

Appendix A

Chemicals Identified in Hydraulic Fracturing Fluids and/or Flowback and Produced Water

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Appendix A. Chemicals Identified in Hydraulic Fracturing Fluids and/or Flowback and Produced Water

A.1. Supplemental Tables and Information

1 The EPA identified authoritative sources for information on hydraulic fracturing chemicals and, to
 2 the extent possible, verified the chemicals used in hydraulic fracturing fluids and detected in
 3 flowback and produced water of hydraulically fractured wells. The EPA used 10 sources to identify
 4 the chemicals used in hydraulic fracturing fluids or detected in flowback or produced water. Seven
 5 sources are government entities (Congressional, federal, or state) that obtained the data directly
 6 from industry. The remaining three represent collaborations between state, non-profit, academic,
 7 and industry groups. FracFocus is the result of a collaboration between the Ground Water
 8 Protection Council (a non-profit coalition of state ground water protection agencies) and
 9 the Interstate Oil and Gas Compact Commission (a multi-state government agency). The Marcellus
 10 Shale Coalition is a drilling industry trade group. [Colborn et al. \(2011\)](#) is a peer-reviewed journal
 11 article. Most of the listed chemicals were cited by multiple sources.

12 Seven of the ten sources obtained information about the chemicals used in hydraulic fracturing
 13 fluids from material safety data sheets (MSDSs) provided by chemical manufacturers for the
 14 products they sell, as required by the Occupational Safety and Health Administration (OSHA). The
 15 MSDSs must list all hazardous ingredients if they comprise at least 1% of the product; for
 16 carcinogens, the reporting threshold is 0.1%. However, chemical manufacturers may withhold
 17 information (e.g., chemical name, concentration of the substance in a mixture) about a hazardous
 18 substance from MSDSs if it is claimed as confidential business information (CBI), provided that
 19 certain conditions are met ([OSHA, 2013](#)).

Table A-1. Description of sources used to create lists of chemicals used in fracturing fluids or detected in flowback or produced water.

The number next to each citation in the reference column corresponds to numbers in the reference columns found in Table A-2, Table A-3, and Table A-4.

Description / Content	Reference
Chemicals and other components used by 14 hydraulic fracturing service companies from 2005 to 2009 as reported to the House Committee on Energy and Commerce. For each hydraulic fracturing product reported, companies also provided an MSDS with information about the product's chemical components.	House of Representatives (2011)^a (1)

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Description / Content	Reference
Chemicals used during natural gas operations with some potential health effects. The list of chemicals was compiled from MSDSs from several sources, including the Bureau of Land Management, U.S. Forest Service, state agencies, and industry.	Colborn et al. (2011)^a (2)
Chemicals used or proposed for use in hydraulic fracturing in the Marcellus Shale in New York based on product composition disclosures and MSDSs submitted to the New York State Department of Environmental Conservation (NYSDEC). Also includes data provided separately to NYSDEC by well operators on analytical results of flowback water samples from Marcellus Shale operations in Pennsylvania and West Virginia.	NYSDEC (2011)^{a,b} (3)
Chemicals reported to be used by nine hydraulic fracturing service companies from 2005 to 2010. Companies provided the chemical names in MSDSs, product bulletins, and formulation sheets.	U.S. EPA (2013a)^a (4)
MSDSs provided to the EPA during on-site visits to hydraulically fractured oil and gas wells in Oklahoma and Colorado.	Sheets
Characteristics of undiluted chemicals found in hydraulic fracturing fluids associated with coalbed methane production, based on MSDSs, literature searches, reviews of relevant MSDSs provided by service companies, and discussions with field engineers, service company chemists, and state and federal employees.	U.S. EPA (2004)^a (6)
Chemicals used in Pennsylvania for hydraulic fracturing activities based on MSDSs provided by industry.	PA DEP (2010)^a (7)
Chemical records entered in FracFocus by oil and gas operators for individual wells from January 1, 2011, through February 28, 2013. FracFocus is a publicly accessible hydraulic fracturing chemical registry developed by the Ground Water Protection Council and the Interstate Oil and Gas Compact Commission. Chemicals claimed as confidential business information (CBI) do not have to be reported in FracFocus.	U.S. EPA (2015c)^a (8)
Chemicals detected in flowback from 19 hydraulically fractured shale gas wells in Pennsylvania and West Virginia, based on analyses conducted by 17 Marcellus Shale Coalition member companies.	Hayes (2009)^b (9)
Chemicals reportedly detected in flowback and produced water from 81 wells provided to the EPA by nine well operating companies.	U.S. EPA (2011b)^b (10)

^a Sources used to identify chemicals used in hydraulic fracturing fluids.

^b Sources used to identify chemicals detected in flowback and produced water.

- 1 Once it had identified chemicals used in hydraulic fracturing fluids and chemicals detected in
- 2 flowback/produced water, the EPA conducted an initial review of the chemicals for preliminary
- 3 validation of provided chemical name and Chemical Abstracts Service Registry Number (CASRN)
- 4 combinations. A CASRN is a unique numeric identifier assigned by the Chemical Abstracts Service
- 5 (CAS) to a chemical substance when it enters the CAS Registry Database. The EPA Office of Research

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1 and Development's National Center for Computational Toxicology (NCCT) provided the final formal
2 validation and verification of the listed chemicals.

3 The EPA first compared the hydraulic fracturing chemical CASRN and names with chemicals listed
4 in NCCT's Distributed Structure-Searchable Toxicity Database network (DSSTox) database ([U.S.
5 EPA, 2013b](#)). For the CASRN and chemical names that did not appear in the DSSTox database, the
6 EPA's Substance Registry Services database and the U.S. National Library of Medicine ChemID
7 database were used to verify accurate chemical name and CASRN pairing ([NLM, 2014](#); [U.S. EPA,
8 2014c](#)). The EPA also identified cases where CASRN/name combinations could not be verified by
9 use of selected public sources and flagged those cases for resolution by NCCT.

10 NCCT then verified all of the CASRN and chemical names for the chemical lists generated by the EPA
11 in accordance with NCCT DSSTox Chemical Information Quality Review Procedures
12 (<http://www.epa.gov/ncct/dsstox/ChemicalInfQAProcedures.html>). The process included QA/QC
13 on the identification and validation of CASRN/chemical name combinations and resolution of
14 inconsistencies and problems including duplications, CASRN errors, and CASRN/chemical name
15 mismatches.

16 The general methodology for resolving conflicts between CASRN/chemical name combinations and
17 other chemical identification issues differed slightly depending on the data provided by each
18 source. To resolve chemical/CASRN conflict in data provided by the nine service companies, the
19 EPA worked with each company to verify the CASRN/chemical combinations proposed by NCCT. In
20 cases of CASRN/chemical name mismatches in data provided by FracFocus, chemical names were
21 considered primary to the CASRN (i.e., the name overrode the CASRN). When the chemical name
22 was non-specific and the CASRN was valid, then the CASRN was considered primary to the chemical
23 name, and the correct specific chemical name from DSSTox was assigned to the CASRN. For all other
24 sources, the CASRN was considered primary unless it was invalid or missing. In such cases, the
25 chemical name was primary. All Toxic Substance Control Act (TSCA) CBI chemical lists were
26 managed in accordance with TSCA CBI procedures.

27 Chemicals with verified CASRN that are used in hydraulic fracturing fluids are presented in Table
28 A-2. Generic chemicals used in hydraulic fracturing fluids are presented in Table A-3. Chemicals
29 with verified CASRN that have been detected in flowback or produced water are presented in
30 Table A-4. Chemicals found in both fracturing fluids (see Table A-2) and flowback and produced
31 water (see Table A-4) are italicized in each table.

Table A-2. Chemicals reported to be used in hydraulic fracturing fluids.

An “X” indicates the availability of physicochemical properties from EPI Suite™ (see Appendix C) and selected toxicity reference values (see Appendix G). An empty cell indicates no information was available from the sources we consulted. Reference number corresponds to the citations in Table A-1. Italicized chemicals are found in both fracturing fluids and flowback/produced water.

Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
(13Z)-N,N-bis(2-hydroxyethyl)-N-methyldocos-13-en-1-aminium chloride	120086-58-0	X		1
(2,3-dihydroxypropyl)trimethylammonium chloride	34004-36-9	X		8
(E)-Crotonaldehyde	123-73-9	X	X	1, 4
[Nitrilotris(methylene)]tris-phosphonic acid pentasodium salt	2235-43-0	X		1
1-(1-Naphthylmethyl)quinolinium chloride	65322-65-8	X		1
1-(Alkyl* amino)-3-aminopropane *(42%C12, 26%C18, 15%C14, 8%C16, 5%C10, 4%C8)	68155-37-3	X		8
1-(Phenylmethyl)pyridinium Et Me derivs., chlorides	68909-18-2	X		1, 2, 3, 4, 6, 8
1,2,3-Trimethylbenzene	526-73-8	X		1, 4
<i>1,2,4-Trimethylbenzene</i>	<i>95-63-6</i>	X		<i>1, 2, 3, 4, 5</i>
1,2-Benzisothiazolin-3-one	2634-33-5	X		1, 3, 4
1,2-Dibromo-2,4-dicyanobutane	35691-65-7	X		1, 4
1,2-Dimethylbenzene	95-47-6	X		4
1,2-Ethanediamine, polymer with 2-methyloxirane	25214-63-5			8
1,2-Ethanediaminium, N,N'-bis[2-[bis(2-hydroxyethyl)methylammonio]ethyl]-N,N'-bis(2-hydroxyethyl)-N,N'-dimethyl-, tetrachloride	138879-94-4	X		1, 4
<i>1,2-Propylene glycol</i>	<i>57-55-6</i>	X	X	<i>1, 2, 3, 4, 8</i>
1,2-Propylene oxide	75-56-9	X	X	1, 4
1,3,5-Triazine	290-87-9	X		8
1,3,5-Triazine-1,3,5(2H,4H,6H)-triethanol	4719-04-4	X		1, 4
<i>1,3,5-Trimethylbenzene</i>	<i>108-67-8</i>	X		<i>1, 4</i>
1,3-Butadiene	106-99-0	X	X	8

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
1,3-Dichloropropene	542-75-6	X	X	8
1,4-Dioxane	123-91-1	X	X	2, 3, 4
1,4-Dioxane-2,5-dione, 3,6-dimethyl-, (3R,6R)-, polymer with (3S,6S)-3,6-dimethyl-1,4-dioxane-2,5-dione and (3R,6S)-rel-3,6-dimethyl-1,4-dioxane-2,5-dione	9051-89-2			1, 4, 8
1,6-Hexanediamine	124-09-4	X		1, 2
1,6-Hexanediamine dihydrochloride	6055-52-3	X		1
1-[2-(2-Methoxy-1-methylethoxy)-1-methylethoxy]-2-propanol	20324-33-8	X		4
1-Amino-2-propanol	78-96-6	X		8
1-Benzylquinolinium chloride	15619-48-4	X		1, 3, 4
1-Butanol	71-36-3	X	X	1, 2, 3, 4, 7
1-Butoxy-2-propanol	5131-66-8	X		8
1-Decanol	112-30-1	X		1, 4
1-Dodecyl-2-pyrrolidinone	2687-96-9	X		1, 4
1-Eicosene	3452-07-1	X		3
1-Ethyl-2-methylbenzene	611-14-3	X		4
1-Hexadecene	629-73-2	X		3
1-Hexanol	111-27-3	X		1, 4, 8
1-Hexanol, 2-ethyl-, manuf. of, by products from, distn. residues	68909-68-7			4
1H-Imidazole-1-ethanamine, 4,5-dihydro-, 2-nortall-oil alkyl derivs.	68442-97-7			2, 4
1-Methoxy-2-propanol	107-98-2	X		1, 2, 3, 4
1-Octadecanamine, acetate (1:1)	2190-04-7	X		8
1-Octadecanamine, N,N-dimethyl-	124-28-7	X		1, 3, 4
1-Octadecene	112-88-9	X		3
1-Octanol	111-87-5	X		1, 4
1-Pentanol	71-41-0	X		8
1-Propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl-, N-coco acyl derivs., chlorides, sodium salts	61789-39-7			1

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
1-Propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl-, N-coco acyl derivs., inner salts	61789-40-0			1, 2, 3, 4
1-Propanaminium, 3-chloro-2-hydroxy-N,N,N-trimethyl-, chloride	3327-22-8	X		8
1-Propanaminium, N-(3-aminopropyl)-2-hydroxy-N,N-dimethyl-3-sulfo-, N-coco acyl derivs., inner salts	68139-30-0			1, 3, 4
1-Propanaminium, N-(carboxymethyl)-N,N-dimethyl-3-[(1-oxooctyl)amino]-, inner salt	73772-46-0			8
1-Propanesulfonic acid	5284-66-2	X		3
1-Propanol	71-23-8	X		1, 2, 4, 5
1-Propanol, zirconium(4+) salt	23519-77-9			1, 4, 8
1-Propene	115-07-1	X		2
1-tert-Butoxy-2-propanol	57018-52-7	X		8
1-Tetradecene	1120-36-1	X		3
1-Tridecanol	112-70-9	X		1, 4
1-Undecanol	112-42-5	X		2
2-(2-Butoxyethoxy)ethanol	112-34-5	X	X	2, 4
2-(2-Ethoxyethoxy)ethanol	111-90-0	X	X	1, 4
2-(2-Ethoxyethoxy)ethyl acetate	112-15-2	X		1, 4
2-(Dibutylamino)ethanol	102-81-8	X		1, 4
2-(Hydroxymethylamino)ethanol	34375-28-5	X		1, 4
2-(Thiocyanomethylthio)benzothiazole	21564-17-0	X	X	2
2,2'-(diazene-1,2-diyl)diethane-1,1-diyl)bis-4,5-dihydro-1H-imidazole dihydrochloride	27776-21-2	X		3
2,2'-(Octadecylimino)diethanol	10213-78-2	X		1
2,2'-[Ethane-1,2-diylbis(oxy)]diethanamine	929-59-9	X		1, 4
2,2'-Azobis(2-amidinopropane) dihydrochloride	2997-92-4	X		1, 4
2,2-Dibromo-3-nitrilopropionamide	10222-01-2	X		1, 2, 3, 4, 6, 7, 8
2,2-Dibromopropanediamide	73003-80-2	X		3
2,4-Hexadienoic acid, potassium salt, (2E,4E)-	24634-61-5	X		3

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
2,6,8-Trimethyl-4-nonanol	123-17-1	X		8
2-Acrylamide - 2-propanesulfonic acid and N,N-dimethylacrylamide copolymer	NOCAS_51252			2
2-Acrylamido -2-methylpropanesulfonic acid copolymer	NOCAS_51255			8
2-Acrylamido-2-methyl-1-propanesulfonic acid	15214-89-8	X		1, 3
2-Amino-2-methylpropan-1-ol	124-68-5	X		8
2-Aminoethanol ester with boric acid (H3BO3) (1:1)	10377-81-8			8
2-Aminoethanol hydrochloride	2002-24-6	X		4, 8
2-Bromo-3-nitrilopropionamide	1113-55-9	X		1, 2, 3, 4, 5
2-Butanone oxime	96-29-7	X		1
2-Butenediamide, (2E)-, N,N'-bis[2-(4,5-dihydro-2-nortall-oil alkyl-1H-imidazol-1-yl)ethyl] derivs.	68442-77-3			3, 8
2-Butoxy-1-propanol	15821-83-7	X		8
2-Butoxyethanol	111-76-2	X	X	1, 2, 3, 4, 6, 7, 8
2-Dodecylbenzenesulfonic acid- n-(2-aminoethyl)ethane-1,2-diamine(1:1)	40139-72-8	X		8
2-Ethoxyethanol	110-80-5	X	X	6
2-Ethoxynaphthalene	93-18-5	X		3
2-Ethyl-1-hexanol	104-76-7	X		1, 2, 3, 4, 5
2-Ethyl-2-hexenal	645-62-5	X		2
2-Ethylhexyl benzoate	5444-75-7	X		4
2-Hydroxyethyl acrylate	818-61-1	X		1, 4
2-Hydroxyethylammonium hydrogen sulphite	13427-63-9	X		1
2-Hydroxy-N,N-bis(2-hydroxyethyl)-N-methylethanaminium chloride	7006-59-9	X		8
2-Mercaptoethanol	60-24-2	X		1, 4
2-Methoxyethanol	109-86-4	X	X	4
2-Methyl-1-propanol	78-83-1	X	X	1, 2, 4
2-Methyl-2,4-pentanediol	107-41-5	X		1, 2, 4

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
2-Methyl-3(2H)-isothiazolone	2682-20-4	X		1, 2, 4
2-Methyl-3-butyn-2-ol	115-19-5	X		3
2-Methylbutane	78-78-4	X		2
2-Methylquinoline hydrochloride	62763-89-7	X		3
2-Phosphono-1,2,4-butanetricarboxylic acid	37971-36-1	X		1, 4
2-Phosphonobutane-1,2,4-tricarboxylic acid, potassium salt (1:x)	93858-78-7	X		1
2-Propanol, aluminum salt	555-31-7			1
2-Propen-1-aminium, N,N-dimethyl-N-2-propenyl-, chloride, homopolymer	26062-79-3			3
2-Propenamide, homopolymer	25038-45-3			8
2-Propenoic acid, 2-(2-hydroxyethoxy)ethyl ester	13533-05-6	X		4
2-Propenoic acid, 2-ethylhexyl ester, polymer with 2-hydroxyethyl 2-propenoate	36089-45-9			8
2-Propenoic acid, 2-methyl-, polymer with 2-propenoic acid, sodium salt	28205-96-1			8
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			8
2-Propenoic acid, ethyl ester, polymer with ethenyl acetate and 2,5-furandione, hydrolyzed	113221-69-5			4, 8
2-Propenoic acid, ethyl ester, polymer with ethenyl acetate and 2,5-furandione, hydrolyzed, sodium salt	111560-38-4			8
2-Propenoic acid, polymer with 2-propenamide, sodium salt	25987-30-8			3, 4, 8
2-Propenoic acid, polymer with ethene, zinc salt	28208-80-2			8
2-Propenoic acid, polymer with ethenylbenzene	25085-34-1			8
2-Propenoic acid, polymer with sodium ethanesulfonate, peroxydisulfuric acid, disodium salt- initiated, reaction products with tetrasodium ethenylidenebis (phosphonata)	397256-50-7			8
2-Propenoic acid, polymer with sodium phosphinate (1:1), sodium salt	129898-01-7			8

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
2-Propenoic acid, sodium salt (1:1), polymer with sodium 2-methyl-2-[(1-oxo-2-propen-1-yl)amino]-1-propanesulfonate (1:1)	37350-42-8			1
2-Propenoic acid, telomer with sodium 4-ethenylbenzenesulfonate (1:1), sodium 2-methyl-2-[(1-oxo-2-propen-1-yl)amino]-1-propanesulfonate (1:1) and sodium sulfite (1:1), sodium salt	151006-66-5			4
2-Propenoic, polymer with sodium phosphinate	71050-62-9			3, 4
3-(Dimethylamino)propylamine	109-55-7	X		8
3,4,4-Trimethyloxazolidine	75673-43-7	X		8
3,5,7-Triazatricyclo(3.3.1.1 ^{3,7})decane, 1-(3-chloro-2-propenyl)-, chloride, (Z)-	51229-78-8	X		3
3,7-Dimethyl-2,6-octadienal	5392-40-5	X		3
3-Hydroxybutanal	107-89-1	X		1, 2, 4
3-Methoxypropylamine	5332-73-0	X		8
3-Phenylprop-2-enal	104-55-2	X		1, 2, 3, 4, 7
4,4-Dimethyloxazolidine	51200-87-4	X		8
4,6-Dimethyl-2-heptanone	19549-80-5	X		8
4-[Abieta-8,11,13-trien-18-yl(3-oxo-3-phenylpropyl)amino]butan-2-one hydrochloride	143106-84-7	X		1, 4
4-Ethyl-1-oct-3-yn-1-ol	5877-42-9	X		1, 2, 3, 4
4-Hydroxy-3-methoxybenzaldehyde	121-33-5	X		3
4-Methoxybenzyl formate	122-91-8	X		3
4-Methoxyphenol	150-76-5	X		4
4-Methyl-2-pentanol	108-11-2	X		1, 4
4-Methyl-2-pentanone	108-10-1	X		5
4-Nonylphenol	104-40-5	X		8
4-Nonylphenol polyethoxylate	68412-54-4			2, 3, 4
5-Chloro-2-methyl-3(2H)-isothiazolone	26172-55-4	X		1, 2, 4
Acetaldehyde	75-07-0	X		1, 4
Acetic acid	64-19-7	X		1, 2, 3, 4, 5, 6, 7, 8

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Acetic acid ethenyl ester, polymer with ethenol	25213-24-5			1, 4
Acetic acid, C6-8-branched alkyl esters	90438-79-2	X		4
Acetic acid, hydroxy-, reaction products with triethanolamine	68442-62-6	X		3
Acetic acid, mercapto-, monoammonium salt	5421-46-5	X		2, 8
Acetic anhydride	108-24-7	X		1, 2, 3, 4, 7
Acetone	67-64-1	X	X	1, 3, 4, 6
Acetonitrile, 2,2',2''-nitrilotris-	7327-60-8	X		1, 4
Acetophenone	98-86-2	X	X	1
Acetyltriethyl citrate	77-89-4	X		1, 4
Acrolein	107-02-8	X	X	2
Acrylamide	79-06-1	X	X	1, 2, 3, 4
Acrylamide/ sodium acrylate copolymer	25085-02-3			1, 2, 3, 4, 8
Acrylamide-sodium-2-acrylamido-2-methylpropane sulfonate copolymer	38193-60-1			1, 2, 3, 4
Acrylic acid	79-10-7	X	X	2, 4
Acrylic acid, with sodium-2-acrylamido-2-methyl-1-propanesulfonate and sodium phosphinate	110224-99-2	X		8
Alcohols (C13-C15), ethoxylated	64425-86-1			8
Alcohols, C10-12, ethoxylated	67254-71-1	X		3
Alcohols, C10-14, ethoxylated	66455-15-0			3
Alcohols, C11-14-iso-, C13-rich	68526-86-3	X		3
Alcohols, C11-14-iso-, C13-rich, butoxylated ethoxylated	228414-35-5			1
Alcohols, C11-14-iso-, C13-rich, ethoxylated	78330-21-9	X		3, 4, 8
Alcohols, C12-13, ethoxylated	66455-14-9	X		4
Alcohols, C12-14, ethoxylated	68439-50-9			2, 3, 4, 8
Alcohols, C12-14, ethoxylated propoxylated	68439-51-0	X		1, 3, 4, 8
Alcohols, C12-14-secondary	126950-60-5	X		1, 3, 4
Alcohols, C12-14-secondary, ethoxylated	84133-50-6			3, 4, 8
Alcohols, C12-15, ethoxylated	68131-39-5			3, 4

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Alcohols, C12-16, ethoxylated	68551-12-2	X		3, 4, 8
Alcohols, C14-15, ethoxylated	68951-67-7	X		3, 4, 8
Alcohols, C6-12, ethoxylated	68439-45-2	X		3, 4, 8
Alcohols, C7-9-iso-, C8-rich, ethoxylated	78330-19-5	X		2, 4, 8
Alcohols, C8-10, ethoxylated propoxylated	68603-25-8			3
Alcohols, C9-11, ethoxylated	68439-46-3	X		3, 4
Alcohols, C9-11-iso-, C10-rich, ethoxylated	78330-20-8	X		1, 2, 4, 8
Alkanes C10-16-branched and linear	90622-52-9			4
Alkanes, C10-14	93924-07-3			1
Alkanes, C12-14-iso-	68551-19-9	X		2, 4, 8
Alkanes, C13-16-iso-	68551-20-2	X		1, 4
Alkenes, C>10 .alpha.-	64743-02-8	X		1, 3, 4, 8
Alkenes, C>8	68411-00-7			1
Alkenes, C24-25 alpha-, polymers with maleic anhydride, docosyl esters	68607-07-8			8
Alkyl quaternary ammonium with bentonite	71011-24-0			4
Alkyl* dimethyl ethylbenzyl ammonium chloride *(50%C12, 30%C14, 17%C16, 3%C18)	85409-23-0_1	X		8
Alkyl* dimethyl ethylbenzyl ammonium chloride *(60%C14, 30%C16, 5%C12, 5%C18)	68956-79-6	X		8
Alkylbenzenesulfonate, linear	42615-29-2	X		1, 4, 6
Almandite and pyrope garnet	1302-62-1			1, 4
alpha-[3.5-dimethyl-1-(2-methylpropyl)hexyl]-omega-hydroxy-poly(oxy-1,2-ethandiyl)	60828-78-6			3
alpha-Amylase	9000-90-2			4
alpha-Lactose monohydrate	5989-81-1	X		8
alpha-Terpineol	98-55-5	X		3
Alumina	1344-28-1			1, 2, 4
Aluminatesilicate	1327-36-2			8
Aluminum	7429-90-5		X	1, 4, 6
Aluminum calcium oxide (Al2CaO4)	12042-68-1			2

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Aluminum chloride	7446-70-0			1, 4
Aluminum chloride hydroxide sulfate	39290-78-3			8
Aluminum chloride, basic	1327-41-9			3, 4
Aluminum oxide (Al ₂ O ₃)	90669-62-8			8
Aluminum oxide silicate	12068-56-3			1, 2, 4
Aluminum silicate	12141-46-7			1, 2, 4
Aluminum sulfate	10043-01-3			1, 4
Amaranth	915-67-3	X		4
Amides, C8-18 and C18-unsatd., N,N-bis(hydroxyethyl)	68155-07-7			3
Amides, coco, N-[3-(dimethylamino)propyl]	68140-01-2			1, 4
Amides, coco, N-[3-(dimethylamino)propyl], alkylation products with chloroacetic acid, sodium salts	70851-07-9			1, 4
Amides, coco, N-[3-(dimethylamino)propyl], alkylation products with sodium 3-chloro-2-hydroxypropanesulfonate	70851-08-0			8
Amides, coco, N-[3-(dimethylamino)propyl], N-oxides	68155-09-9			1, 3, 4
Amides, from C16-22 fatty acids and diethylenetriamine	68876-82-4			3
Amides, tall-oil fatty, N,N-bis(hydroxyethyl)	68155-20-4			3, 4
Amides, tallow, N-[3-(dimethylamino)propyl],N-oxides	68647-77-8			1, 4
Amine oxides, cocoalkyldimethyl	61788-90-7			8
Amines, C14-18; C16-18-unsaturated, alkyl, ethoxylated	68155-39-5			1
Amines, C8-18 and C18-unsatd. alkyl	68037-94-5			5
Amines, coco alkyl	61788-46-3			4
Amines, coco alkyl, acetates	61790-57-6			1, 4
Amines, coco alkyl, ethoxylated	61791-14-8			8
Amines, coco alkyldimethyl	61788-93-0			8
Amines, dicoco alkyl	61789-76-2			8

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Amines, dicoco alkylmethyl	61788-62-3			8
Amines, ditallow alkyl, acetates	71011-03-5			8
Amines, hydrogenated tallow alkyl, acetates	61790-59-8			4
Amines, N-tallow alkyltrimethylenedi-, ethoxylated	61790-85-0			8
Amines, polyethylenepoly-, ethoxylated, phosphonomethylated	68966-36-9			1, 4
Amines, polyethylenepoly-, reaction products with benzyl chloride	68603-67-8			1
Amines, tallow alkyl	61790-33-8			8
Amines, tallow alkyl, ethoxylated, acetates (salts)	68551-33-7			1, 3, 4
Amines, tallow alkyl, ethoxylated, phosphates	68308-48-5			4
Aminotrimethylene phosphonic acid	6419-19-8	X		1, 4, 8
<i>Ammonia</i>	7664-41-7			1, 2, 3, 4, 7
Ammonium (lauryloxy)polyethoxyethyl sulfate	32612-48-9			4
Ammonium acetate	631-61-8	X		1, 3, 4, 5, 8
Ammonium acrylate	10604-69-0	X		8
Ammonium acrylate-acrylamide polymer	26100-47-0			2, 4, 8
Ammonium bisulfate	7803-63-6			2
Ammonium bisulfite	10192-30-0			1, 2, 3, 4, 7
Ammonium chloride	12125-02-9			1, 2, 3, 4, 5, 6, 8
Ammonium citrate (1:1)	7632-50-0	X		3
Ammonium citrate (2:1)	3012-65-5	X		8
Ammonium dodecyl sulfate	2235-54-3	X		1
Ammonium fluoride	12125-01-8			1, 4
Ammonium hydrogen carbonate	1066-33-7	X		1, 4
Ammonium hydrogen difluoride	1341-49-7			1, 3, 4, 7
Ammonium hydrogen phosphonate	13446-12-3			4
Ammonium hydroxide	1336-21-6			1, 3, 4
Ammonium lactate	515-98-0	X		8

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Ammonium ligninsulfonate	8061-53-8			2
Ammonium nitrate	6484-52-2			1, 2, 3
Ammonium phosphate	7722-76-1		X	1, 4
Ammonium sulfate	7783-20-2			1, 2, 3, 4, 6
Ammonium thiosulfate	7783-18-8			8
Amorphous silica	99439-28-8			1, 7
Anethole	104-46-1	X		3
Aniline	62-53-3	X	X	2, 4
Antimony pentoxide	1314-60-9			1, 4
Antimony trichloride	10025-91-9		X	1, 4
Antimony trioxide	1309-64-4		X	8
<i>Arsenic</i>	7440-38-2		X	4
Ashes, residues	68131-74-8			4
Asphalt, sulfonated, sodium salt	68201-32-1			2
Attapulgate	12174-11-7			2, 3
Aziridine, polymer with 2-methyloxirane	31974-35-3			4, 8
Barium sulfate	7727-43-7			1, 2, 4
Bauxite	1318-16-7			1, 2, 4
Benactyzine hydrochloride	57-37-4	X		8
Bentonite	1302-78-9			1, 2, 4, 6
Bentonite, benzyl(hydrogenated tallow alkyl) dimethylammonium stearate complex	121888-68-4			3, 4
Benzamorf	12068-08-5	X		1, 4
<i>Benzene</i>	71-43-2	X	X	1, 3, 4
Benzene, 1,1'-oxybis-, sec-hexyl derivs., sulfonated, sodium salts	147732-60-3			8
Benzene, 1,1'-oxybis-, tetrapropylene derivs., sulfonated	119345-03-8			8
Benzene, 1,1'-oxybis-, tetrapropylene derivs., sulfonated, sodium salts	119345-04-9			3, 4, 8
Benzene, C10-16-alkyl derivs.	68648-87-3	X		1

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Benzene, ethenyl-, polymer with 2-methyl-1,3-butadiene, hydrogenated	68648-89-5			8
Benzenemethanaminium, N,N-dimethyl-N-(2-((1-oxo-2-propen-1-yl)oxy)ethyl)-, chloride (1:1), polymer with 2-propenamide	74153-51-8			3
Benzenesulfonic acid	98-11-3	X		2
Benzenesulfonic acid, (1-methylethyl)-,	37953-05-2	X		4
Benzenesulfonic acid, (1-methylethyl)-, ammonium salt	37475-88-0	X		3, 4
Benzenesulfonic acid, (1-methylethyl)-, sodium salt	28348-53-0	X		8
Benzenesulfonic acid, C10-16-alkyl derivs.	68584-22-5		X	1, 4
Benzenesulfonic acid, C10-16-alkyl derivs., compds. with cyclohexylamine	255043-08-4	X		1
Benzenesulfonic acid, C10-16-alkyl derivs., compds. with triethanolamine	68584-25-8	X		8
Benzenesulfonic acid, C10-16-alkyl derivs., potassium salts	68584-27-0	X		1, 4, 8
Benzenesulfonic acid, dodecyl-, branched, compds. with 2-propanamine	90218-35-2	X		4
Benzenesulfonic acid, mono-C10-16 alkyl derivs., compds. with 2-propanamine	68648-81-7			1, 4
Benzenesulfonic acid, mono-C10-16-alkyl derivs., sodium salts	68081-81-2	X		8
Benzoic acid	65-85-0	X	X	1, 4, 7
Benzyl chloride	100-44-7	X	X	1, 2, 4, 8
Benzyltrimethylammonium chloride	139-07-1	X		2, 8
Benzylhexadecyldimethylammonium chloride	122-18-9	X		8
Benzyltrimethylammonium chloride	56-93-9	X		8
Bicine	150-25-4	X		1, 4
Bio-Perge	55965-84-9			8
Bis(1-methylethyl)naphthalenesulfonic acid, cyclohexylamine salt	68425-61-6	X		1
<i>Bis(2-chloroethyl) ether</i>	<i>111-44-4</i>	X	X	8

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Bisphenol A	80-05-7	X	X	4
Bisphenol A/ Epichlorohydrin resin	25068-38-6			1, 2, 4
Bisphenol A/ Novolac epoxy resin	28906-96-9			1, 4
Blast furnace slag	65996-69-2			2, 3
Borax	1303-96-4			1, 2, 3, 4, 6
Boric acid	10043-35-3			1, 2, 3, 4, 6, 7
Boric acid (H3BO3), compd. with 2-aminoethanol (1:x)	26038-87-9			8
Boric oxide	1303-86-2			1, 2, 3, 4
Boron potassium oxide (B4K2O7)	1332-77-0			8
Boron potassium oxide (B4K2O7), tetrahydrate	12045-78-2			8
Boron potassium oxide (B5KO8)	11128-29-3			1
Boron sodium oxide	1330-43-4			1, 2, 4
Boron sodium oxide pentahydrate	12179-04-3			8
Bronopol	52-51-7	X		1, 2, 3, 4, 6
Butane	106-97-8	X		2, 5
Butanedioic acid, sulfo-, 1,4-bis(1,3-dimethylbutyl) ester, sodium salt	2373-38-8	X		1
Butene	25167-67-3	X		8
Butyl glycidyl ether	2426-08-6	X		1, 4
Butyl lactate	138-22-7	X		1, 4
Butyryl trihexyl citrate	82469-79-2	X		8
C.I. Acid Red 1	3734-67-6	X		4
C.I. Acid violet 12, disodium salt	6625-46-3	X		4
C.I. Pigment Red 5	6410-41-9	X		4
C.I. Solvent Red 26	4477-79-6	X		4
C10-16-Alkyldimethylamines oxides	70592-80-2	X		4
C10-C16 ethoxylated alcohol	68002-97-1	X		1, 2, 3, 4, 8
C11-15-Secondary alcohols ethoxylated	68131-40-8			1, 2, 8
C12-14 tert-alkyl ethoxylated amines	73138-27-9	X		3
C8-10 Alcohols	85566-12-7			8

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Calcined bauxite	66402-68-4			2, 8
Calcium aluminate	12042-78-3			2
Calcium bromide	7789-41-5			4
Calcium carbide (CaC ₂)	75-20-7			8
Calcium chloride	10043-52-4			1, 2, 3, 4, 7
Calcium dichloride dihydrate	10035-04-8			1, 4
Calcium dodecylbenzene sulfonate	26264-06-2	X		4
Calcium fluoride	7789-75-5			1, 4
Calcium hydroxide	1305-62-0			1, 2, 3, 4
Calcium hypochlorite	7778-54-3			1, 2, 4
Calcium magnesium hydroxide oxide	58398-71-3			4
Calcium oxide	1305-78-8			1, 2, 4, 7
Calcium peroxide	1305-79-9			1, 3, 4, 8
Calcium sulfate	7778-18-9			1, 2, 4
Calcium sulfate dihydrate	10101-41-4			2
Camphor	76-22-2	X		3
Canola oil	120962-03-0			8
Carbon black	1333-86-4			1, 2, 4
<i>Carbon dioxide</i>	<i>124-38-9</i>	X		1, 3, 4, 6
Carbonic acid calcium salt (1:1)	471-34-1			1, 2, 4
Carbonic acid, dipotassium salt	584-08-7	X		1, 2, 3, 4, 8
Carboxymethyl guar gum, sodium salt	39346-76-4			1, 2, 4
Castor oil	8001-79-4			8
Cedarwood oil	8000-27-9			3
Cellophane	9005-81-6			1, 4
Cellulose	9004-34-6			1, 2, 3, 4
<i>Chloride</i>	<i>16887-00-6</i>			4, 8
<i>Chlorine</i>	<i>7782-50-5</i>		X	2
Chlorine dioxide	10049-04-4		X	1, 2, 3, 4, 8
Choline bicarbonate	78-73-9	X		3, 8

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Choline chloride	67-48-1	X		1, 3, 4, 7, 8
Chromium (III)	16065-83-1		X	2, 6
Chromium (VI)	18540-29-9		X	6
Chromium acetate, basic	39430-51-8			2
Chromium(III) acetate	1066-30-4			1, 2
Citric acid	77-92-9	X		1, 2, 3, 4, 7
Citronella oil	8000-29-1			3
Citronellol	106-22-9	X		3
Citrus extract	94266-47-4			1, 3, 4, 8
Coal, granular	50815-10-6			1, 2, 4
Cobalt(II) acetate	71-48-7			1, 4
Coco-betaine	68424-94-2			3
Coconut oil	8001-31-8			8
Coconut oil acid/Diethanolamine condensate (2:1)	68603-42-9			1
Coconut trimethylammonium chloride	61789-18-2	X		1, 8
Copper	7440-50-8		X	1, 4
Copper sulfate	7758-98-7			1, 4, 8
Copper(I) chloride	7758-89-6			1, 4
Copper(I) iodide	7681-65-4		X	1, 2, 4, 6
Copper(II) chloride	7447-39-4			1, 3, 4
Copper(II) sulfate, pentahydrate	7758-99-8			8
Corn flour	68525-86-0			4
Corn sugar gum	11138-66-2			1, 2, 4
Corundum (Aluminum oxide)	1302-74-5			4, 8
Cottonseed, flour	68308-87-2			2, 4
Coumarin	91-64-5	X		3
Cremophor(R) EL	61791-12-6			1, 3
Cristobalite	14464-46-1			1, 2, 4
Crystalline silica, tridymite	15468-32-3			1, 2, 4

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<i>Cumene</i>	98-82-8	X	X	1, 2, 3, 4
Cupric chloride dihydrate	10125-13-0			1, 4, 7
Cyclohexane	110-82-7	X		1, 7
Cyclohexanol	108-93-0	X		8
Cyclohexanone	108-94-1	X	X	1, 4
Cyclohexylamine sulfate	19834-02-7	X		8
D&C Red 28	18472-87-2	X		4
D&C Red No. 33	3567-66-6	X		8
Daidzein	486-66-8	X		8
Dapsone	80-08-0	X		1, 4
Dazomet	533-74-4	X		1, 2, 3, 4, 7, 8
Decamethylcyclopentasiloxane	541-02-6			8
Decyldimethylamine	1120-24-7	X		3, 4
Deuterium oxide	7789-20-0			8
D-Glucitol	50-70-4	X		1, 3, 4
D-Gluconic acid	526-95-4	X		1, 4
D-Glucopyranoside, methyl	3149-68-6	X		2
D-Glucose	50-99-7	X		1, 4
<i>Di(2-ethylhexyl) phthalate</i>	117-81-7	X	X	1, 4
Diammonium peroxydisulfate	7727-54-0			1, 2, 3, 4, 6, 7, 8
Diatomaceous earth	68855-54-9			2, 4
Diatomaceous earth, calcined	91053-39-3			1, 2, 4
Dibromoacetonitrile	3252-43-5	X		1, 2, 3, 4, 8
Dicalcium silicate	10034-77-2			1, 2, 4
<i>Dichloromethane</i>	75-09-2	X	X	8
Didecyldimethylammonium chloride	7173-51-5	X	X	1, 2, 4, 8
Diethanolamine	111-42-2	X		1, 2, 3, 4, 6
Diethylbenzene	25340-17-4	X		1, 3, 4
Diethylene glycol	111-46-6	X		1, 2, 3, 4, 7

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Diethylene glycol monomethyl ether	111-77-3	X		1, 2, 4
Diethylenetriamine	111-40-0	X		1, 2, 4, 5
Diethylenetriamine reaction product with fatty acid dimers	68647-57-4			2
Diisobutyl ketone	108-83-8	X		8
Diisopropanolamine	110-97-4	X		8
Diisopropyl naphthalene	38640-62-9	X		3, 4
Dimethyl adipate	627-93-0	X		8
Dimethyl glutarate	1119-40-0	X		1, 4
Dimethyl polysiloxane	63148-62-9			1, 2, 4
Dimethyl succinate	106-65-0	X		8
Dimethylaminoethanol	108-01-0	X		2, 4
Dimethyldiallylammonium chloride	7398-69-8	X		3, 4
Diphenyl oxide	101-84-8	X		3
Dipotassium monohydrogen phosphate	7758-11-4			5
Dipropylene glycol	25265-71-8	X		1, 3, 4
Di-sec-butylphenol	31291-60-8	X		1
Disodium dodecyl(sulphonatophenoxy) benzenesulphonate	28519-02-0	X		1
Disodium ethylenediaminediacetate	38011-25-5	X		1, 4
Disodium ethylenediaminetetraacetate dihydrate	6381-92-6	X		1
Disodium octaborate	12008-41-2			4, 8
Disodium octaborate tetrahydrate	12280-03-4			1, 4
Disodium sulfide	1313-82-2			8
Distillates, petroleum, catalytic reformer fractionator residue, low-boiling	68477-31-6			1, 4
Distillates, petroleum, heavy arom.	67891-79-6			1, 4
Distillates, petroleum, hydrodesulfurized light catalytic cracked	68333-25-5			1
Distillates, petroleum, hydrodesulfurized middle	64742-80-9			1

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Distillates, petroleum, hydrotreated heavy naphthenic	64742-52-5			1, 2, 3, 4
Distillates, petroleum, hydrotreated heavy paraffinic	64742-54-7			1, 2, 4
Distillates, petroleum, hydrotreated light	64742-47-8			1, 2, 3, 4, 5, 7, 8
Distillates, petroleum, hydrotreated light naphthenic	64742-53-6			1, 2, 8
Distillates, petroleum, hydrotreated light paraffinic	64742-55-8			8
Distillates, petroleum, hydrotreated middle	64742-46-7			1, 2, 3, 4, 8
Distillates, petroleum, light catalytic cracked	64741-59-9			1, 4
Distillates, petroleum, light hydrocracked	64741-77-1			3
Distillates, petroleum, solvent-dewaxed heavy paraffinic	64742-65-0			1
Distillates, petroleum, solvent-refined heavy naphthenic	64741-96-4			1, 4
Distillates, petroleum, steam-cracked	64742-91-2			1, 4
Distillates, petroleum, straight-run middle	64741-44-2			1, 2, 4
Distillates, petroleum, sweetened middle	64741-86-2			1, 4
Ditallow alkyl ethoxylated amines	71011-04-6			3
D-Lactic acid	10326-41-7	X		1, 4
D-Limonene	5989-27-5	X	X	1, 3, 4, 5, 7, 8
Docusate sodium	577-11-7	X		1
Dodecamethylcyclohexasiloxane	540-97-6			8
Dodecane	112-40-3	X		8
Dodecylbenzene	123-01-3	X		3, 4
Dodecylbenzenesulfonic acid	27176-87-0	X	X	2, 3, 4, 8
Dodecylbenzenesulfonic acid, monoethanolamine salt	26836-07-7	X		1, 4
Edifas B	9004-32-4			2, 3, 4
EDTA, copper salt	12276-01-6			1, 5, 6
Endo-1,4-.beta.-mannanase	37288-54-3			3, 8

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Epichlorohydrin	106-89-8	X	X	1, 4, 8
Epoxy resin	25085-99-8			1, 4, 8
Erucic amidopropyl dimethyl betaine	149879-98-1			1, 3
Ethanaminium, N,N,N-trimethyl-2-[(1-oxo-2-propenyl)oxy]-, chloride	44992-01-0	X		3
Ethanaminium, N,N,N-trimethyl-2-[(1-oxo-2-propenyl)oxy]-,chloride, polymer with 2-propenamamide	69418-26-4			1, 3, 4
Ethanaminium, N,N,N-trimethyl-2-[(2-methyl-1-oxo-2-propen-1-yl)oxy]-, chloride (1:1), polymer with 2-propenamamide	35429-19-7			8
Ethanaminium, N,N,N-trimethyl-2-[(2-methyl-1-oxo-2-propenyl)oxy]-, methyl sulfate, homopolymer	27103-90-8			8
Ethane	74-84-0	X		2, 5
Ethanol	64-17-5	X		1, 2, 3, 4, 5, 6, 8
Ethanol, 2,2',2''-nitrilotris-, tris(dihydrogen phosphate) (ester), sodium salt	68171-29-9	X		4
Ethanol, 2,2'-iminobis-, N-coco alkyl derivs., N-oxides	61791-47-7			1
Ethanol, 2,2'-iminobis-, N-tallow alkyl derivs.	61791-44-4			1
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivs. residues	68909-77-3			4, 8
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivs. residues, acetates (salts)	68877-16-7			4
Ethanol, 2,2'-oxybis-, reaction products with ammonia, morpholine derivs. residues, reaction products with sulfur dioxide	102424-23-7			4
Ethanol, 2-[2-[2-(tridecyloxy)ethoxy]ethoxy]-, hydrogen sulfate, sodium salt	25446-78-0	X		1, 4
Ethanol, 2-amino-, polymer with formaldehyde	34411-42-2			4
Ethanol, 2-amino-, reaction products with ammonia, by-products from, phosphonomethylated	68649-44-5			4

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Ethanolamine	141-43-5	X		1, 2, 3, 4, 6
Ethoxylated dodecyl alcohol	9002-92-0	X		4
Ethoxylated hydrogenated tallow alkylamines	61790-82-7			4
Ethoxylated, propoxylated trimethylolpropane	52624-57-4			3
Ethyl acetate	141-78-6	X	X	1, 4, 7
Ethyl acetoacetate	141-97-9	X		1, 4
Ethyl benzoate	93-89-0	X		3
Ethyl lactate	97-64-3	X		3
Ethyl salicylate	118-61-6	X		3
<i>Ethylbenzene</i>	<i>100-41-4</i>	X	X	1, 2, 3, 4, 7
Ethylcellulose	9004-57-3			2
Ethylene	74-85-1	X		8
<i>Ethylene glycol</i>	<i>107-21-1</i>	X	X	1, 2, 3, 4, 6, 7, 8
Ethylene oxide	75-21-8	X	X	1, 2, 3, 4
Ethylenediamine	107-15-3	X	X	2, 4
Ethylenediaminetetraacetic acid	60-00-4	X		1, 2, 4
Ethylenediaminetetraacetic acid tetrasodium salt	64-02-8	X		1, 2, 3, 4
Ethylenediaminetetraacetic acid, diammonium copper salt	67989-88-2			4
Ethylenediaminetetraacetic acid, disodium salt	139-33-3	X		1, 3, 4, 8
Ethyne	74-86-2	X		7
Fats and Glyceridic oils, vegetable, hydrogenated	68334-28-1			8
Fatty acid, tall oil, hexa esters with sorbitol, ethoxylated	61790-90-7			1, 4
Fatty acids, C 8-18 and C18-unsaturated compounds with diethanolamine	68604-35-3			3
Fatty acids, C14-18 and C16-18-unsatd., distn. residues	70321-73-2			2
Fatty acids, C18-unsatd., dimers	61788-89-4	X		2

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Fatty acids, C18-unsatd., dimers, compds. with ethoxylated tall-oil fatty acid-polyethylenepolyamine reaction products	68132-59-2			8
Fatty acids, C18-unsatd., dimers, ethoxylated propoxylated	68308-89-4			8
Fatty acids, coco, ethoxylated	61791-29-5			3
Fatty acids, coco, reaction products with diethylenetriamine and soya fatty acids, ethoxylated, chloromethane-quaternized	68604-75-1			8
Fatty acids, coco, reaction products with ethanolamine, ethoxylated	61791-08-0			3
Fatty acids, tall oil, reaction products with acetophenone, formaldehyde and thiourea	68188-40-9			3
Fatty acids, tall-oil	61790-12-3			1, 2, 3, 4
Fatty acids, tall-oil, reaction products with diethylenetriamine	61790-69-0			1, 4
Fatty acids, tall-oil, reaction products with diethylenetriamine, maleic anhydride, tetraethylenepentamine and triethylenetetramine	68990-47-6			8
Fatty acids, tallow, sodium salts	8052-48-0			1, 3
Fatty acids, vegetable-oil, reaction products with diethylenetriamine	68153-72-0			3
Fatty quaternary ammonium chloride	61789-68-2			1, 4
FD&C Blue no. 1	3844-45-9	X		1, 4
FD&C Yellow 5	1934-21-0	X		8
FD&C Yellow 6	2783-94-0	X		8
Ferric chloride	7705-08-0			1, 3, 4
Ferric sulfate	10028-22-5			1, 4
Ferrous sulfate monohydrate	17375-41-6			2
Ferumoxytol	1309-38-2			8
Fiberglass	65997-17-3			2, 3, 4
Formaldehyde	50-00-0	X	X	1, 2, 3, 4

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Formaldehyde polymer with 4,1,1-(dimethylethyl)phenol and methyloxirane	29316-47-0			3
Formaldehyde polymer with methyl oxirane, 4-nonylphenol and oxirane	63428-92-2			4, 8
Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, 2-methyloxirane and oxirane	30704-64-4			1, 2, 4, 8
Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, 2-methyloxirane, 4-nonylphenol and oxirane	68188-99-8			8
Formaldehyde, polymer with 4-nonylphenol and oxirane	30846-35-6			1, 4
Formaldehyde, polymer with 4-nonylphenol and phenol	40404-63-5			8
Formaldehyde, polymer with ammonia and phenol	35297-54-2			1, 4
Formaldehyde, polymer with bisphenol A	25085-75-0			4
Formaldehyde, polymer with N1-(2-aminoethyl)-1,2-ethanediamine, benzylated	70750-07-1			8
Formaldehyde, polymer with nonylphenol and oxirane	55845-06-2			4
Formaldehyde, polymers with branched 4-nonylphenol, oxirane and 2-methyloxirane	153795-76-7			1 3
Formaldehyde/ amine	50-00-0_3			1, 2, 3, 4
Formamide	75-12-7	X		1, 2, 3, 4
<i>Formic acid</i>	<i>64-18-6</i>	X	X	<i>1, 2, 3, 4, 6, 7</i>
Formic acid, potassium salt	590-29-4	X		1, 3, 4
Frits, chemicals	65997-18-4			8
Fuel oil, no. 2	68476-30-2			1, 2
Fuels, diesel	68334-30-5			2
Fuels, diesel, no. 2	68476-34-6			2, 4, 8
Fuller's earth	8031-18-3			2
Fumaric acid	110-17-8	X		1, 2, 3, 4, 6
Fumes, silica	69012-64-2			8

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Furfural	98-01-1	X	X	1, 4
Furfuryl alcohol	98-00-0	X		1, 4
Galantamine hydrobromide	69353-21-5	X		8
Gas oils, petroleum, straight-run	64741-43-1			1, 4
Gelatin	9000-70-8			1, 4
Gilsonite	12002-43-6			1, 2, 4
Gluconic acid	133-42-6	X		7
Glutaraldehyde	111-30-8	X		1, 2, 3, 4, 7
Glycerides, C14-18 and C16-18-unsatd. mono- and di-	67701-32-0			8
Glycerol	56-81-5	X		1, 2, 3, 4, 5
Glycine, N-(carboxymethyl)-N-(2-hydroxyethyl)-, disodium salt	135-37-5	X		1
Glycine, N-(hydroxymethyl)-, monosodium salt	70161-44-3	X		8
Glycine, N,N-bis(carboxymethyl)-, trisodium salt	5064-31-3	X		1, 2, 3, 4
Glycine, N-[2-[bis(carboxymethyl)amino]ethyl]-N-(2-hydroxyethyl)-, trisodium salt	139-89-9	X		1
Glycolic acid	79-14-1	X		1, 3, 4
Glycolic acid sodium salt	2836-32-0	X		1, 3, 4
Glyoxal	107-22-2	X	X	1, 2, 4
Glyoxylic acid	298-12-4	X		1
Goethite (Fe(OH)O)	1310-14-1			8
Guar gum	9000-30-0			1, 2, 3, 4, 7, 8
Guar gum, carboxymethyl 2-hydroxypropyl ether, sodium salt	68130-15-4			1, 2, 3, 4, 7
Gypsum (Ca(SO ₄).2H ₂ O)	13397-24-5			2, 4
Hematite	1317-60-8			1, 2, 4
Hemicellulase	9012-54-8			1, 2, 3, 4, 5
Hemicellulase enzyme concentrate	9025-56-3			3, 4
Heptane	142-82-5	X		1, 2
Heptene, hydroformylation products, high-boiling	68526-88-5			1, 4

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Hexadecyltrimethylammonium bromide	57-09-0	X		1
Hexane	110-54-3	X	X	5
Hexanedioic acid	124-04-9	X	X	1, 2, 4, 6
Humic acids, commercial grade	1415-93-6			2
Hydrazine	302-01-2		X	8
Hydrocarbons, terpene processing by-products	68956-56-9			1, 3, 4
Hydrochloric acid	7647-01-0			1, 2, 3, 4, 5, 6, 7, 8
Hydrogen fluoride	7664-39-3			1, 2, 4
Hydrogen peroxide	7722-84-1			1, 3, 4
Hydrogen sulfide	7783-06-4			1, 2
Hydroxyethylcellulose	9004-62-0			1, 2, 3, 4
Hydroxylamine hydrochloride	5470-11-1			1, 3, 4
Hydroxylamine sulfate (2:1)	10039-54-0			4
Hydroxypropyl cellulose	9004-64-2			2, 4
Hydroxypropyl guar gum	39421-75-5			1, 3, 4, 5, 6, 8
Hydroxyvaleric acid	1619-16-5	X		8
Hypochlorous acid	7790-92-3			8
Illite	12173-60-3			8
Ilmenite (FeTiO ₃), conc.	98072-94-7			8
Indole	120-72-9	X		2
Inulin, carboxymethyl ether, sodium salt	430439-54-6			1, 4
Iridium oxide	12030-49-8			8
<i>Iron</i>	7439-89-6		X	2, 4
Iron oxide	1332-37-2			1, 4
Iron oxide (Fe ₃ O ₄)	1317-61-9			4
Iron(II) sulfate	7720-78-7			2
Iron(II) sulfate heptahydrate	7782-63-0			1, 2, 3, 4
Iron(III) oxide	1309-37-1			1, 2, 4
Isoascorbic acid	89-65-6	X		1, 3, 4

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Isobutane	75-28-5	X		2
Isobutene	115-11-7	X		8
Isooctanol	26952-21-6	X		1, 4, 5
Isopentyl alcohol	123-51-3	X		1, 4
<i>Isopropanol</i>	<i>67-63-0</i>	X		1, 2, 3, 4, 6, 7
Isopropanolamine dodecylbenzene	42504-46-1	X		1, 3, 4
Isopropylamine	75-31-0	X		1, 4
Isoquinoline	119-65-3	X		8
Isoquinoline, reaction products with benzyl chloride and quinoline	68909-80-8	X		3
Isoquinolinium, 2-(phenylmethyl)-, chloride	35674-56-7	X		3
Isotridecanol, ethoxylated	9043-30-5			1, 3, 4, 8
Kaolin	1332-58-7			1, 2, 4
Kerosine, petroleum, hydrodesulfurized	64742-81-0			1, 2, 4
Kieselguhr	61790-53-2			1, 2, 4
Kyanite	1302-76-7			1, 2, 4
Lactic acid	50-21-5	X		1, 4, 8
Lactose	63-42-3	X		3
Latex 2000 TM	9003-55-8			2, 4
Lauryl hydroxysultaine	13197-76-7	X		1
Lavandula hybrida abrial herb oil	8022-15-9			3
L-Dilactide	4511-42-6	X		1, 4
<i>Lead</i>	<i>7439-92-1</i>		X	1, 4
Lecithin	8002-43-5			4
L-Glutamic acid	56-86-0	X		8
Lignite	129521-66-0			2
Lignosulfuric acid	8062-15-5			2
Ligroine	8032-32-4			8
Limestone	1317-65-3			1, 2, 3, 4
Linseed oil	8001-26-1			8

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
L-Lactic acid	79-33-4	X		1, 4, 8
Magnesium carbonate (1:1)	7757-69-9			8
Magnesium carbonate (1:x)	546-93-0			1, 3, 4
Magnesium chloride	7786-30-3			1, 2, 4
Magnesium chloride hexahydrate	7791-18-6			4
Magnesium hydroxide	1309-42-8			1, 4
Magnesium iron silicate	19086-72-7			1, 4
Magnesium nitrate	10377-60-3			1, 2, 4
Magnesium oxide	1309-48-4			1, 2, 3, 4
Magnesium peroxide	14452-57-4			1, 4
Magnesium phosphide	12057-74-8			1
Magnesium silicate	1343-88-0			1, 4
Magnesium sulfate	7487-88-9			8
Maleic acid homopolymer	26099-09-2			8
Methanamine-N-methyl polymer with chloromethyl oxirane	25988-97-0			4
Methane	74-82-8	X		2, 5
<i>Methanol</i>	67-56-1	X	X	1, 2, 3, 4, 5, 6, 7, 8
Methenamine	100-97-0	X		1, 2, 4
Methoxyacetic acid	625-45-6	X		8
Methyl cellulose	9004-67-5			8
Methyl salicylate	119-36-8	X		1, 2, 3, 4, 7
Methyl vinyl ketone	78-94-4	X		1, 4
Methylcyclohexane	108-87-2	X		1
Methylene bis(thiocyanate)	6317-18-6	X		2
Methylenebis(5-methyloxazolidine)	66204-44-2	X		2
Methyloxirane polymer with oxirane, mono (nonylphenol) ether, branched	68891-11-2			3
Mica	12001-26-2			1, 2, 4, 6
Mineral oil - includes paraffin oil	8012-95-1		X	4, 8

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Mineral spirits	64475-85-0			2
Mono- and di- potassium salts of phosphorous acid	13492-26-7			8
Montmorillonite	1318-93-0			2
Morpholine	110-91-8	X		1, 2, 4
Morpholinium, 4-ethyl-4-hexadecyl-, ethyl sulfate	78-21-7	X		8
MT 6	76-31-3			8
Mullite	1302-93-8			1,2, 4, 8
N-(2-Acryloyloxyethyl)-N-benzyl-N,N-dimethylammonium chloride	46830-22-2	X		3
N-(3-Chloroallyl)hexaminium chloride	4080-31-3	X		8
N,N,N-Trimethyl-2[1-oxo-2-propenyl]oxy ethanaminium chloride, homopolymer	54076-97-0			3
N,N,N-Trimethyl-3-((1-oxooctadecyl)amino)-1-propanaminium methyl sulfate	19277-88-4	X		1
N,N,N-Trimethyloctadecan-1-aminium chloride	112-03-8	X		1, 3, 4
N,N'-Dibutylthiourea	109-46-6	X		1, 4
N,N-Dimethyldecylamine oxide	2605-79-0	X		1, 3, 4
N,N-Dimethylformamide	68-12-2	X	X	1, 2, 4, 5, 8
N,N-Dimethylmethanamine hydrochloride	593-81-7	X		1, 4, 5, 7
N,N-Dimethyl-methanamine-N-oxide	1184-78-7	X		3
N,N-dimethyloctadecylamine hydrochloride	1613-17-8	X		1, 4
N,N'-Methylenebisacrylamide	110-26-9	X		1, 4
Naphtha, petroleum, heavy catalytic reformed	64741-68-0			1, 2, 3, 4
Naphtha, petroleum, hydrotreated heavy	64742-48-9			1, 2, 3, 4, 8
<i>Naphthalene</i>	91-20-3	X	X	1, 2, 3, 4, 5, 7
Naphthalenesulfonic acid, bis(1-methylethyl)-	28757-00-8	X		1, 3, 4
Naphthalenesulfonic acid, polymer with formaldehyde, sodium salt	9084-06-4			2
Naphthalenesulphonic acid, bis (1-methylethyl)-methyl derivatives	99811-86-6	X		1

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Naphthenic acid ethoxylate	68410-62-8	X		4
Navy fuels JP-5	8008-20-6_2			1, 2, 3, 4, 8
Nickel sulfate	7786-81-4			2
Nickel(II) sulfate hexahydrate	10101-97-0			1, 4
Nitriles, tallow, hydrogenated	61790-29-2			4
Nitrilotriacetamide	4862-18-4	X		1, 4, 7
Nitrilotriacetic acid	139-13-9	X	X	1, 4
Nitrilotriacetic acid trisodium monohydrate	18662-53-8	X	X	1, 4
Nitrogen	7727-37-9			1, 2, 3, 4, 6
N-Methyl-2-pyrrolidone	872-50-4	X	X	1, 4
N-Methyldiethanolamine	105-59-9	X		2, 4, 8
N-Methylethanolamine	109-83-1	X		4
N-Methyl-N-hydroxyethyl-N-hydroxyethoxyethylamine	68213-98-9	X		4
N-Oleyl diethanolamide	13127-82-7	X		1, 4
Nonyl nonoxynol-10	9014-93-1			4
Nonylphenol (mixed)	25154-52-3			1, 4
Octamethylcyclotetrasiloxane	556-67-2			8
Octoxynol-9	9036-19-5			1, 2, 3, 4, 8
Oil of eucalyptus	8000-48-4			3
Oil of lemongrass	8007-02-1			3
Oil of rosemary	8000-25-7			3
Oleic acid	112-80-1	X		2, 4
Olivine-group minerals	1317-71-1			4
Orange terpenes	8028-48-6			4
Oxirane, 2-methyl-, polymer with oxirane, ether with (chloromethyl) oxirane polymer with 4,4'-(1-methylidene) bis[phenol]	68036-95-3			8
Oxirane, 2-methyl-, polymer with oxirane, mono(2-ethylhexyl) ether	64366-70-7			8
Oxirane, 2-methyl-, polymer with oxirane, monodecyl ether	37251-67-5			8

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Oxirane, methyl-, polymer with oxirane, mono-C10-16-alkyl ethers, phosphates	68649-29-6			1, 4
Oxygen	7782-44-7			4
Ozone	10028-15-6			8
Paraffin waxes and Hydrocarbon waxes	8002-74-2			1
Paraformaldehyde	30525-89-4			2
PEG-10 Hydrogenated tallow amine	61791-26-2			1, 3
Pentaethylenehexamine	4067-16-7	X		4
Pentane	109-66-0	X		2, 5
Pentyl acetate	628-63-7	X		3
Pentyl butyrate	540-18-1	X		3
Peracetic acid	79-21-0	X		8
Perboric acid, sodium salt, monohydrate	10332-33-9			1, 8
Perlite	93763-70-3			4
Petrolatum, petroleum, oxidized	64743-01-7			3
Petroleum	8002-05-9			1, 2
Petroleum distillate hydrotreated light	6742-47-8			8
<i>Phenanthrene</i>	85-01-8	X		6
<i>Phenol</i>	108-95-2	X	X	1, 2, 4
Phenol, 4,4'-(1-methylethylidene)bis-, polymer with 2-(chloromethyl)oxirane, 2-methyloxirane and oxirane	68123-18-2			8
Phenol-formaldehyde resin	9003-35-4			1, 2, 4, 7
Phosphine	7803-51-2		X	1, 4
Phosphonic acid	13598-36-2			1, 4
Phosphonic acid (dimethylamino(methylene))	29712-30-9	X		1
Phosphonic acid, (((2-[(2-hydroxyethyl)(phosphonomethyl)amino]ethyl)imino]bis(methylene))bis-, compd. with 2-aminoethanol	129828-36-0	X		1
Phosphonic acid, (1-hydroxyethylidene)bis-, potassium salt	67953-76-8	X		4

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Phosphonic acid, (1-hydroxyethylidene)bis-, tetrasodium salt	3794-83-0	X		1, 4
Phosphonic acid, [[[phosphonomethyl)imino]bis[2,1-ethanediylnitrilobis(methylene)]]]tetrakis-	15827-60-8	X		1, 2, 4
Phosphonic acid, [[[phosphonomethyl)imino]bis[2,1-ethanediylnitrilobis(methylene)]]]tetrakis-, ammonium salt (1:x)	70714-66-8	X		3
Phosphonic acid, [[[phosphonomethyl)imino]bis[2,1-ethanediylnitrilobis(methylene)]]]tetrakis-, sodium salt	22042-96-2	X		3
Phosphonic acid, [[[phosphonomethyl)imino]bis[6,1-hexanediylnitrilobis(methylene)]]]tetrakis-	34690-00-1	X		1, 4, 8
Phosphoric acid	7664-38-2		X	1, 2, 4
Phosphoric acid, aluminium sodium salt	7785-88-8		X	1, 2
Phosphoric acid, ammonium salt (1:3)	10361-65-6			8
Phosphoric acid, diammonium salt	7783-28-0		X	2
Phosphoric acid, mixed decyl and Et and octyl esters	68412-60-2			1
Phosphorous acid	10294-56-1			1
Phthalic anhydride	85-44-9	X	X	1, 4
Pine oils	8002-09-3			1, 2, 4
Pluronic F-127	9003-11-6			1, 3, 4, 8
Policapram (Nylon 6)	25038-54-4			1, 4
Poly (acrylamide-co-acrylic acid), partial sodium salt	62649-23-4			3, 4
Poly(acrylamide-co-acrylic acid)	9003-06-9			4, 8
Poly(lactide)	26680-10-4			1
Poly(oxy-1,2-ethanediy), .alpha.-(nonylphenyl)-.omega.-hydroxy-, phosphate	51811-79-1			1, 4
Poly(oxy-1,2-ethanediy), .alpha.-(octylphenyl)-.omega.-hydroxy-, branched	68987-90-6	X		1, 4

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Poly(oxy-1,2-ethanediyl), .alpha.,.alpha.'-[[[(9Z)-9-octadecenylimino]di-2,1-ethanediyl]bis[.omega.-hydroxy-	26635-93-8			1, 4
Poly(oxy-1,2-ethanediyl), .alpha.-[(9Z)-1-oxo-9-octadecenyl]-.omega.-hydroxy-	9004-96-0			8
Poly(oxy-1,2-ethanediyl), .alpha.-hydro-.omega.-hydroxy-, mono-C10-14-alkyl ethers, phosphates	68585-36-4			8
Poly(oxy-1,2-ethanediyl), .alpha.-hydro-.omega.-hydroxy-, mono-C8-10-alkyl ethers, phosphates	68130-47-2			8
Poly(oxy-1,2-ethanediyl), .alpha.-isodecyl-.omega.-hydroxy-	61827-42-7			8
Poly(oxy-1,2-ethanediyl), .alpha.-sulfo-.omega.-hydroxy-, C10-16-alkyl ethers, sodium salts	68585-34-2			8
Poly(oxy-1,2-ethanediyl), .alpha.-sulfo-.omega.-hydroxy-, C12-14-alkyl ethers, sodium salts	68891-38-3			1, 4
Poly(oxy-1,2-ethanediyl), alpha-(2,3,4,5-tetramethylnonyl)-omega-hydroxy	68015-67-8			1
Poly(oxy-1,2-ethanediyl), alpha-(nonylphenyl)-omega-hydroxy-, branched, phosphates	68412-53-3			1
Poly(oxy-1,2-ethanediyl), alpha-hexyl-omega-hydroxy	31726-34-8			3, 8
Poly(oxy-1,2-ethanediyl), alpha-hydro-omega-hydroxy-, (9Z)-9-octadecenoate	56449-46-8			3
Poly(oxy-1,2-ethanediyl), alpha-hydro-omega-hydroxy-, ether with alpha-fluoro-omega-(2-hydroxyethyl)poly(difluoromethylene) (1:1)	65545-80-4			1
Poly(oxy-1,2-ethanediyl), alpha-hydro-omega-hydroxy-, ether with D-glucitol (2:1), tetra-(9Z)-9-octadecenoate	61723-83-9			8
Poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(decyloxy)-, ammonium salt (1:1)	52286-19-8			4
Poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(hexyloxy)-, ammonium salt (1:1)	63428-86-4			1, 3, 4
Poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(hexyloxy)-, C6-10-alkyl ethers, ammonium salts	68037-05-8			3, 4

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Poly(oxy-1,2-ethanediyl), alpha-sulfo-omega--(nonylphenoxy)-	9081-17-8			4
Poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(octyloxy)-, ammonium salt (1:1)	52286-18-7			4
Poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-hydroxy-, C10-12-alkyl ethers, ammonium salts	68890-88-0			8
Poly(oxy-1,2-ethanediyl), alpha-tridecyl-omega-hydroxy-	24938-91-8			1, 3, 4
Poly(oxy-1,2-ethanediyl), alpha-undecyl-omega-hydroxy-, branched and linear	127036-24-2			1
Poly-(oxy-1,2-ethanediyl)-alpha-undecyl-omega-hydroxy	34398-01-1			1, 3, 4, 8
Poly(oxy-1,2-ethanediyl)-nonylphenyl-hydroxy branched	127087-87-0			1, 2, 3, 4
Poly(sodium-p-styrenesulfonate)	25704-18-1			1,4
Poly(tetrafluoroethylene)	9002-84-0			8
Poly[imino(1,6-dioxo-1,6-hexanediyl)imino-1,6-hexanediyl]	32131-17-2			2
Polyacrylamide	9003-05-8			1, 2, 4, 6
Polyacrylate/ polyacrylamide blend	NOCAS_51256			2
Polyacrylic acid, sodium bisulfite terminated	66019-18-9			3
Polyethylene glycol	25322-68-3			1, 2, 3, 4, 7, 8
Polyethylene glycol (9Z)-9-octadecenyl ether	9004-98-2			8
Polyethylene glycol ester with tall oil fatty acid	68187-85-9			1
Polyethylene glycol monobutyl ether	9004-77-7			1, 4
Polyethylene glycol mono-C8-10-alkyl ether sulfate ammonium	68891-29-2			1, 3, 4
Polyethylene glycol nonylphenyl ether	9016-45-9			1, 2, 3, 4, 8
Polyethylene glycol tridecyl ether phosphate	9046-01-9			1, 3, 4
Polyethyleneimine	9002-98-6			4
Polyglycerol	25618-55-7			2
Poly-L-aspartic acid sodium salt	34345-47-6			8
Polyoxyethylene sorbitan trioleate	9005-70-3			3

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Polyoxyethylene(10)nonylphenyl ether	26027-38-3			1, 2, 3, 4, 8
Polyoxyl 15 hydroxystearate	70142-34-6			8
Polyoxypropylenediamine	9046-10-0			1
Polyphosphoric acids, esters with triethanolamine, sodium salts	68131-72-6			1
Polyphosphoric acids, sodium salts	68915-31-1		X	1, 4
Polypropylene glycol	25322-69-4			1, 2, 4
Polypropylene glycol glycerol triether, epichlorohydrin, bisphenol A polymer	68683-13-6			1
Polyquaternium 5	26006-22-4			1, 4
Polysorbate 20	9005-64-5			8
Polysorbate 60	9005-67-8			3, 4
Polysorbate 80	9005-65-6			3, 4
Polyvinyl acetate copolymer	9003-20-7			2
Polyvinyl acetate, partially hydrolyzed	304443-60-5			8
Polyvinyl alcohol	9002-89-5			1, 2, 4
Polyvinyl alcohol/polyvinyl acetate copolymer	NOCAS_50147			2
Polyvinylidene chloride	9002-85-1			8
Polyvinylpyrrolidone	9003-39-8			8
Portland cement	65997-15-1			2, 4
Potassium acetate	127-08-2	X		1, 3, 4
Potassium aluminum silicate	1327-44-2			5
Potassium antimonate	29638-69-5			1, 4
Potassium bisulfate	7646-93-7			8
Potassium borate	12712-38-8			3
Potassium borate (1:x)	20786-60-1			1, 3
Potassium carbonate sesquihydrate	6381-79-9			5
Potassium chloride	7447-40-7			1, 2, 3, 4, 5, 6, 7
Potassium dichromate	7778-50-9			4
Potassium hydroxide	1310-58-3			1, 2, 3, 4, 6

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Potassium iodide	7681-11-0		X	1, 4
Potassium metaborate	13709-94-9			1, 2, 3, 4, 8
Potassium oleate	143-18-0	X		4
Potassium oxide	12136-45-7			1, 4
Potassium persulfate	7727-21-1			1, 2, 4
Potassium phosphate, tribasic	7778-53-2		X	8
Potassium sulfate	7778-80-5			2
Propane	74-98-6	X		2, 5
Propanol, 1(or 2)-(2-methoxymethylethoxy)-	34590-94-8	X		1, 2, 3, 4
Propargyl alcohol	107-19-7	X	X	1, 2, 3, 4, 5, 6, 7, 8
Propylene carbonate	108-32-7	X		1, 4
Propylene pentamer	15220-87-8	X		1
p-Xylene	106-42-3	X		1, 4
Pyridine, alkyl derivs.	68391-11-7			1, 4
Pyridinium, 1-(phenylmethyl)-, alkyl derivs., chlorides	100765-57-9			4, 8
Pyridinium, 1-(phenylmethyl)-, C7-8-alkyl derivs., chlorides	70914-44-2			6
Pyrimidine	289-95-2	X		2
Pyrrrole	109-97-7	X		2
Quartz-alpha (SiO2)	14808-60-7			1, 2, 3, 4, 5, 6, 8
Quaternary ammonium compounds (2-ethylhexyl) hydrogenated tallow alkyl)dimethyl, methyl sulfates	308074-31-9			8
Quaternary ammonium compounds, (oxydi-2,1-ethanediyl)bis[coco alkyldimethyl, dichlorides	68607-28-3			2, 3, 4, 8
Quaternary ammonium compounds, benzyl(hydrogenated tallow alkyl)dimethyl, bis(hydrogenated tallow alkyl)dimethylammonium salt with bentonite	71011-25-1			8

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Quaternary ammonium compounds, benzylbis(hydrogenated tallow alkyl)methyl, salts with bentonite	68153-30-0			2, 5, 6
Quaternary ammonium compounds, benzyl-C10-16-alkyldimethyl, chlorides	68989-00-4			1, 4
Quaternary ammonium compounds, benzyl-C12-16-alkyldimethyl, chlorides	68424-85-1		X	1, 2, 4, 8
Quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, chlorides	68391-01-5			8
Quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with bentonite	68953-58-2			2, 3, 4, 8
Quaternary ammonium compounds, bis(hydrogenated tallow alkyl)dimethyl, salts with hectorite	71011-27-3			2
Quaternary ammonium compounds, di-C8-10-alkyldimethyl, chlorides	68424-95-3	X		2
Quaternary ammonium compounds, dicoco alkyldimethyl, chlorides	61789-77-3			1
Quaternary ammonium compounds, pentamethyltallow alkyltrimethylenedi-, dichlorides	68607-29-4			4
Quaternary ammonium compounds, trimethyltallow alkyl, chlorides	8030-78-2			1, 4
Quinaldine	91-63-4	X		8
Quinoline	91-22-5	X	X	2, 4
Raffinates (petroleum)	68514-29-4			5
Raffinates, petroleum, sorption process	64741-85-1			1, 2, 4, 8
Residual oils, petroleum, solvent-refined	64742-01-4			5
Residues, petroleum, catalytic reformer fractionator	64741-67-9			1, 4, 8
Rhodamine B	81-88-9	X		4
Rosin	8050-09-7			1, 4
Rutile titanium dioxide	1317-80-2			8
Sand	308075-07-2			8

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Scandium oxide	12060-08-1			8
Sepiolite	63800-37-3			2
Silane, dichlorodimethyl-, reaction products with silica	68611-44-9			2, 4
<i>Silica</i>	7631-86-9			1, 2, 3, 4, 8
silica gel, cryst. -free	112926-00-8			3, 4
Silica, amorphous, fumed, cryst.-free	112945-52-5			1, 3, 4
Silica, vitreous	60676-86-0			1, 4, 8
Silicic acid, aluminum potassium sodium salt	12736-96-8			4
Siloxanes (Polysiloxane)	9011-19-2			4
Siloxanes and Silicones, di-Me, 3-hydroxypropyl Me, ethoxylated propoxylated	68937-55-3			8
Siloxanes and Silicones, di-Me, Me hydrogen	68037-59-2			8
Siloxanes and silicones, di-Me, polymers with Me silsesquioxanes	68037-74-1			4
Siloxanes and Silicones, di-Me, reaction products with silica	67762-90-7			4
Siloxanes and silicones, dimethyl,	63148-52-7			4
Silwet L77	27306-78-1			1
Sodium 1-octanesulfonate	5324-84-5	X		3
Sodium 2-mercaptobenzothiolate	2492-26-4	X		2
Sodium acetate	127-09-3	X		1, 3, 4
Sodium aluminate	1302-42-7			2, 4
Sodium benzoate	532-32-1	X		3
Sodium bicarbonate	144-55-8	X		1, 2, 3, 4, 7
Sodium bis(tridecyl) sulfobutanedioate	2673-22-5	X		4
Sodium bisulfite	7631-90-5			1, 3, 4
Sodium borate	1333-73-9			1, 4, 6, 7
Sodium bromate	7789-38-0			1, 2, 4
Sodium bromide	7647-15-6			1, 2, 3, 4, 7
Sodium bromosulfamate	1004542-84-0			8

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Sodium C14-16 alpha-olefin sulfonate	68439-57-6	X		1, 3, 4
Sodium caprylamphopropionate	68610-44-6	X		4
Sodium carbonate	497-19-8	X		1, 2, 3, 4, 8
Sodium chlorate	7775-09-9		X	1, 4
Sodium chloride	7647-14-5			1, 2, 3, 4, 5, 8
Sodium chlorite	7758-19-2		X	1, 2, 3, 4, 5, 8
Sodium chloroacetate	3926-62-3	X		3
Sodium cocaminopropionate	68608-68-4			1
Sodium decyl sulfate	142-87-0	X		1
Sodium D-gluconate	527-07-1	X		4
Sodium diacetate	126-96-5	X		1, 4
Sodium dichloroisocyanurate	2893-78-9	X		2
Sodium dl-lactate	72-17-3	X		8
Sodium dodecyl sulfate	151-21-3	X		8
Sodium erythorbate (1:1)	6381-77-7	X		1, 3, 4, 8
Sodium ethasulfate	126-92-1	X		1
Sodium formate	141-53-7	X		2, 8
Sodium hydrogen sulfate	7681-38-1			4
Sodium hydroxide	1310-73-2			1, 2, 3, 4, 7, 8
Sodium hydroxymethanesulfonate	870-72-4	X		8
Sodium hypochlorite	7681-52-9			1, 2, 3, 4, 8
Sodium iodide	7681-82-5		X	4
Sodium ligninsulfonate	8061-51-6			2
Sodium l-lactate	867-56-1	X		8
Sodium maleate (1:x)	18016-19-8	X		8
Sodium metabisulfite	7681-57-4			1
Sodium metaborate	7775-19-1			3, 4
Sodium metaborate dihydrate	16800-11-6			1, 4
Sodium metaborate tetrahydrate	10555-76-7			1, 4, 8
Sodium metasilicate	6834-92-0			1, 2, 4

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Sodium molybdate(VI)	7631-95-0			8
Sodium nitrate	7631-99-4			2
Sodium nitrite	7632-00-0			1, 2, 4
Sodium N-methyl-N-oleoyltaurate	137-20-2	X		4
Sodium octyl sulfate	142-31-4	X		1
Sodium oxide	1313-59-3			1
Sodium perborate	11138-47-9			4
Sodium perborate tetrahydrate	10486-00-7			1, 4, 5, 8
Sodium peroxoborate	7632-04-4			1
Sodium persulfate	7775-27-1			1, 2, 3, 4, 7, 8
Sodium phosphate	7632-05-5			1, 4
Sodium polyacrylate	9003-04-7			1, 2, 3, 4
Sodium pyrophosphate	7758-16-9		X	1, 2, 4
Sodium salicylate	54-21-7	X		1, 4
Sodium sesquicarbonate	533-96-0	X		1, 2
Sodium silicate	1344-09-8			1, 2, 4
Sodium starch glycolate	9063-38-1			2
Sodium sulfate	7757-82-6			1, 2, 3, 4
Sodium sulfite	7757-83-7			2, 4, 8
Sodium thiocyanate	540-72-7	X		1, 4
Sodium thiosulfate	7772-98-7			1, 2, 3, 4
Sodium thiosulfate, pentahydrate	10102-17-7			1, 4
Sodium trichloroacetate	650-51-1	X		1, 4
Sodium trimetaphosphate	7785-84-4		X	8
Sodium xylenesulfonate	1300-72-7	X		1, 3, 4
Sodium zirconium lactate	15529-67-6			8
Sodium zirconium lactic acid (4:4:1)	10377-98-7			1, 4
Solvent naphtha, petroleum, heavy aliph.	64742-96-7			2, 4, 8
Solvent naphtha, petroleum, heavy arom.	64742-94-5			1, 2, 4, 5, 8
Solvent naphtha, petroleum, light aliph.	64742-89-8			8

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Solvent naphtha, petroleum, light arom.	64742-95-6			1, 2, 4
Sorbic acid	110-44-1	X		8
Sorbitan sesquioleate	8007-43-0	X		4
Sorbitan, mono-(9Z)-9-octadecenoate	1338-43-8	X		1, 2, 3, 4
Sorbitan, monooctadecanoate	1338-41-6	X		8
Sorbitan, tri-(9Z)-9-octadecenoate	26266-58-0	X		8
Spirit of ammonia, aromatic	8013-59-0			8
Stannous chloride dihydrate	10025-69-1			1, 4
Starch	9005-25-8			1, 2, 4
Steam cracked distillate, cyclodiene dimer, dicyclopentadiene polymer	68131-87-3			1
Stoddard solvent	8052-41-3			1, 3, 4
Stoddard solvent IIC	64742-88-7			1, 2, 4
Strontium chloride	10476-85-4		X	4
Styrene	100-42-5	X	X	2
Subtilisin	9014-01-1			8
Sucrose	57-50-1	X		1, 2, 3, 4
Sulfamic acid	5329-14-6			1, 4
Sulfan blue	129-17-9	X		8
<i>Sulfate</i>	<i>14808-79-8</i>			<i>1, 4</i>
Sulfo NHS Biotin	119616-38-5			8
Sulfomethylated quebracho	68201-64-9			2
Sulfonic acids, C10-16-alkane, sodium salts	68608-21-9			6
Sulfonic acids, petroleum	61789-85-3			1
Sulfonic acids, petroleum, sodium salts	68608-26-4			3
Sulfur dioxide	7446-09-5			2, 4, 8
Sulfuric acid	7664-93-9			1, 2, 4, 7
Sulfuric acid, mono-C12-18-alkyl esters, sodium salts	68955-19-1	X		4
Sulfuric acid, mono-C6-10-alkyl esters, ammonium salts	68187-17-7	X		1, 4, 8

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Symclosene	87-90-1	X		2
Talc	14807-96-6			1, 3, 4, 6, 7
Tall oil	8002-26-4			4, 8
Tall oil imidazoline	61791-36-4			4
Tall oil, compound with diethanolamine	68092-28-4			1
Tall oil, ethoxylated	65071-95-6			4, 8
Tall-oil pitch	8016-81-7			4
Tallow alkyl amines acetate	61790-60-1			8
Tar bases, quinoline derivatives, benzyl chloride-quaternized	72480-70-7			1, 3, 4
Tegin M	8043-29-6			8
Terpenes and Terpenoids, sweet orange-oil	68647-72-3			1, 3, 4, 8
Terpineol	8000-41-7			1, 3
tert-Butyl hydroperoxide	75-91-2	X		1, 4
tert-Butyl perbenzoate	614-45-9	X		1
Tetra-calcium-alumino-ferrite	12068-35-8			1, 2, 4
Tetradecane	629-59-4	X		8
Tetradecyldimethylbenzylammonium chloride	139-08-2	X		1, 4, 8
Tetraethylene glycol	112-60-7	X		1, 4
Tetraethylenepentamine	112-57-2	X		1, 4
Tetrakis(hydroxymethyl)phosphonium sulfate	55566-30-8	X		1, 2, 3, 4, 7
Tetramethyl orthosilicate	681-84-5			1
Tetramethylammonium chloride	75-57-0	X		1, 2, 3, 4, 7, 8
Tetrasodium pyrophosphate	7722-88-5		X	8
Thiamine hydrochloride	67-03-8	X		8
Thiocyanic acid, ammonium salt	1762-95-4	X		2, 3, 4
Thioglycolic acid	68-11-1	X		1, 2, 3, 4
Thiourea	62-56-6	X	X	1, 2, 3, 4, 6
Thiourea, polymer with formaldehyde and 1-phenylethanone	68527-49-1			1, 4, 8
Thuja plicata donn ex. D. don leaf oil	68917-35-1			3

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Tin(II) chloride	7772-99-8			1
Titanium dioxide	13463-67-7			1, 2, 4
Titanium(4+) 2-[bis(2-hydroxyethyl)amino]ethanolate propan-2-olate (1:2:2)	36673-16-2			1
Titanium, isopropoxy (triethanolaminate)	74665-17-1			1, 4
<i>Toluene</i>	<i>108-88-3</i>	X	X	1, 3, 4
Tributyl phosphate	126-73-8	X	X	1, 2, 4
Tributyltetradecylphosphonium chloride	81741-28-8	X		1, 3, 4
Tricalcium phosphate	7758-87-4		X	1, 4
Tricalcium silicate	12168-85-3			1, 2, 4
Tridecane	629-50-5	X		8
Triethanolamine	102-71-6	X		1, 2, 4
Triethanolamine hydrochloride	637-39-8	X		8
Triethanolamine hydroxyacetate	68299-02-5	X		3
Triethanolamine polyphosphate ester	68131-71-5			1, 4, 8
Triethyl citrate	77-93-0	X		1, 4
Triethyl phosphate	78-40-0	X		1, 4
Triethylene glycol	112-27-6	X		1, 2, 3
Triethylenetetramine	112-24-3	X		4
Triisopropanolamine	122-20-3	X		1, 4
Trimethanolamine	14002-32-5	X		3
Trimethyl borate	121-43-7			8
Trimethylamine	75-50-3	X		8
Trimethylamine quaternized polyepichlorohydrin	51838-31-4			1, 2, 3, 4, 5, 8
Trimethylbenzene	25551-13-7			1, 2, 4
Triphosphoric acid, pentasodium salt	7758-29-4		X	1, 4
Tripoli	1317-95-9			4
Tripotassium citrate monohydrate	6100-05-6	X		4
Tripropylene glycol monomethyl ether	25498-49-1	X		2

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Trisodium citrate	68-04-2	X		3
Trisodium citrate dihydrate	6132-04-3	X		1, 4
Trisodium ethylenediaminetetraacetate	150-38-9	X		1, 3
Trisodium ethylenediaminetriacetate	19019-43-3	X		1, 4, 8
Trisodium phosphate	7601-54-9		X	1, 2, 4
Trisodium phosphate dodecahydrate	10101-89-0			1
Tritan R (X-100)	92046-34-9			8
Triton X-100	9002-93-1			1, 3, 4
Tromethamine	77-86-1	X		3, 4
Tryptone	73049-73-7			8
Ulexite	1319-33-1			1, 2, 3, 8
Undecane	1120-21-4	X		3, 8
Undecanol, branched and linear	128973-77-3			8
Urea	57-13-6	X		1, 2, 4, 8
Vermiculite	1318-00-9			2
Vinyl acetate ethylene copolymer	24937-78-8			1, 4
Vinylidene chloride/methylacrylate copolymer	25038-72-6			4
Water	7732-18-5			2, 4, 8
White mineral oil, petroleum	8042-47-5			1, 2, 4
<i>Xylenes</i>	1330-20-7	X	X	1, 2, 4
Yeast extract	8013-01-2			8
Zeolites	1318-02-1			8
<i>Zinc</i>	7440-66-6		X	2
Zinc carbonate	3486-35-9			2
Zinc chloride	7646-85-7			1, 2
Zinc oxide	1314-13-2			1, 4
Zinc sulfate monohydrate	7446-19-7			8
Zirconium nitrate	13746-89-9			2, 6
Zirconium oxide sulfate	62010-10-0			1, 4
Zirconium oxychloride	7699-43-6			1, 2, 4

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Zirconium(IV) chloride tetrahydrofuran complex	21959-01-3			5
Zirconium(IV) sulfate	14644-61-2			2, 6
Zirconium, 1,1'-((2-((2-hydroxyethyl)(2-hydroxypropyl)amino)ethyl)imino)bis(2-propanol) complexes	197980-53-3			4
Zirconium, acetate lactate oxo ammonium complexes	68909-34-2			4, 8
Zirconium, chloro hydroxy lactate oxo sodium complexes	174206-15-6			4
Zirconium, hydroxylactate sodium complexes	113184-20-6			1, 4
Zirconium,tetrakis[2-[bis(2-hydroxyethyl)amino-kN]ethanolato-kO]-	101033-44-7			1, 2, 4, 5

Table A-3. List of generic names of chemicals reportedly used in hydraulic fracturing fluids.

In some cases, the generic chemical name masks a specific chemical name and CASRN provided to the EPA and claimed as CBI by one or more of the nine hydraulic fracturing service companies.

Generic chemical name	Reference
2-Substituted aromatic amine salt	1, 4
Acetylenic alcohol	1
Acrylamide acrylate copolymer	4
Acrylamide copolymer	1, 4
Acrylamide modified polymer	4
Acrylamide-sodium acrylate copolymer	4
Acrylate copolymer	1
Acrylic copolymer	1
Acrylic polymer	1, 4
Acrylic resin	4
Acyclic hydrocarbon blend	1, 4
Acylbenzylpyridinium choride	8
Alcohol alkoxylate	1, 4
Alcohol and fatty acid blend	2

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Generic chemical name	Reference
Alcohol ethoxylates	4
Alcohols	1, 4
Alcohols, C9-C22	1, 4
Aldehydes	1, 4, 5
Alfa-alumina	1, 4
Aliphatic acids	1, 2, 3, 4
Aliphatic alcohol	2
Aliphatic alcohol glycol ether	3, 4
Aliphatic alcohols, ethoxylated	2
Aliphatic amine derivative	1
Aliphatic carboxylic acid	4
Alkaline bromide salts	1, 4
Alkaline metal oxide	4
Alkanes/alkenes	4
Alkanolamine derivative	2
Alkanolamine/aldehyde condensate	1, 2, 4
Alkenes	1, 4
Alklaryl sulfonic acid	1, 4
Alkoxyated alcohols	1
Alkoxyated amines	1, 4
Alkyaryl sulfonate	1, 2, 3, 4
Alkyl alkoxyate	1, 4
Alkyl amide	4
Alkyl amine	1, 4
Alkyl amine blend in a metal salt solution	1, 4
Alkyl aryl amine sulfonate	4
Alkyl aryl polyethoxy ethanol	3, 4
Alkyl dimethyl benzyl ammonium chloride	4
Alkyl esters	1, 4
Alkyl ether phosphate	4
Alkyl hexanol	1, 4
Alkyl ortho phosphate ester	1, 4

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Generic chemical name	Reference
Alkyl phosphate ester	1, 4
Alkyl phosphonate	4
Alkyl pyridines	2
Alkyl quaternary ammonium chlorides	1, 4
Alkyl quaternary ammonium salt	4
Alkylamine alkylaryl sulfonate	4
Alkylamine salts	2
Alkylaryl sulfonate	1, 4
Alkylated quaternary chloride	1, 2, 4
Alkylated sodium naphthalenesulphonate	2
Alkylbenzenesulfonate	2
Alkylbenzenesulfonic acid	1, 4, 5
Alkylethoammonium sulfates	1
Alkylphenol ethoxylates	1, 4
Alkylpyridinium quaternary	4
Aliphatic alcohol polyglycol ether	2
Aluminum oxide	1, 4
Amide	4
Amidoamine	1, 4
Amine	1, 4
Amine compound	4
Amine oxides	1, 4
Amine phosphonate	1, 4
Amine salt	1
Amino compounds	1, 4
Amino methylene phosphonic acid salt	1, 4
Ammonium alcohol ether sulfate	1, 4
Ammonium salt	1, 4
Ammonium salt of ethoxylated alcohol sulfate	1, 4
Amorphous silica	4
Amphoteric surfactant	2
Anionic acrylic polymer	2

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Generic chemical name	Reference
Anionic copolymer	1, 4
Anionic polyacrylamide	1, 2, 4
Anionic polyacrylamide copolymer	1, 4, 6
Anionic polymer	1, 3, 4
Anionic surfactants	2, 4, 6
Antifoulant	1, 4
Antimonate salt	1, 4
Aqueous emulsion of diethylpolysiloxane	2
Aromatic alcohol glycol ether	1
Aromatic aldehyde	1, 4
Aromatic hydrocarbons	3, 4
Aromatic ketones	1, 2, 3, 4
Aromatic polyglycol ether	1
Arsenic compounds	4
Ashes, residues	4
Bentone clay	4
Biocide	4
Biocide component	1, 4
Bis-quaternary methacrylamide monomer	4
Blast furnace slag	4
Borate salts	1, 2, 4
Cadmium compounds	4
Carbohydrates	1, 2, 4
Carboxymethyl hydroxypropyl guar	4
Cationic polyacrylamide	4
Cationic polymer	2, 4
Cedar fiber, processed	2
Cellulase enzyme	1
Cellulose derivative	1, 2, 4
Cellulose ether	2
Cellulosic polymer	2
Ceramic	4

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Generic chemical name	Reference
Chlorous ion solution	1
Chromates	1, 4
Chrome-free lignosulfonate compound	2
Citrus rutaceae extract	4
Common white	4
Complex alkylaryl polyo-ester	1
Complex aluminum salt	1, 4
Complex carbohydrate	2
Complex organometallic salt	1
Complex polyamine salt	7
Complex substituted keto-amine	1
Complex substituted keto-amine hydrochloride	1
Copper compounds	6
Coric oxide	4
Cotton dust (raw)	2
Cottonseed hulls	2
Cured acrylic resin	1, 4
Cured resin	1, 4, 5
Cured urethane resin	1, 4
Cyclic alkanes	1, 4
Defoamer	4
Dibasic ester	4
Dicarboxylic acid	1, 4
Diesel	1, 4, 6
Dimethyl silicone	1, 4
Dispersing agent	1
Emulsifier	4
Enzyme	4
Epoxy	4
Epoxy resin	1, 4
Essential oils	1, 4
Ester Salt	2, 4

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Generic chemical name	Reference
Esters	2, 4
Ether compound	4
Ether salt	4
Ethoxylated alcohol blend	4
Ethoxylated alcohol/ester mixture	4
Ethoxylated alcohols	1, 2, 4, 5, 7
Ethoxylated alkyl amines	1, 4
Ethoxylated amine blend	4
Ethoxylated amines	1, 4
Ethoxylated fatty acid	4
Ethoxylated fatty acid ester	1, 4
Ethoxylated nonionic surfactant	1, 4
Ethoxylated nonylphenol	1, 2, 4
Ethoxylated sorbitol esters	1, 4
Ethylene oxide-nonylphenol polymer	4
Fatty acid amine salt mixture	4
Fatty acid ester	1, 2, 4
Fatty acid tall oil	1, 4
Fatty acid, ethoxylate	4
Fatty acids	1
Fatty alcohol alkoxyate	1, 4
Fatty alkyl amine salt	1, 4
Fatty amine carboxylates	1, 4
Fatty imidazoline	4
Fluoroaliphatic polymeric esters	1, 4
Formaldehyde polymer	1
Glass fiber	1, 4
Glyceride esters	2
Glycol	4
Glycol blend	2
Glycol ethers	1, 4, 7
Ground cedar	2

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Generic chemical name	Reference
Ground paper	2
Guar derivative	1, 4
Guar gum	4
Haloalkyl heteropolycycle salt	1, 4
Hexanes	1
High molecular weight polymer	2
High pH conventional enzymes	2
Hydrocarbons	1
Hydrogen solvent	4
Hydrotreated and hydrocracked base oil	1, 4
Hydrotreated distillate, light C9-16	4
Hydrotreated heavy naphthalene	5
Hydrotreated light distillate	2, 4
Hydrotreated light petroleum distillate	4
Hydroxyalkyl imino carboxylic sodium salt	2
Hydroxycellulose	6
Hydroxyethyl cellulose	1, 2, 4
Imidazolium compound	4
Inner salt of alkyl amines	1, 4
Inorganic borate	1, 4
Inorganic chemical	4
Inorganic particulate	1, 4
Inorganic salt	2, 4
Iso-alkanes/n-alkanes	1, 4
Isomeric aromatic ammonium salt	1, 4
Latex	2, 4
Lead compounds	4
Low toxicity base oils	1, 4
Lubra-Beads course	4
Maghemite	1, 4
Magnetite	1, 4
Metal salt	1

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Generic chemical name	Reference
Metal salt solution	1
Mineral	1, 4
Mineral fiber	2
Mineral filler	1
Mineral oil	4
Mixed titanium ortho ester complexes	1, 4
Modified acrylamide copolymer	2, 4
Modified acrylate polymer	4
Modified alkane	1, 4
Modified bentonite	4
Modified cycloaliphatic amine adduct	1, 4
Modified lignosulfonate	2, 4
Naphthalene derivatives	1, 4
Neutralized alkylated naphthalene sulfonate	4
Nickel chelate catalyst	4
Nonionic surfactant	1
N-tallowalkyltrimethylenediamines	4
Nuisance particulates	1, 2, 4
Nylon	4
Olefinic sulfonate	1, 4
Olefins	1, 4
Organic acid salt	1, 4
Organic acids	1, 4
Organic alkyl amines	4
Organic chloride	4
Organic modified bentonite clay	4
Organic phosphonate	1, 4
Organic phosphonate salts	1, 4
Organic phosphonic acid salts	1, 4
Organic polymer	4
Organic polyol	4
Organic salt	1, 4

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Generic chemical name	Reference
Organic sulfur compound	1, 4
Organic surfactants	1
Organic titanate	1, 4
Organo amino silane	4
Organo phosphonic acid	4
Organo phosphonic acid salt	4
Organometallic ammonium complex	1
Organophilic clay	4
Oxidized tall oil	2
Oxoaliphatic acid	2
Oxyalkylated alcohol	1, 4
Oxyalkylated alkyl alcohol	2, 4
Oxyalkylated alkylphenol	1, 2, 3, 4
Oxyalkylated fatty acid	1, 4
Oxyalkylated fatty alcohol salt	2
Oxyalkylated phenol	1, 4
Oxyalkylated phenolic resin	4
Oxyalkylated polyamine	1
Oxyalkylated tallow diamine	2
Oxyethylated alcohol	2
Oxylated alcohol	1, 4
P/F resin	4
Paraffin inhibitor	4
Paraffinic naphthenic solvent	1
Paraffinic solvent	1, 4
Paraffins	1
Pecan shell	2
Petroleum distillate blend	2, 3, 4
Petroleum gas oils	1
Petroleum hydrocarbons	4
Petroleum solvent	2
Phosphate ester	1, 4

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Generic chemical name	Reference
Phosphonate	2
Phosphonic acid	1, 4
Phosphoric acid, mixed polyoxyalkylene aryl and alkyl esters	4
Plasticizer	1, 2
Polyacrylamide copolymer	4
Polyacrylamides	1
Polyacrylate	1, 4
Polyactide resin	4
Polyalkylene esters	4
Polyaminated fatty acid	2
Polyaminated fatty acid surfactants	2
Polyamine	1, 4
Polyamine polymer	4
Polyanionic cellulose	1
Polyaromatic hydrocarbons	6
Polycyclic organic matter	6
Polyelectrolyte	4
Polyether polyol	2
Polyethoxylated alkanol	2, 3, 4
Polyethylene copolymer	4
Polyethylene glycols	4
Polyethylene wax	4
Polyglycerols	2
Polyglycol	2
Polyglycol ether	6
Poly lactide resin	4
Polymer	2, 4
Polymeric hydrocarbons	3, 4
Polymerized alcohol	4
Polymethacrylate polymer	4
Polyol phosphate ester	2
Polyoxyalkylene phosphate	2

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Generic chemical name	Reference
Polyoxyalkylene sulfate	2
Polyoxyalkylenes	1, 4, 7
Polyphenylene ether	4
Polyphosphate	4
Polypropylene glycols	2
Polyquaternary amine	4
Polysaccharide polymers in suspension	2
Polysaccharide	4
Polysaccharide blend	4
Polyvinylalcohol/polyvinylacetate copolymer	4
Potassium chloride substitute	4
Quaternized heterocyclic amines	4
Quaternary amine	2, 4
Quaternary amine salt	4
Quaternary ammonium chloride	4
Quaternary ammonium compound	1, 2, 4
Quaternary ammonium salts	1, 2, 4
Quaternary compound	1, 4
Quaternary salt	1, 4
Quaternized alkyl nitrogenated compd	4
Red dye	4
Refined mineral oil	2
Resin	4
Salt of amine-carbonyl condensate	3, 4
Salt of fatty acid/polyamine reaction product	3, 4
Salt of phosphate ester	1
Salt of phosphono-methylated diamine	1, 4
Salts	4
Salts of oxyalkylated fatty amines	4
Sand	4
Sand, AZ silica	4
Sand, brown	4

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Generic chemical name	Reference
Sand, sacked	4
Sand, white	4
Secondary alcohol	1, 4
Silica sand, 100 mesh, sacked	4
Silicone emulsion	1
Silicone ester	4
Sodium acid pyrophosphate	4
Sodium calcium magnesium polyphosphate	4
Sodium phosphate	4
Sodium salt of aliphatic amine acid	2
Sodium xylene sulfonate	4
Softwood dust	2
Starch blends	6
Substituted alcohol	1, 2, 4
Substituted alkene	1
Substituted alkylamine	1, 4
Substituted alkyne	4
Sulfate	4
Sulfomethylated tannin	2, 5
Sulfonate	4
Sulfonate acids	1
Sulfonate surfactants	1
Sulfonated asphalt	2
Sulfonic acid salts	1, 4
Sulfur compound	1, 4
Sulphonic amphoteric	4
Sulphonic amphoteric blend	4
Surfactant blend	3, 4
Surfactants	1, 2, 4
Synthetic copolymer	2
Synthetic polymer	4
Tallow soap	4

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Generic chemical name	Reference
Telomer	4
Terpenes	1, 4
Titanium complex	4
Triethanolamine zirconium chelate	1 4
Triterpanes	4
Vanadium compounds	4
Wall material	1
Walnut hulls	1, 2, 4
Zirconium complex	2, 4
Zirconium salt	4

Table A-4. Chemicals detected in flowback or produced water.

An “X” indicates the availability of physicochemical properties from EPI Suite™ and selected toxicity reference values (see Appendix G). An empty cell indicates no information was available from the sources we consulted. Reference number corresponds to the citations in Table A-1. Italicized chemicals are found in both fracturing fluids and flowback/produced water.

Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
1,2,3-Trichlorobenzene	87-61-6	X	X	3, 9
1,2,4-Trichlorobenzene	120-82-1	X	X	9
<i>1,2,4-Trimethylbenzene</i>	<i>95-63-6</i>	X		<i>3, 9, 10</i>
<i>1,2-Propylene glycol</i>	<i>57-55-6</i>	X	X	<i>3, 9</i>
<i>1,3,5-Trimethylbenzene</i>	<i>108-67-8</i>	X		<i>3, 9, 10</i>
<i>1,4-Dioxane</i>	<i>123-91-1</i>	X	X	<i>9, 10</i>
2,4-Dimethylphenol	105-67-9	X	X	3, 9, 10
2,6-Dichlorophenol	87-65-0	X		3, 9
2-Methylnaphthalene	91-57-6	X	X	3, 9, 10
2-Methylpropanoic acid	79-31-2	X		10
2-Methylpyridine	109-06-8	X		3, 9
7,12-Dimethylbenz(a)anthracene	57-97-6	X	X	3, 9
<i>Acetic acid</i>	<i>64-19-7</i>	X		<i>3, 9, 10</i>

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
<i>Acetone</i>	67-64-1	X	X	3, 9, 10
<i>Acetophenone</i>	98-86-2	X	X	3, 9
<i>Acrolein</i>	107-02-8	X	X	9
Acrylonitrile	107-13-1	X	X	3, 9
Aldrin	309-00-2	X	X	3, 9
<i>Aluminum</i>	7429-90-5		X	3, 9, 10
<i>Ammonia</i>	7664-41-7			3, 9, 10
Antimony	7440-36-0		X	3, 9, 10
Aroclor 1248	12672-29-6	X		3, 9
<i>Arsenic</i>	7440-38-2		X	3, 9, 10
Barium	7440-39-3		X	3, 9, 10
<i>Benzene</i>	71-43-2	X	X	3, 9, 10
Benzo(a)pyrene	50-32-8	X	X	3, 9
Benzo(b)fluoranthene	205-99-2	X	X	3, 9
Benzo(g,h,i)perylene	191-24-2	X		3, 9, 10
Benzo(k)fluoranthene	207-08-9	X	X	3, 9
Benzyl alcohol	100-51-6	X	X	3, 9, 10
Beryllium	7440-41-7		X	3, 9, 10
beta-Hexachlorocyclohexane	319-85-7	X	X	3, 9
<i>Bis(2-chloroethyl) ether</i>	111-44-4	X	X	3, 9
Boron	7440-42-8		X	3, 9, 10
Bromide	24959-67-9			3, 9, 10
Bromodichloromethane	75-27-4	X	X	3
Bromoform	75-25-2	X	X	3, 9, 10
Butanoic acid	107-92-6	X		9, 10
Butylbenzene	104-51-8	X	X	9, 10
Cadmium	7440-43-9		X	3, 9, 10
Caesium-137	10045-97-3			3
Calcium	7440-70-2			3, 9, 10
<i>Carbon dioxide</i>	124-38-9	X		3, 9, 10

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Carbon disulfide	75-15-0	X	X	3, 9
<i>Chloride</i>	16887-00-6			3, 9, 10
<i>Chlorine</i>	7782-50-5		X	3, 10
Chlorodibromomethane	124-48-1	X	X	3
Chloroform	67-66-3	X	X	3, 9, 10
Chloromethane	74-87-3	X		3, 10
Chromium	7440-47-3			3, 9, 10
<i>Chromium (III)</i>	16065-83-1		X	3
<i>Chromium (VI)</i>	18540-29-9		X	3, 10
Cobalt	7440-48-4		X	3, 9, 10
<i>Copper</i>	7440-50-8		X	3, 9, 10
<i>Cumene</i>	98-82-8	X	X	3, 9
Cyanide	57-12-5	X	X	3, 9, 10
delta-Hexachlorocyclohexane	319-86-8	X		9
<i>Di(2-ethylhexyl) phthalate</i>	117-81-7	X	X	3, 9, 10
Dibenz(a,h)anthracene	53-70-3	X	X	3, 9
Dibutyl phthalate	84-74-2	X	X	3, 9, 10
<i>Dichloromethane</i>	75-09-2	X	X	9, 10
Dieldrin	60-57-1	X	X	9
Diethyl phthalate	84-66-2	X	X	9
Diocetyl phthalate	117-84-0	X	X	9, 10
Diphenylamine	122-39-4	X	X	3, 9
Endosulfan I	959-98-8	X		3, 9
Endosulfan II	33213-65-9	X		3, 9
Endrin aldehyde	7421-93-4	X		3, 9
<i>Ethylbenzene</i>	100-41-4	X	X	3, 9, 10
<i>Ethylene glycol</i>	107-21-1	X	X	3, 9
Fluoranthene	206-44-0	X	X	3, 9
Fluorene	86-73-7	X	X	3, 9, 10
Fluoride	16984-48-8			3, 9, 10

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
<i>Formic acid</i>	64-18-6	X	X	10
Heptachlor	76-44-8	X	X	3, 9
Heptachlor epoxide	1024-57-3	X	X	3, 9
Heptanoic acid	111-14-8	X		10
Hexanoic acid	142-62-1	X		10
Indeno(1,2,3-cd)pyrene	193-39-5	X	X	3, 9
<i>Iron</i>	7439-89-6		X	3, 9, 10
<i>Isopropanol</i>	67-63-0	X		3, 9
Isovaleric acid	503-74-2	X		10
<i>Lead</i>	7439-92-1		X	3, 9, 10
Lindane	58-89-9	X	X	3, 9
Lithium	7439-93-2		X	3, 9, 10
Magnesium	7439-95-4			3, 9, 10
Manganese	7439-96-5		X	3, 9, 10
m-Cresol	108-39-4	X	X	3, 9, 10
Mercury	7439-97-6		X	3, 9, 10
<i>Methanol</i>	67-56-1	X	X	3, 9
Methyl bromide	74-83-9	X	X	3, 9
Methyl ethyl ketone	78-93-3	X	X	3, 9, 10
Molybdenum	7439-98-7		X	3, 9, 10
<i>Naphthalene</i>	91-20-3	X	X	3, 9, 10
Nickel	7440-02-0			3, 9, 10
Nitrate	14797-55-8		X	3, 9, 10
Nitrite	14797-65-0		X	3, 9, 10
N-Nitrosodiphenylamine	86-30-6	X	X	3, 9
o-Cresol	95-48-7	X	X	3, 9, 10
p,p'-DDE	72-55-9	X	X	3, 9
p-Cresol	106-44-5	X	X	3, 9, 10
p-Cymene	99-87-6	X		9, 10
Pentanoic acid	109-52-4	X		10

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
<i>Phenanthrene</i>	85-01-8	X		3, 9, 10
<i>Phenol</i>	108-95-2	X	X	3, 9, 10
Phorate	298-02-2	X	X	9
Phosphorus	7723-14-0		X	3, 9
Potassium	7440-09-7			3, 9, 10
Propionic acid	79-09-4	X		10
Propylbenzene	103-65-1	X		9
Pyrene	129-00-0	X	X	9, 10
Pyridine	110-86-1	X	X	3, 9, 10
Radium	7440-14-4			3
Radium-226	13982-63-3			3, 10
Radium-228	15262-20-1			3, 10
Safrole	94-59-7	X	X	3, 9
sec-Butylbenzene	135-98-8	X		9
Selenium	7782-49-2		X	3, 9, 10
<i>Silica</i>	7631-86-9			10
Silicon	7440-21-3			10
Silver	7440-22-4		X	3, 9, 10
Sodium	7440-23-5			3, 9, 10
Strontium	7440-24-6		X	3, 9, 10
<i>Sulfate</i>	14808-79-8			3, 9, 10
Sulfite	14265-45-3			3
Tetrachloroethylene	127-18-4	X	X	3, 9
Thallium	7440-28-0			3, 9, 10
Tin	7440-31-5		X	9, 10
Titanium	7440-32-6			3, 9, 10
<i>Toluene</i>	108-88-3	X	X	3, 9, 10
Vanadium	7440-62-2		X	3, 10

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Chemical name	CASRN	Physico-chemical properties	Selected toxicity reference value	Reference
Xylenes	1330-20-7	X	X	3, 9, 10
Zinc	7440-66-6		X	3, 9, 10
Zirconium	7440-67-7			3

A.2. References for Appendix A

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