

spotlight

No. 460 – August 28, 2014

THE CHEMICALS IN FRACKING FLUIDS

Earth and water, you'll find plenty of both down there

KEY FACTS:

- **Since the 1940s, over a million wells have used hydraulic fracturing (“fracking”) safely.**
- **Numerous academic, federal, and state studies have found no link between hydraulic fracturing and groundwater contamination.**
- **The process of hydraulic fracturing is not intrinsically dangerous.**
- **A growing consensus among energy companies, state regulators, academics, and environmentalists is that the safety issue rests in proper well construction.**
- **That is good news. It means that safe drilling is achievable through proper regulation and company due diligence.**
- **Chemicals used in fracking are about 99 percent water and sand.**
- **The rest is a blend of chemical additives used to condition the water, prevent well casing corrosion, control the fluid pH levels, kill bacteria, etc.**
- **Most of the chemicals used for fracking are also found in typical household products, including soaps, makeup, and other personal care products. That means they are chemicals people already willingly encounter daily and safely.**
- **They are also used in consumer products for homes, pets, and yards.**

200 W. Morgan, #200
Raleigh, NC 27601
phone: 919-828-3876
fax: 919-821-5117
www.johnlocke.org

The John Locke Foundation is a 501(c)(3) nonprofit, nonpartisan research institute dedicated to improving public policy debate in North Carolina. Viewpoints expressed by authors do not necessarily reflect those of the staff or board of the Locke Foundation.

north Carolina law now allows hydraulic fracturing (“fracking”) in gas and oil exploration.¹ Along with the hope of new jobs and a new industry, there is a great deal of public concern over whether fracking is safe.

One area of concern surrounds the chemical makeup of the fluid used. Fracking involves pumping fracturing fluids at high pressure to create and prop open fissures in solid rock formations over a mile underground. The fractures allow the natural gas and oil trapped in rock to flow and be recovered.

The fracturing fluid is about 99 percent water and sand. The rest is a blend of chemical additives. What are those chemicals, how dangerous are they, and how risky is it to inject them into the ground are questions people generally seem to have about this aspect of hydraulic fracturing.

This Spotlight report addresses the safety of hydraulic fracturing fluids and the chemicals typically used. It is drawn from a longer Policy Report that covers several concerns over hydraulic fracturing in more depth. Readers seeking more information on the subject are encouraged to consult that report.²

A safe process

Hydraulic fracturing has been used since the 1940s, and over a million wells have used the technique safely.³ Numerous studies have found no link between hydraulic fracturing and groundwater contamination.

A 2004 study by the U.S. Environmental Protection Agency (EPA) found no incident of contamination of drinking water wells from hydraulic fracturing fluid injection in coalbed methane wells.⁴ In 2009 state regulators in all member states of the Interstate Oil & Gas Compact Commission found no cases where hydraulic fracturing had caused drinking water to be contaminated.⁵

In May 2011, EPA administrator Lisa P. Jackson, testifying under oath before the U.S. House Committee on Oversight and Government Reform, stated she was “not aware of any proven case where the fracking process itself has affected water.”⁶

In July 2013, the U.S. Department of Energy announced finding no evidence of hydraulic fracturing contaminating groundwater after a year of monitoring in western Pennsylvania. The study, still ongoing, is the first to use tracers in the fracturing fluids to see if they migrate back up. While the fluids were injected over 8,000 feet (well over a mile) underground, monitoring zones were established at 3,000 feet — about half a mile beneath drinking water aquifers, which are normally within 500 to 1,000 feet underground. In a year, the fluids had not been detected at the monitoring zones.⁷

If fluids are not migrating back up, then they are certainly not threatening to get into streams, lakes, or drinking water.

Flowback

During hydraulic fracturing, an estimated 9 to 35 percent of the fluid pumped into a well flows back up to the surface before gas or oil production begins. This is called flowback, and it is recaptured by the energy companies.⁸

Less than 10 percent of the chemicals injected return as flowback. The flowback may also contain other mineral content from the well.⁹

The top option for recaptured fracturing fluid is recycling and reuse. This option alleviates some concern about wastewater disposal and is also a more economical option for the energy companies.¹⁰ Other options include on-site pretreatment, disposal at specially purposed facilities, and storage pits with upper and lower synthetic liners and built-in leak-detection zones.¹¹ Many states allow flowback to be disposed of via injection wells, but that method is not allowed under North Carolina law.¹²

Well construction

The process of hydraulic fracturing is not intrinsically dangerous. A growing consensus among energy companies, state regulators, academics, and environmentalists is that the safety issue rests in well construction.¹³

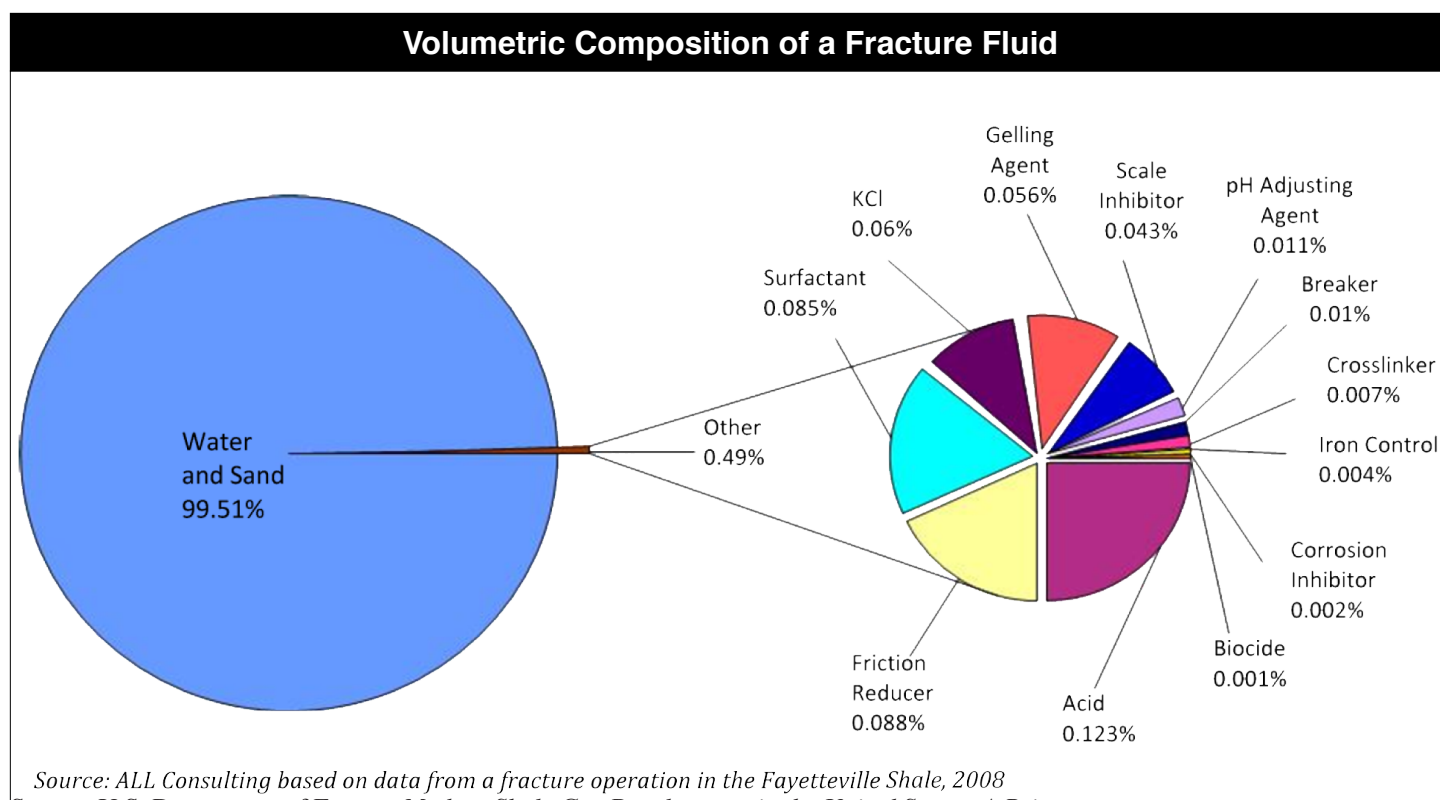
That is good news; it means that safe drilling is achievable through proper regulation and company due diligence.

A study released in April 2012 by the North Carolina Department of Environment and Natural Resources (DENR) and Department of Commerce under Gov. Bev Perdue found, “information available to date suggests that production of natural gas by means of hydraulic fracturing can be done safely as long as the right protections are in place.”¹⁴

North Carolina is a latecomer to hydraulic fracturing. That means the state is well positioned to learn from other states’ experiences, use state-of-the-art technologies, and adopt the best legal and regulatory practices.¹⁵

Chemicals used in hydraulic fracturing

The fluid used in hydraulic fracturing is 98 to 99.5 percent water and sand.¹⁶ The rest is chemical additives used to condition the water, prevent well casing corrosion, control the fluid pH levels, kill bacteria, and so forth.¹⁷



Most of the chemicals used are also found in typical household products, including soaps, makeup, and hair care products. That means they are chemicals people already willingly encounter daily and safely. They include chemicals used in consumer products for homes, pets, and yards.

Chemical disclosure

While many chemicals may be used in hydraulic fracturing, those used for a routine fracturing operation are generally well known.¹⁸ An energy company may have a proprietary or patent-pending blend of chemicals that it

regards as a trade secret not to be shared with competitors. North Carolina law seeks to respect those trade secrets without compromising public safety through confidential disclosure to state officials.

State law requires companies to disclose the chemicals used in their fracking operations to several state officials and agencies, including the Mining and Energy Committee (MEC), DENR, the State Geologist, the State Health Director, and the Division of Emergency Management. The law makes it a Class 1 misdemeanor for state personnel to disclose that information unlawfully. It also requires immediate disclosure of it to first responders and medical personnel in the event of an emergency.¹⁹

Draft rules by the MEC would require the chemicals to be disclosed to the Chemical Disclosure Registry at FracFocus,²⁰ a web site managed by the Ground Water Protection Council and Interstate Oil and Gas Compact Commission. FracFocus gives factual information to the public about groundwater protection and the chemicals used in hydraulic fracturing operations in general. It also gives reports on chemicals used in individual wells. States using FracFocus for official state chemical disclosure include Colorado, Oklahoma, Louisiana, Texas, North Dakota, Montana, Mississippi, Utah, Ohio and Pennsylvania.²¹

The table at the end of this paper looks at the chemicals listed by FracFocus as routinely used in hydraulic fracturing and the purposes for which they are used. It supplements that information with the chemicals' common names, whether they are derived from or used as additives to food, and how they are used in consumer products.

For more information on fracking coming to North Carolina, see the "Facts on Fracking" report at JohnLocke.org.

Jon Sanders is Director of Regulatory Studies at the John Locke Foundation.

Endnotes

1. S.L. 2014-4, <http://www.ncga.state.nc.us/gascripts/BillLookUp/BillLookUp.pl?Session=2013&BillID=S786&submitButton=Go>.
2. See Jon Sanders, "Facts on Fracking: Addressing concerns over hydraulic fracturing coming to North Carolina," John Locke Foundation Policy Report, August 2014, <http://www.johnlocke.org/research/show/policy%20reports/259>.
3. Rob Millican, "Hydraulic Fracturing — Is It Safe?," Institute for Energy Research, May 3, 2011, <http://instituteforenergyresearch.org/analysis/hydraulic-fracturing-is-it-safe>.
4. Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs Study, EPA 816-R-04-003, United States Environmental Protection Agency, June 2004, http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/wells_coalbedmethanestudy.cfm.
5. "Regulatory Statements on Hydraulic Fracturing Submitted by the States," Interstate Oil & Gas Compact Commission, June 2009, <http://iogcc.publishpath.com/Websites/iogcc/Images/2009StateRegulatoryStatementsonHydraulic%20Fracturing.pdf>.
6. "EPA Jackson 'Not Aware of Any Proven Case Where the Fracking Process Itself Has Affected Water,'" press release, United States Senate Committee on Environment and Public Works, May 24, 2011, http://www.epw.senate.gov/public/index.cfm?FuseAction=Minority.PressReleases&ContentRecord_id=23eb85dd-802a-23ad-43f9-da281b2cd287.
7. "Study finds fracking chemicals didn't pollute water," Associated Press, July 19, 2012, via CBS News, <http://www.cbsnews.com/news/study-finds-fracking-chemicals-didnt-pollute-water-ap>.
8. "North Carolina Oil and Gas Study under Session Law 2011276," North Carolina Department of Environment and Natural Resources and the North Carolina Department of Commerce, April 30, 2012, accessible at <http://portal.ncdenr.org/web/guest/denr-study>.
9. Vikram Rao, *Shale Gas: The Promise and the Peril*, (Research Triangle: Research Triangle Institute Press, 2012), p. 41.
10. See discussion in "North Carolina Oil and Gas Study" and Jean-Philippe Nicot, Robert C. Reedy, Ruth A. Costley, and Yun Huang, "Oil & Gas Water Use in Texas: Update to the 2011 Mining Water Use Report," Bureau of Economic Geology, Jackson School of Geosciences, The University of Texas at Austin, September 2012, http://www.twdb.state.tx.us/publications/reports/contracted_reports/doc/0904830939_2012Update_MiningWaterUse.pdf.
11. "Status of Draft Rules," North Carolina Mining and Energy Commission (MEC), June 11, 2014, <http://portal.ncdenr.org/web/mining-and-energy-commission/draft-rules>, last accessed August 25, 2014.
12. North Carolina General Statute 143-214.2(b), http://www.ncga.state.nc.us/EnactedLegislation/Statutes/HTML/ByArticle/Chapter_143/Article_21.html.
13. Russell Gold, "Faulty Wells, Not Fracking, Blamed for Water Pollution," *The Wall Street Journal*, March 25, 2012, <http://online.wsj.com/news/articles/SB10001424052702304537904577277814040731688>.
14. "North Carolina Oil and Gas Study."
15. See, e.g., "Shale Gas Extraction in North Carolina: Public Health Implications," Recommendations from the Research Triangle Environmental Health Collaborative, October 2012, <http://environmentalhealthcollaborative.org/images/2012SummitWorkProduct.pdf>, and Daniel Fine, New Mexico Center for Energy Policy, remarks to the Shaftesbury Society, John Locke Foundation, February 27, 2012, viewable at <http://lockerroom.johnlocke.org/2012/02/27/north-carolinas-approach-to-natural-gas-fracking>.
16. "North Carolina Oil and Gas Study."
17. For a discussion on chemicals used and their purposes, see "Chemical Use," FracFocus Chemical Disclosure Registry, <http://fracfocus.org/chemical-use>.
18. See, e.g., "What Chemicals Are Used," FracFocus.org, <http://www.fracfocus.org/chemical-use/what-chemicals-are-used>, and Rao, *Shale Gas*, pp. 38 and 40.
19. Section 8, S.L. 2014-4.
20. "Status of Draft Rules," (MEC).
21. "About Us," Chemical Disclosure Registry, FracFocus, <http://fracfocus.org/welcome>.

Chemicals commonly used in hydraulic fracturing and other consumer uses

Chemical name ^a	Common or trade name	Function(s) and chemical purpose(s) in hydraulic fracturing ^a	Derived from food or used as a food additive ^b	Use in personal, house, lawn, and pet products ^c	Examples of use in consumer products ^c
2-Butoxyethanol		<i>Surfactant</i> : Product stabilizer	Yes	211 household, 2 personal care, and 13 lawn products listed	Simple Green Hand Cleaner Gel Windex Aerosol Glass Plus Mirror & Glass Cleaner
Acetaldehyde		<i>Corrosion Inhibitor</i> : Prevents the corrosion of the pipe	Yes	6 household products and 1 lawn product listed	Aleenes School Glue Sakrete Concrete Glue DAP Kwik Seal Tub & Tile Adhesive Caulk
Acetic Acid	Vinegar	<i>Iron Control</i> : Prevents precipitation of metal oxides <i>pH Adjusting Agent</i> : Adjusts the pH of fluid to maintains the effectiveness of other components, such as crosslinkers	Yes	16 household products and 1 personal care product listed	Earth Friendly Window Kleener, Grecian Formula 16 Liquid with Conditioner Pledge Clean & Dust Spray
Ammonium Persulfate		<i>Breaker</i> : Allows a delayed breakdown of the gel	Yes	8 personal care and 3 household products listed	Clairol Maxi Blonde Clairol Kaleidicolors Glidden Brilliance Collection Exterior Latex Paint, Semi-Gloss, Accent Base, 9403G
Borate Salts		<i>Crosslinker</i> : Maintains fluid viscosity as temperature increases	No	2 household products and 1 pet care product listed	Method Laundry Detergent for Baby Method Laundry Detergent High-Efficiency Fresh Air Kordon Nov Aqua Water Conditioner and Fish Protector
Boric Acid	Boric acid	<i>Crosslinker</i> : Maintains fluid viscosity as temperature increases	No	1 personal care product listed	Efferdent Denture Cleaner
Calcium Chloride	Ice bite	<i>Breaker</i> : Product stabilizer	Yes	47 household, 16 personal care, 11 lawn, and 3 pet care products listed	Downy Fabric Softener, Ultra, Free & Sensitive, Unscented Sunlight Liquid Dish Soap, Lemon Scent Gain Liquid Fabric Softener, Apple Mango Tango
Choline Chloride		<i>Clay Stabilizer</i> : Prevents clays from swelling or shifting	Yes	None listed	
Citric Acid	Lemon juice, lime juice	<i>Iron Control</i> : Prevents precipitation of metal oxides	Yes	849 personal care, 225 household, 4 lawn, and 24 pet care products listed	Pampers Sensitive Wipes Pantene Pro-V Color Revival Shampoo Lever 2000 Family Body Wash, Pure Rain
Copolymer of Acrylamide and Sodium Acrylate		<i>Scale Inhibitor</i> : Prevents scale deposits in the pipe	Indeterminate	4 personal care, 5 household, and 3 pet care products listed	Olay Purely Pristine Body Bissell Deepclean, Spring Breeze Gillette Fusion ProSeries UV Moisturizer, Instant Hydration, SPF Plus 15
Ethanol	Grain alcohol, ethyl alcohol	<i>Surfactant</i> : Product stabilizer and/or winterizing agent	Yes	539 personal care, 548 household, 12 lawn, and 16 pet care products listed	Aveeno Baby Soothing Relief Moisture Cream, Fragrance Free Lanacane First Aid Spray Earth Friendly Products Pet Stain & Odor Remover, Pump Spray

Chemical name ^a	Common or trade name	Function(s) and chemical purpose(s) in hydraulic fracturing ^a	Derived from food or used as a food additive ^b	Use in personal, house, lawn, and pet products ^c	Examples of use in consumer products ^c
Ethylene Glycol	Antifreeze	<i>Breaker</i> : Product stabilizer and/or winterizing agent <i>Friction Reducer</i> : Product stabilizer and/or winterizing agent <i>Gelling Agent</i> : Product stabilizer and/or winterizing agent <i>Non-Emulsifier</i> : Product stabilizer and/or winterizing agent	No	689 household, 2 personal care, and 13 lawn products listed	Burt's Bees, Baby Bee, Diaper Ointment with Vitamin A and Vitamin E Kiwi Scuff Magic, Black Epson Ink Cartridges
Formic Acid	Formic acid	<i>Corrosion Inhibitor</i> : Prevents the corrosion of the pipe	Yes	6 personal care and 20 household products listed	Downy Fabric Softener, Ultra, Free & Sensitive, Unscented Softsoap Body Wash, Pure Cashmere Pantene Pro-V Fine Hair Style Mousse, Maximum Hold
Glutaraldehyde	Diswart	<i>Biocide</i> : Eliminates bacteria in the water that produces corrosive by-products	No	2 household products listed	Sunlight Liquid Dish Soap Lemon Scented Snuggle Ultra Blue Sparkle Fabric Softener
Guar Gum	Cluster bean	<i>Gelling Agent</i> : Thickens the water in order to suspend the sand	Yes	1 pet care product listed	Arm & Hammer Essentials Natural Clumping Litter
Hydrochloric Acid	Stomach acid, muriatic acid, spirit of salt	<i>Acid</i> : Helps dissolve minerals and initiate cracks in the rock	Yes	46 household, 1 personal, 1 pet care, and 16 lawn products listed	Lysol Power Toilet Bowl Cleaner Febreze Air Fresheners Herbal Essences Hello Hydration 2 In 1
Hydrotreated Light Petroleum Distillate		<i>Crosslinker</i> : Carrier fluid for borate or zirconate crosslinker <i>Friction Reducer</i> : Carrier fluid for polyacrylamide friction reducer <i>Gelling Agent</i> : Carrier fluid for guar gum in liquid gels	No	145 household, 3 personal care, 11 lawn, and 9 pet care products listed	Spray N Wash Prewash Stain Remover Lysol Neutra Air Freshmatic Automatic Spray Goo Gone Aerosol
Isopropanol (Isopropyl Alcohol)	Rubbing alcohol	<i>Corrosion Inhibitor</i> : Product stabilizer and/or winterizing agent <i>Non-Emulsifier</i> : Product stabilizer and/or winterizing agent <i>Surfactant</i> : Product stabilizer and/or winterizing agent	Yes	202 personal care, 339 household, 8 lawn, and 27 pet care products listed	Purell Instant Hand Sanitizer New-Skin Liquid Bandage L'Oreal Preference Haircolors
Lauryl Sulfate		<i>Non-Emulsifier</i> : Used to prevent the formation of emulsions in the fracture fluid <i>Surfactant</i> : Used to increase the viscosity of the fracture fluid	Yes	383 personal care, 79 household, and 21 pet care products listed	Pantene Pro-V Ice Shine Shampoo Colgate Toothpaste Nature's Miracle Ultra-Cleanse Gentle Dog Shampoo
Magnesium Oxide	Magnesia	<i>Breaker</i> : Allows a delayed breakdown of the gel	Yes	8 household and 8 lawn products listed	Ajax Cleanser with Bleach Master Collection All Purpose Plant Food 15-13-13 Sakrete Anchor Cement
Magnesium Peroxide	Magnesium dioxide	<i>Breaker</i> : Allows a delayed breakdown of the gel	No	4 personal care products listed	Garnier Nutrisse Level 3 Permanent Creme Haircolors

Chemical name ^a	Common or trade name	Function(s) and chemical purpose(s) in hydraulic fracturing ^a	Derived from food or used as a food additive ^b	Use in personal, house, lawn, and pet products ^c	Examples of use in consumer products ^c
Methanol	Wood alcohol, wood spirits	<i>Corrosion Inhibitor:</i> Product stabilizer and/or winterizing agent <i>Crosslinker:</i> Product stabilizer and/or winterizing agent <i>Friction Reducer:</i> Product stabilizer and/or winterizing agent <i>Gelling Agent:</i> Product stabilizer and/or winterizing agent <i>Surfactant:</i> Product stabilizer and/or winterizing agent	Yes	83 household, 4 personal care, and 3 lawn products listed	Murphy Wet Disposable Soft Wipes Palmolive Dishwashing Detergent Softsoap Body Wash, Pure Cashmere
Naphthalene	Mothballs	<i>Surfactant:</i> Carrier fluid for the active surfactant ingredients	No	8 household and 4 lawn products listed	Enoz Old Fashioned Moth Balls Spectracide Brush Killer Concentrate Sherwin-Williams All Surface Enamel Oil Base Primer, White
Petroleum Distillate		<i>Crosslinker:</i> Carrier fluid for borate or zirconate crosslinker <i>Friction Reducer:</i> Carrier fluid for polyacrylamide friction reducer <i>Gelling Agent:</i> Carrier fluid for guar gum in liquid gels	No	1 household product listed	Klean-Strip Brush Cleaner
Phosphonic Acid Salt		<i>Scale Inhibitor:</i> Prevents scale deposits in the pipe	Indeterminate	Indeterminate	
Polyacrylamide	PAM soil conditioner	<i>Friction Reducer:</i> "Slicks" the water to minimize friction	No	36 personal care and 2 household products listed	Oil of Olay Active Hydrating Beauty Fluid-Sensitive Skin Dove Men+Care Body & Face Wash Aveeno Positively Radiant Moisturizing Lotion
Polysaccharide Blend		<i>Gelling Agent:</i> Thickens the water in order to suspend the sand	Indeterminate	None listed	
Potassium Carbonate	Potash	<i>pH Adjusting Agent:</i> Adjusts the pH of fluid to maintains the effectiveness of other components, such as crosslinkers	Yes	8 household and 3 lawn products listed	Clorox Green Works Natural Dilutable Cleaner Simple Green Naturals Dilutable Concentrated Cleaner Miracle Gro Instant Action Houseplant Food Tablets 15-20-15
Potassium Hydroxide	Caustic potash	<i>pH Adjusting Agent:</i> Adjusts the pH of fluid to maintains the effectiveness of other components, such as crosslinkers	Yes	36 personal care and 2 household products listed	Aveeno Baby Soothing Relief Diaper Rash Cream, Fragrance Free Vaseline Petroleum Jelly Cream, Deep Moisture Mop & Glo Triple Action Floor Shine
Potassium Metaborate*		<i>Crosslinker:</i> Maintains fluid viscosity as temperature increases	Indeterminate	1 personal care product listed	Efferdent Denture Cleaner
Quaternary Ammonium Chloride		<i>Biocide:</i> Eliminates bacteria in the water that produces corrosive by-products	Indeterminate	92 personal care and 32 household products listed	Suave for Kids 2-in-1 Shampoo, Wild Watermelon Suave Herbal Care Shampoo AXE Shower Gel, Apollo
Sodium Carbonate	Soda ash, washing soda	<i>pH Adjusting Agent:</i> Adjusts the pH of fluid to maintains the effectiveness of other components, such as crosslinkers	Yes	285 household, 39 personal care, 11 lawn, and 4 pet care products listed	Sensodyne Extra Whitening Toothpaste Clairol Mens Choice Haircolor Purex Ultra Laundry Detergent

Chemical name ^a	Common or trade name	Function(s) and chemical purpose(s) in hydraulic fracturing ^a	Derived from food or used as a food additive ^b	Use in personal, house, lawn, and pet products ^c	Examples of use in consumer products ^c
Sodium Chloride	Table salt	<i>Breaker</i> : Product Stabilizer <i>Clay Stabilizer</i> : Prevents clays from swelling or shifting	Yes	583 personal care, 131 household, 14 lawn, and 23 pet care products listed	Snuggle Ultra Blue Sparkle Fabric Softener Aussie Moist Shampoo Drano Crystal Clog Remover
Sodium Erythorbate*	Sodium isoascorbate, erythorbic acid	<i>Iron Control</i> : Prevents precipitation of metal oxides	Yes	180 personal care products and 1 household product listed	Clairol Natural Instincts for Men Haircolors Revlon Colorist Expert Color and Glaze Systems Spray N Wash Prewash Stain Remover
Sodium Hydroxide	Lye	<i>pH Adjusting Agent</i> : Adjusts the pH of fluid to maintain the effectiveness of other components, such as crosslinkers	Yes	276 personal care, 290 household, 7 lawn, and 3 pet care products listed	Aveeno Baby Calming Comfort Bath Dove Ultra Moisturizing Body Wash Colgate Total Toothpaste
Sodium Polycarboxylate		<i>Scale Inhibitor</i> : Prevents scale deposits in the pipe	Indeterminate	Indeterminate	
Sodium Tetraborate	Borax	<i>Crosslinker</i> : Maintains fluid viscosity as temperature increases	No	21 personal care, 87 household, 13 lawn, and 4 pet care products listed	Burt's Bees, Baby Bee Buttermilk Lotion for Sensitive Skin Cheer Liquid Laundry Detergent Four Paws Pet Dental Liquid Tartar Remover for Dogs
Tetrakis Hydroxymethyl-Phosphonium Sulfate		<i>Biocide</i> : Eliminates bacteria in the water that produces corrosive by-products	No	None listed	
Tetramethyl ammonium chloride*		<i>Clay Stabilizer</i> : Prevents clays from swelling or shifting	No	21 personal care products and 1 pet care product listed	Avon Perfect Wear Extralasting Lipstick Infusium 23 Shampoo 1 Frizz Controller Olay Regenerist Night Recovery Moisturizing Treatment
Thioglycolic Acid*	Mercaptoacetic acid	<i>Iron Control</i> : Prevents precipitation of metal oxides	No	8 personal care products listed	Veet Bikini Hair Removal Cream for Sensitive Skin Nair Lotion Hair Remover with Aloe & Lanolin Veet Underarm Kit
Triethanolamine Zirconate		<i>Crosslinker</i> : Maintains fluid viscosity as temperature increases	Indeterminate	None listed	
Zirconium Complex*		<i>Crosslinker</i> : Maintains fluid viscosity as temperature increases	Indeterminate	49 personal care products listed	Dial Roll-On Antiperspirant Lady Speed Stick by Mennen Right Guard Xtreme Clear Antiperspirant and Deodorant

Sources:

- "What Chemicals Are Used," FracFocus.org, <http://www.fracfocus.org/chemical-use/what-chemicals-are-used>.
- Most of this information is found under "Food Additives" at NutritionData.com, which supplements data from the U.S. Department of Agriculture with information provided by restaurants and food manufacturers. NutritionData.com, <http://nutritiondata.self.com/topics/food-additives>.
- Household Product Database, U.S. Department of Health and Human Services, <http://householdproducts.nlm.nih.gov>. Chemicals marked with an asterisk (*) are listed in the Household Product Database under a synonym.