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What’s in that fracking fluid?

*Pennsylvania discloses the chemicals used
by the drilling companies*

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PENNSYLVANIA — It’s something many people in the Upper Delaware region want to know: what chemicals are being used by the natural gas industry in its drilling processes?

The Pennsylvania Department of Environmental Protection (DEP) notes that while companies may keep their fracking “formulas” proprietary, the individual ingredients are public record in Pennsylvania. The agency supplied **The River Reporter** with a list of chemicals that may be used during the fracking process. Any of them may be present in the wastewater generated and may be stored temporarily in open pits at the site.

We asked researchers at The Endocrine Disruption Exchange (TEDX) to analyze the list for its potential health effects. TEDX

is a non-profit organization that reviews and interprets scientific research focused on the effects of synthetic chemicals on human and animal health. TEDX president Dr. Theo Colborn has published, lectured and testified extensively on the effects of chemicals on the developing endocrine, immune, metabolic and nervous systems.

The tables and graphs presented here were generated by that organization. Of the 59 chemicals on the list, several were synonyms for the same chemical (e.g. Isopropanol, Isopropyl Alcohol, Propan-2-01). When this occurred, the names were combined to create a final list of 54 chemicals.

TEDX staff searched the literature for health effects associated with the 54 chemicals and broke them into 14 different health effect categories commonly used in government toxicological literature. The table below shows the number of chemicals out of the 54 that have effects on at least 10 health categories.

Chemical	# of Categories	Chemical	# of Categories
2-butoxyethanol	13	Monoethanolamine	11
Ethylhexanol	13	Dazomet	10
Formaldehyde	13	Acetic Anhydride	10
Glutaraldehyde	13	Isopropanol	10
Boric Acid	12	Propargyl Alcohol (Prop-2-yn-1-01)	10
Ethane-1,2-diol (ethylene glycol)	12	5-chloro-2-methyl-4-isothiazotin-3-one	10
Ethylene Glycol	12	Sodium Bicarbonate (NaHCO3)	10
Methanol	11	Diesel	10

Fracking chemicals associated with ten or more health effect categories.

Controlling fracking fluids

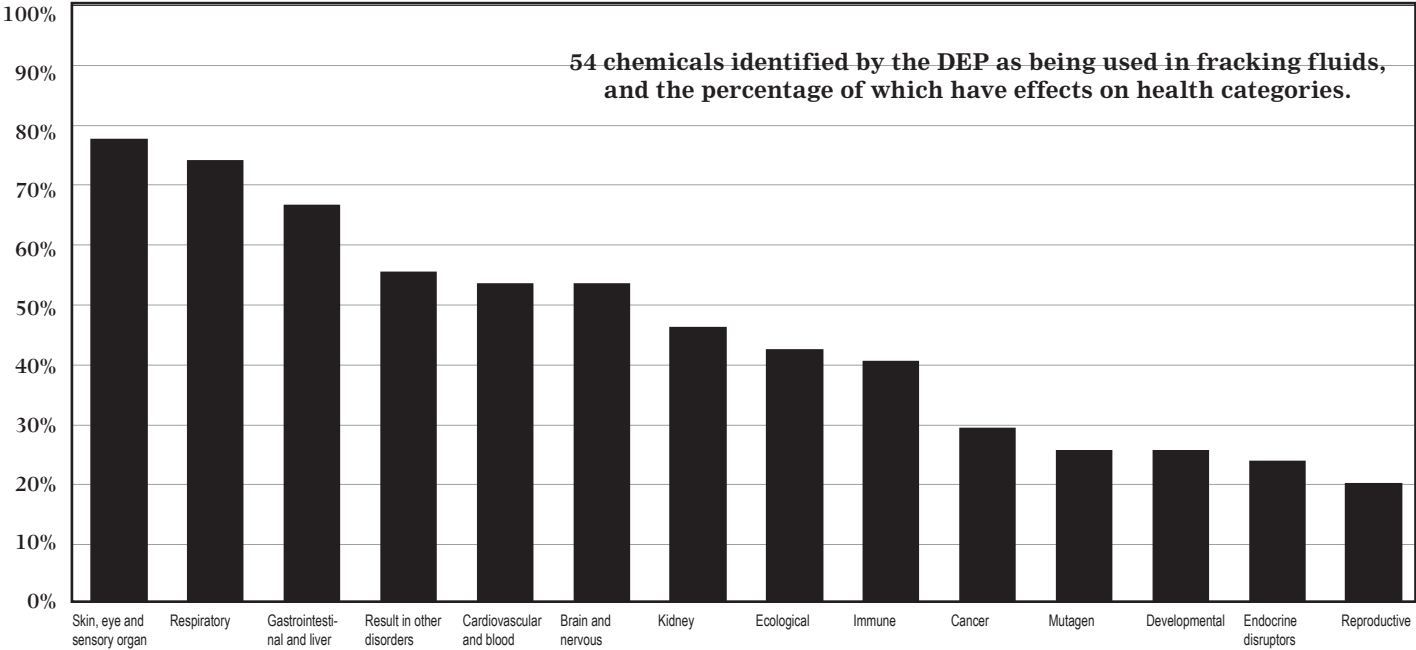
Defenders of the fracking process say that in the Marcellus Shale it is safe because the process takes place well below the water table that provides drinking water.

The water is injected deep underground through lined wells that prevent the fracking fluid from contaminating the water in the higher part of the earth beneath the drill site.

Critics, however, argue that the casings around the well bore

that are intended to prevent fracking fluids from entering the ground water supply have failed in the past, and will likely fail in the future in at least some instances.

Further, a large amount of fracking fluid comes back out of the well after drilling, and can then contaminate air and ground water if not properly handled. The chemicals pose a threat to human health until they are disposed of.



Most of the chemicals in the above chart were associated with skin, eye and sensory organ irritation and toxicity, followed by respiratory effects, gastrointestinal and liver effects.

The “Other” category includes such effects as death, teeth effects, etc. The most often cited effect in this category is the ability of the chemical to cause death.

The “Ecological” category refers to damage to a wide variety of birds, fish, amphibians, or other aquatic species.

Fracking fluid complaints and identification

According to a report from the Oil & Gas Accountability Project, citizens from many states have reported negative impacts to water quality in the wake of hydraulic fracturing.

The report says, “Common complaints include: murky or cloudy water, black or gray sediments, iron precipitates, soaps, black jelly-like grease, floating particles, diesel fuel or petroleum odors, increased methane in water, rashes from showering, gassy taste and decrease or complete loss of water flow.”

The report continues, “In most cases, the agencies conducting follow-up water quality sampling do not know what chemicals have been used in fracturing operations because companies are not required to disclose this information. Consequently, state agencies do not test for all fracturing fluid chemicals. Citizens have also experienced soil and surface water contamination from spills of hydraulic fracturing fluids.”

Chemicals that can move through air

Of the 54 chemicals identified by DEP as being used in fracking fluid, 21 are readily airborne. As noted in the table below, all of these chemicals can harm the eyes, skin, respiratory tract, gastrointestinal tract or liver.

Health Effect Category	Number of Chemicals	Percent of Chemicals
Gastrointestinal and liver	21	100%
Respiratory	21	100%
Skin, eye and sensory organ	21	100%
Other	20	95%
Cardiovascular and blood	19	90%
Brain and nervous system	19	90%
Kidney	17	81%
Ecological	15	71%
Immune	11	52%
Developmental	10	48%
Reproductive	9	43%
Mutagen	7	33%
Endocrine disruptors	7	33%
Cancer	6	29%

Chemicals that can move through water

Of the 54 chemicals identified by DEP as being used in fracking fluids, 34 are soluble, allowing them to move into surface and underground water.

Health Effect Category	Number of Chemicals	Percent of Chemicals
Skin, eye and sensory organ	34	100%
Respiratory	32	94%
Gastrointestinal and liver	31	91%
Cardiovascular and blood	26	76%
Other	26	76%
Brain and nervous system	25	74%
Kidney	21	62%
Ecological	21	62%
Immune	19	56%
Developmental	14	41%
Cancer	11	32%
Endocrine disruptors	11	32%
Reproductive	11	32%
Mutagen	10	29%

SEE next page for the PA DEP Chemical List this analysis is based on.

FROM PA DEP 12/08

Frac Water Chemicals Chemical Components (From MSDS)

This list is the basis for the River Reporter article analyzing the health effects of fracturing ingredients to be found at this link <http://www.riverreporter.com/issues/08-12-04/fracking.pdf>

2,2-Dibromo-3-Nitrilopropionamide
2-butoxyethanol
2-methyl-4-isothiazolin-3-one
5-chloro-2-methyl-4-isothiazotin-3-one

Acetic Acid
Acetic Anhydride
Aliphatic Acid
Aliphatic Alcohol Polyglycol Ether
Ammonia Persulfate
Aromatic Hydrocarbon
Aromatic Ketones
Boric Acid
Boric Oxide
Butan-1-ol

Citric Acid
Crystalline Silica: Cristobalite
Crystalline Silica: Quartz
Dazomet
Diatomaceous Earth
Diesel (use discontinued)
Ethane-1,2-diol
Ethoxylated Alcohol
Ethoxylated Alcohol
Ethoxylated Octylphenol
Ethylene Glycol
Ethylhexanol
Ferrous Sulfate Heptahydrate
Formaldehyde
Glutaraldehyde
Glycol Ethers
Guar gum
Hemicellulase Enzyme
Hydrochloric Acid
Hydrotreated light distillate
Hydrotreated Light Distilled
Isopropanol
Isopropyl Alcohol
Magnesium Nitrate
Mesh Sand (Crystalline Silica)
Methanol
Mineral Spirits
Monoethanolamine
Petroleum Distillate Blend
Petroleum Distillates

Polyethoxylated Alkanol (1)
Polyethoxylated Alkanol (2)
Polyethylene Glycol Mixture
Polysaccharide
Potassium Carbonate
Potassium Hydroxide
Prop-2-yn-1-ol
Propan-2-ol
Propargyl Alcohol
Propylene
Sodium Bicarbonate
Sodium Chloride
Sodium Hydroxide
Sucrose
Tetramethylammonium Chloride

Frac Stage #1

Hydrochloric Acid
Propargyl Alcohol
Methanol

Acetic Acid
Acetic Anhydride

Frac Stage #2

Methanol
Boric Oxide
Petroleum Distillate Blend
Polysaccharide
Potassium Carbonate
Sodium Chloride
Potassium Hydroxide
Ethylene Glycol
Boric Acid

Sodium Bicarbonate
Monoethanolamine

Frac Stage #3

Hydrotreated light distillate
Ethoxylated Alcohol
Glutaraldehyde
Dazomet
Sodium Hydroxide
Methanol
Diesel (use discontinued)
2,2-Dibromo-3-Nitrilopropionamide
Polyethylene Glycol Mixture
Mesh Sand (Crystalline Silica)