

Annex 1

Table A.1: Chemical constituents of products used in fracturing fluid (table uses information from <http://ecb.jrc.ec.europa.eu>)

CAS Number	Substance	Priority list	PBT or Listed on First Priority List	Aquatic Toxicity (Chronic and/or Acute)	Acute Toxicity	Carcinogen	Mutagen	Repro
2634-33-5	1,2 Benzisothiazolin-2-one / 1,2-benzisothiazolin-3-one			Yes	Yes			
95-63-6	1,2,4 trimethylbenzene			Yes	Yes			
123-91-1	1,4 Dioxane	2				Carc 2		
52-51-7	2-Bromo-2-nitro-1,3-propanediol			Yes	Yes			
111-76-2	2-Butoxy ethanol	4			Yes			
107-19-7	2-Propyn-1-ol / Propargyl Alcohol			Yes	Yes			
51229-78-8	3,5,7-Triaza-1-azoniatricyclo[3.3.1.1 ³ .7]decane, 1-(3-chloro-2-propenyl)-			Yes	Yes			
108-24-7	Acetic Anhydride				Yes			
79-06-1	Acrylamide	1			Yes	Carc 1B	Muta 1B	Repr 2
1336-21-6	Ammonia			Yes				
12125-02-9	Ammonium Chloride				Yes			
1341-49-7	Ammonium hydrogen-difluoride				Yes			
7727-54-0	Ammonium Persulfate / Diammonium peroxodisulphate				Yes			
7664-41-7	Aqueous ammonia			Yes	yes			
71-43-2	Benzene	1	1 st Priority list			Carc 1A	Muta 1B	
10043-35-3	Boric acid	4						
71-36-3	Butan-1-ol				Yes			
10049-04-4	Chlorine Dioxide			Yes	Yes			
10049-04-5	Chlorine Dioxide			Yes	Yes			
7758-98-7	Copper (II) Sulfate			Yes	Yes			
111-46-6	Diethylene Glycol				Yes			
107-21-1	Ethane-1,2-diol / Ethylene Glycol				Yes			
100-41-4	Ethyl Benzene	1			Yes			

Table A.1: Chemical constituents of products used in fracturing fluid (cont)								
CAS Number	Substance	Priority list	PBT or Listed on First Priority List	Aquatic Toxicity (Chronic and/or Acute)	Acute Toxicity	Carcinogen	Mutagen	Repro
9003-11-6	Ethylene Glycol-Propylene Glycol Copolymer (Oxirane, methyl-, polymerwithoxirane)							
75-21-8	Ethylene oxide				Yes	Carc 1B	Muta 1B	
50-00-0	Formaldehyde				Yes	Carc 2		
75-12-7	Formamide							Repr 1B
111-30-8	Glutaraldehyde			Yes	Yes			
7647-01-0	Hydrochloric Acid / Hydrogen Chloride / muriatic acid				Yes			
7722-84-1	Hydrogen Peroxide	2			Yes			
5470-11-1	Hydroxylamine hydrochloride			Yes	Yes	Carc 2		
98-82-8	Isopropylbenzene (cumene)	1						
64742-95-6	Light aromatic solvent naphtha					Carc 1B	Muta 1B	
67-56-1	Methanol				Yes			
8052-41-3	Mineral spirits / Stoddard Solvent					Carc 1B	Muta 1B	
141-43-5	Monoethanolamine				Yes			
64742-48-9	Naphtha (petroleum), hydrotreated heavy					Carc 1B	Muta 1B	
91-20-3	Naphthalene	1	1 st Priority list	Yes	Yes	Carc 2		
38640-62-9	Naphthalene bis(1-methylethyl)		PBT					
64742-65-0	Petroleum Base Oil					Carc 1B		
64741-68-0	Petroleum naphtha					Carc 1B	Muta 1B	
1310-58-3	Potassium Hydroxide				Yes			
107-98-2	Propylene glycol monomethyl ether	4						
7631-90-5	Sodium bisulfate				Yes			
3926-62-3	Sodium Chloroacetate			Yes	Yes			
1310-73-2	Sodium Hydroxide	4						

Table A.1: Chemical constituents of products used in fracturing fluid (cont)

CAS Number	Substance	Priority list	PBT or Listed on First Priority List	Aquatic Toxicity (Chronic and/or Acute)	Acute Toxicity	Carcinogen	Mutagen	Repro
7681-52-9	Sodium hypochlorite	2			Yes			
1303-96-4	Sodium tetraborate decahydrate							Repr 1B
5329-14-6	Sulfamic acid			Yes				
533-74-4	Tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione (a.k.a. Dazomet)			Yes	Yes			
64-02-8	Tetrasodium Ethylenediaminetetraacetate	1			Yes			
68-11-1	Thioglycolic acid				Yes			
62-56-6	Thiourea			Yes	Yes	Carc 2		Repr 2
108-88-3	Toluene	2						Repr 2
5064-31-3	Trisodium Nitrilotriacetate	3			Yes	Carc 2		
1330-20-7	Xylene				Yes			

Table A.2: Analysis of flowback fluid composition (information from New York State (2009))

CAS #	Parameter Name	Total Number of Samples	Number of Detects	Min	Median	Max	Units
	1,4-Dichlorobutane	1	1	198	198	198	%REC
	2,4,6-Tribromophenol ⁹¹	1	1	101	101	101	%REC
	2-Fluorobiphenyl ⁹²	1	1	71	71	71	%REC
	2-Fluorophenol ⁹³	1	1	72.3	72.3	72.3	%REC
00056-57-5	4-Nitroquinoline-1 -oxide	24	24	1422	13908	48336	mg/L
	4-Terphenyl-d14 ⁹⁴	1	1	44.8	44.8	44.8	%REC
00067-64-1	Acetone	3	1	681	681	681	µg/L
	Alkalinity, Carbonate, as CaCO ₃	31	9	4.9	91	117	mg/L
07439-90-5	Aluminum	29	3	0.08	0.09	1.2	mg/L
07440-36-0	Antimony	29	1	0.26	0.26	0.26	mg/L
07664-41-7	Aqueous ammonia	28	25	12.4	58.1	382	mg/L
07440-38-2	Arsenic	29	2	0.09	0.1065	0.123	mg/L
07440-39-3	Barium	34	34	0.553	661.5	15700	mg/L
00071-43-2	Benzene	29	14	15.7	479.5	1950	µg/L
	Bicarbonates ⁹⁵	24	24	0	564.5	1708	mg/L
	Biochemical Oxygen Demand	29	28	3	274.5	4450	mg/L
00117-81-7	Bis(2-ethylhexyl)phthalate	23	2	10.3	15.9	21.5	µg/L
07440-42-8	Boron	26	9	0.539	2.06	26.8	mg/L
24959-67-9	Bromide	6	6	11.3	616	3070	mg/L
00075-25-2	Bromoform	29	2	34.8	36.65	38.5	µg/L
07440-43-9	Cadmium	29	5	0.009	0.032	1.2	mg/L
07440-70-2	Calcium	55	52	29.9	5198	34000	mg/L
	Chemical Oxygen Demand	29	29	1480	5500	31900	mg/L
	Chloride	58	58	287	56900	228000	mg/L
00124-48-1	Chlorodibromomethane	29	2	3.28	3.67	4.06	µg/L
07440-47-3	Chromium	29	3	0.122	5	5.9	mg/L
07440-48-4	Cobalt	25	4	0.03	0.3975	0.58	mg/L
	Color	3	3	200	1000	1250	PCU
07440-50-8	Copper	29	4	0.01	0.035	0.157	mg/L
00057-12-5	Cyanide	7	2	0.006	0.0125	0.019	mg/L
00075-27-4	Dichlorobromomethane	29	1	2.24	2.24	2.24	µg/L
00100-41-4	Ethyl Benzene	29	14	3.3	53.6	164	µg/L
16984-48-8	Fluoride	4	2	5.23	392.615	780	mg/L
07439-89-6	Iron	58	34	0	47.9	810	mg/L
07439-92-1	Lead	29	2	0.02	0.24	0.46	mg/L
	Lithium	25	4	34.4	55.75	161	mg/L
07439-95-4	Magnesium	58	46	9	563	3190	mg/L
07439-96-5	Manganese	29	15	0.292	2.18	14.5	mg/L
00074-83-9	Methyl Bromide	29	1	2.04	2.04	2.04	µg/L
00074-87-3	Methyl Chloride	29	1	15.6	15.6	15.6	µg/L
07439-98-7	Molybdenum	25	3	0.16	0.72	1.08	mg/L
00091-20-3	Naphthalene	26	1	11.3	11.3	11.3	µg/L
07440-02-0	Nickel	29	6	0.01	0.0465	0.137	mg/L
	Nitrogen, Total as N	1	1	13.4	13.4	13.4	mg/L
	Oil and Grease	25	9	5	17	1470	mg/L
	o-Terphenyl ⁹⁶	1	1	91.9	91.9	91.9	%Rec
	pH	56	56	1	6.2	8	S.U.
00108-95-2	Phenol	23	1	459	459	459	µg/L
	Phenols	25	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
07440-09-7	Potassium	31	13	59	206	7810	mg/L
07782-49-2	Selenium	29	1	0.058	0.058	0.058	mg/L
07440-22-4	Silver	29	3	0.129	0.204	6.3	mg/L
07440-23-5	Sodium	31	28	83.1	19650	96700	mg/L

CAS #	Parameter Name	Total Number of Samples	Number of Detects	Min	Median	Max	Units
07440-24-6	Strontium	30	27	0.501	821	5841	mg/L
14808-79-8	Sulfate (as SO ₄)	58	45	0	3	1270	mg/L
	Sulfide (as S)	3	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 ⁹⁷	3	3	0.2	0.22	0.61	mg/L
00127-18-4	Tetrachloroethylene	29	1	5.01	5.01	5.01	µg/L
07440-28-0	Thallium	29	1	0.1	0.1	0.1	mg/L
07440-32-6	Titanium	25	1	0.06	0.06	0.06	mg/L
00108-88-3	Toluene	29	15	2.3	833	3190	µg/L
	Total Dissolved Solids	58	58	1530	93200	337000	mg/L
	Total Kjeldahl Nitrogen	25	25	37.5	122	585	mg/L
	Total Organic Carbon ⁹⁸	23	23	69.2	449	1080	mg/L
	Total Suspended Solids	29	29	30.6	146	1910	mg/L
	Xylenes	22	14	16	487	2670	µg/L
07440-66-6	Zinc	29	6	0.028	0.048	0.09	mg/L
--	Gross Alpha	8	8	22.41	--	18,950	pCi/L
--	Gross Beta	8	8	62	--	7,445	pCi/L
7440-14-4	Total Alpha Radium	6	6	3.8	--	1,810	pCi/L
7440-14-4	Radium-226	3	3	2.58	--	33	pCi/L
7440-14-4	Radium-228	3	3	1.15	--	18.41	pCi/L