Butoxy-2-propanol	57018-52-7	1	0.0%	0.0008%	0.0008%	0.0008%	1	0.0%	15.0%	15.0%	15.0%
1,3,5-Triazine	290-87-9	1	0.0%	0.0001%	0.0001%	0.0001%	1	0.0%	0.9%	0.9%	0.9%
Alkyl* dimethyl ethylbenzyl ammonium chloride *(60%C14, 30%C16, 5%C12, 5%C18)	68956-79-6	1	0.0%	0.0006%	0.0006%	0.0006%	1	0.0%	10.0%	10.0%	10.0%
Aluminum	7429-90-5	1	0.0%	0.0011%	0.0011%	0.0011%	1	0.0%	100.0%	100.0%	100.0%
Aluminum chloride hydroxide sulfate	39290-78-3	1	0.0%	0.0131%	0.0131%	0.0131%	1	0.0%	0.1%	0.1%	0.1%
Aluminum chloride, basic	1327-41-9	1	0.0%	0.0005%	0.0005%	0.0005%	1	0.0%	5.0%	5.0%	5.0%
Aluminum sulfate	10043-01-3	1	0.0%	0.0158%	0.0158%	0.0158%	1	0.0%	10.0%	10.0%	10.0%
Benzene, ethenyl-, polymer with 2-methyl-1,3-No Recordutadiene, hydrogenated	68648-89-5	1	0.0%	0.0106%	0.0106%	0.0106%	1	0.0%	0.1%	0.1%	0.1%
Calcium hypochlorite	7778-54-3	1	0.0%	0.0984%	0.0984%	0.0984%	1	0.0%	75.0%	75.0%	75.0%
Carboxymethyl cellulose	9000-11-7	1	0.0%	0.0433%	0.0433%	0.0433%	1	0.0%	50.0%	50.0%	50.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
Copper(I) iodide	7681-65-4	1	0.0%	0.0001%	0.0001%	0.0001%	1	0.0%	5.0%	5.0%	5.0%
Cyclohexane	110-82-7	1	0.0%	0.0130%	0.0130%	0.0130%	1	0.0%	5.0%	5.0%	5.0%
Ethoxylated C12-15 alcohols	68131-39-5	1	0.0%	0.0281%	0.0281%	0.0281%	1	0.0%	0.3%	0.3%	0.3%
Ethylene	74-85-1	1	0.0%	2.0530%	2.0530%	2.0530%	1	0.0%	10.0%	10.0%	10.0%
Fats and Glyceridic oils, vegetable, hydrogenated	68334-28-1	1	0.0%	0.0865%	0.0865%	0.0865%	1	0.0%	60.0%	60.0%	60.0%
Fatty acids, coco, reaction products with diethylenetriamine and soya fatty acids, ethoxylated, chloromethane-quaternized	68604-75-1	1	0.0%	0.0047%	0.0047%	0.0047%	1	0.0%	0.1%	0.1%	0.1%
Furfural	98-01-1	1	0.0%	0.0206%	0.0206%	0.0206%	1	0.0%	100.0%	100.0%	100.0%
Gilsonite	12002-43-6	1	0.0%	0.0058%	0.0058%	0.0058%	1	0.0%	100.0%	100.0%	100.0%
Hydrazine	302-01-2	1	0.0%	0.0000%	0.0000%	0.0000%	1	0.0%	1.0%	1.0%	1.0%
Hypochlorous acid	7790-92-3	1	0.0%	0.0001%	0.0001%	0.0001%	1	0.0%	0.2%	0.2%	0.2%
Naphthenic acid ethoxylate	68410-62-8	1	0.0%	0.0042%	0.0042%	0.0042%	1	0.0%	0.0%	0.0%	0.0%
Oxirane, 2-methyl-, polymer with oxirane, mono(2-ethylhexyl) ether	64366-70-7	1	0.0%	0.0097%	0.0097%	0.0097%	1	0.0%	13.0%	13.0%	13.0%
Paraformaldehyde	30525-89-4	1	0.0%	0.0000%	0.0000%	0.0000%	1	0.0%	0.2%	0.2%	0.2%
Perboric acid, sodium salt,	10332-33-9	1	0.0%	0.0016%	0.0016%	0.0016%	1	0.0%	95.0%	95.0%	95.0%

Final Report 4: Impacts and Mitigation Measures

Chemical Identification		Maximum concentration in fracturing fluid (% by mass) (USEPA, 2015)					Maximum concentration in additive (% by mass) (USEPA, 2015)				
Chemical name	CAS number	Number of disclosures	Percentage of disclosures	Median	5th percentile	95th percentile	Number of ingredient records	Percent of ingredient records	Median	5th percentile	95th percentile
monohydrate											
Polyethylene glycol mono(1,1,3,3-tetramethylbutyl)phenyl ether	9036-19-5	1	0.0%	0.0031%	0.0031%	0.0031%	1	0.0%	5.0%	5.0%	5.0%
Siloxanes and Silicones, di-Me, Me hydrogen	68037-59-2	1	0.0%	0.0047%	0.0047%	0.0047%	1	0.0%	0.1%	0.1%	0.1%
Sodium trimetaphosphate [USAN]	7785-84-4	1	0.0%	0.0012%	0.0012%	0.0012%	1	0.0%	2.0%	2.0%	2.0%
tert-Butyl perbenzoate	614-45-9	1	0.0%	0.0000%	0.0000%	0.0000%	1	0.0%	7.0%	7.0%	7.0%
Tetraethylene glycol	112-60-7	1	0.0%	0.0084%	0.0084%	0.0084%	1	0.0%	30.0%	30.0%	30.0%
Tetrasodium pyrophosphate	7722-88-5	1	0.0%	0.0030%	0.0030%	0.0030%	1	0.0%	5.0%	5.0%	5.0%
Titanium(4+) 2-[bis(2-hydroxyethyl)amino]ethanolate propan-2-olate (1:2:2)	36673-16-2	1	0.0%	0.1970%	0.1970%	0.1970%	1	0.0%	1.2%	1.2%	1.2%
Triethanolamine hydroxyacetate	68299-02-5	1	0.0%	1.1048%	1.1048%	1.1048%	1	0.0%	20.0%	20.0%	20.0%

Final Report 4: Impacts and Mitigation Measures



Roinn Cumarsáide, Gníomhaíthe
ar son na hAeráide & Comhshaoil
Department of Communications,
Climate Action & Environment

Authors: Roger Olsen, Dawn Keating,
Carlos Claros, Henning Moe and
Lorraine Gaston



Northern Ireland
Environment
Agency

Unconventional gas exploration and extraction (UGEE) involves hydraulic fracturing (“fracking”) of low permeability rock to permit the extraction of natural gas on a commercial scale from unconventional sources, such as shale gas deposits, coal seams and tight sandstone.

The UGEE Joint Research Programme (JRP) (www.ugeerresearch.ie) is composed of five interlinked projects and involves field studies (baseline monitoring of water and seismicity), as well as an extensive desk-based literature review of UGEE practices and regulations worldwide. The UGEE JRP was designed to provide the scientific basis that will assist regulators - in both Northern Ireland and Ireland - to make informed decisions about whether or not it is environmentally safe to permit UGEE projects/operations involving fracking. As well as research in Ireland, the UGEE JRP looks at and collates evidence from other countries.

The JRP is funded by the Department of Communications, Climate Action and Environment, DCCAE (formerly the Department of Communications, Energy and Natural Resources (DCENR) and the Environment Division of the Department of Environment, Community and Local Government (DECLG)) and the Northern Ireland Environment Agency (NIEA). The research programme was managed by a steering committee comprising the EPA, representatives from DCCAE, the Geological Survey of Ireland, Commission for Energy Regulation, An Bord Pleanála, NIEA, the Geological Survey of Northern Ireland and the Health Service Executive.

List of Outputs:

- Final Report 1: Baseline Characterisation of Groundwater, Surface Water and Aquatic Ecosystems
- Summary Report 1: Baseline Characterisation of Groundwater, Surface Water and Aquatic Ecosystems
- Final Report 2: Baseline Characterisation of Seismicity
- Summary Report 2: Baseline Characterisation of Seismicity
- Final Report 3: Baseline Characterisation of Air Quality
- Summary Report 3: Baseline Characterisation of Air Quality
- Final Report 4: Impacts & Mitigation Measures
- Summary Report 4: Impacts & Mitigation Measures
- Final Report 5: Regulatory Framework for Environmental Protection
- Summary Report 5: Regulatory Framework for Environmental Protection
- UGEE Joint Research Programme Integrated Synthesis Report

EPA Research: McCumiskey House,
Richiew, Clonskeagh, Dublin 14.

Phone: 01 268 0100
Twitter: @EPAResearchNews
Email: research@epa.ie

www.ugeerresearch.ie