User Guide for State Summaries

The Ground Water Protection Council (GWPC) and the Interstate Oil and Gas Compact Commission (IOGCC) launched the FracFocus Chemical Disclosure Registry in 2011 to provide information to the public about the chemicals used in hydraulic fracturing fluids.

Background on FracFocus 1.0

Operators submit information on the composition of fluids used for hydraulic fracturing operations at individual oil and gas production wells on specific dates. These submissions, or "disclosures" as they are commonly called, are searchable by the public and available as PDF files. Disclosures provide information on the fracture date, location, well number and name, well operator, intended production type of the well, depth, total water volume used, trade name and purpose of additives, and ingredients in fracturing fluid, as shown below.

Operators initially disclosed information to FracFocus 1.0 voluntarily. During the period of time studied in this report (January 1, 2011 through February 28, 2013), 14 states enacted regulations requiring oil and gas production well operators to disclose hydraulic fracturing chemicals to the public. Four of these states require reporting to FracFocus (one allows reporting to the state, which will then submit the information to FracFocus), two states require reporting to both FracFocus and the state, three states offer the choice of reporting to the state or FracFocus, and five states require reporting directly to the state.

Example disclosure from FracFocus

Hydraulic Fracturing Fluid Product Component Information Disclosure

Fracture Date:	1/10/2011
State:	Texas
County:	Greer
API Number:	99-123-45678
Operator Name:	Company ABC
Well Name and Number:	Well XYZ
Longitude:	-94.611274
Latitude:	27.035098
Long/Lat Projection:	NAD27
Production Type	Oil
True Vertical Depth (TVD):	14,637
Total Water Volume (gal):	3,107,561

Hydraulic Fracturing Fluid Composition:

Trade Name	Supplier	Purpose	Ingredients	Chemical Abstract Service Number (CAS #)	Maximum Ingredient Concentration in Additive (by mass)**	Maximum Ingredient Concentration in HF Fluid (by mass)**	Comments
Water	Company A	Carrier/Base Fluid	Water	7732-18-5	100.00	84.09743	
Sand		Proppant	Crystalline Silica	14808-60-7	100.00	12.32189	
Hydrochloric Acid	Company B	Acid	Hydrogen Chloride	7647-01-0	40.00	1.09518	
Aceticplex 50	Company B	Petrochemical industry: Oil Well Acidizing, Iron Sequesterant	Acetic Acid	64-19-7	50.00	0.01187	
Plexgel 907L-EB	Company C	Viscosifier for water	Distillate, petroleum, hydrotreated light	64742-47-8	60.00	0.21713	
			Propylene Pentamer	15220-87-8	60.00	0.21713	
			C-11 to C-14 n-alkanes, mixed	Mixture	60.00	0.21713	
Plexaid 430	Company A	Gel stabilizer	Sodium Thiosulfate	7772-98-7	30.00	0.02214	
Buffer 12	Company D	pH buffer	Potassium Hydroxide	1310-58-3	23.00	0.04030	
Plexgel Breaker HT	Company B	Encapsulated Oxidizing gel breaker	Ammonium Persulfate	7727-54-0	90.00	0.00144	
Plexcide 24L	Company B	Biocide	Tetrahydro-3, 5-Dimethyl-2H-1,3, 5-Thiadiazine-2-Thione	533-74-4	24.00	0.01131	
			Sodium Hydroxide	1310-73-2	4.00	0.00189	
Greenhib 677	Company C	Oilfield Scale Inhibitor	Salt of Phosphono-methylated Diamine	NA	25.00	0.01172	

How the EPA Conducted Its Analysis of FracFocus 1.0 Data

The goal of this project was to gain a better understanding of the composition of fracturing fluid and water usage for hydraulic fracturing. GWPC provided the EPA with PDF disclosures submitted to FracFocus 1.0 from January 1, 2011, through February 28, 2013. The EPA extracted the data from the PDF disclosures into a database. The database contains information for nearly 39,000 wells located in 406 counties in 20 states. Information was provided by 428 operators on a total of 692 ingredients used for hydraulic fracturing activities. Ingredients were included in analyses if the Chemical Abstract Service (CAS) Registry Number could be verified. Ingredients were excluded from analyses if no CAS Registry Number was provided, as in the case of confidential business information, or if the CAS Registry Number could not be verified.

The complete report of the EPA's analysis of the FracFocus 1.0 data, *Analysis of Hydraulic Fracturing Fluid Data from the FracFocus Chemical Disclosure Registry 1.0*, is available at http://www2.epa.gov/hfstudy/published-scientific-papers. The report describes the methodology for extracting data from the PDF disclosures, the analyses conducted, the results and study limitations. The database and the accompanying *Analysis of Hydraulic Fracturing Fluid Data from the FracFocus Chemical Disclosure Registry 1.0: Data Management and Quality Assessment*, which describes the structure of the database, data fields, and data quality assessment, are also available at http://www2.epa.gov/hfstudy/published-scientific-papers.

State Summaries

The EPA developed state-level summaries of the data found in the FracFocus 1.0 disclosures for the 20 states where operators indicated oil and gas production wells were hydraulically fractured. The state summaries present the total volume of water reported to FracFocus 1.0 for hydraulic fracturing in each state and the names, frequency of use, and concentrations of the additive ingredients. (The information and figures presented in the state summaries may differ from information held by the states.)

Each state summary includes contextual information about the state, the frequency that operators disclosed data, the number of disclosures for oil and gas wells, the geographic location of the disclosures, the most frequently reported chemicals, and reported hydraulic fracturing water usage at a county level. Many of the disclosures were voluntarily provided by well operators. The EPA cannot guarantee accuracy or representativeness of any statistics with regard to actual events.

Three sources of location information from the disclosures were used to assign each FracFocus 1.0 disclosure to a state: (1) the coordinates in the *Latitude* and *Longitude* fields, (2) the name in the *State* field, and (3) the first two digits from the *API Number* field (which are associated with a single state). A disclosure was assigned to a state only if all three fields agreed. Disclosures with disagreement were excluded from these state summaries.

Similarly, three sources of location information were used to assign each FracFocus 1.0 disclosures to a county: (1) the coordinates in the *Latitude* and *Longitude* fields, (2) the names in the *State* and *County* fields, and (3) the first five digits from the *API Number* field (which are associated with a single state and county). A disclosure had a "confirmed" county location only if all three fields agreed. Disclosures for which the county was unconfirmed were excluded from the map and from the county water volume calculations in the state summaries. Disclosures reported in Alaska are the exception; only (1) *Latitude* and *Longitude* and (2) the names in the *State* field were used to validate well locations on the map. All disclosures from Alaska were for wells located in the North Slope borough, the boundary of which is shown on the map.

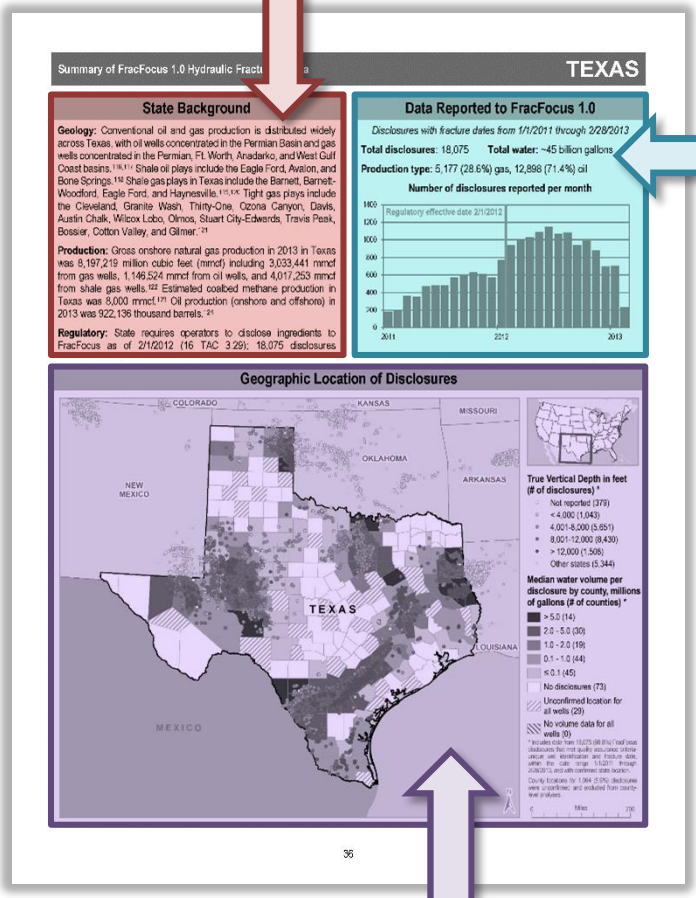
In compiling summary statistics, the median was used to represent the central tendency of water volumes, and the 5th and 95th percentiles were used to represent the range. These measures were selected to minimize the effects of extreme data values that may be included in the database due to errors in operator data entry or conversion problems from PDF to database format.

User Guide for State Summaries

State Background

This box provides basic information about each state's hydraulic fracturing activities, including the geologic formations that produce oil and gas, the oil and gas production history, and any state regulatory requirements to disclose hydraulic fracturing data to FracFocus 1.0 or to the state. Citations are noted as superscript numbers. Full references are located at the end of the state summaries and numbered to correspond with citations.

Note: Information in the state background section of each state summary did not originate with state agencies or the GWPC. All state background information is from third party sources identified in the references, and neither the states nor GWPC verified its accuracy.



Data Reported to FracFocus 1.0

This box provides summary statistics about the FracFocus 1.0 disclosures from the state from January 1, 2011, through February 28, 2013.

Total Disclosures: The number of hydraulically fractured wells disclosed by operators with a confirmed state location in this state (i.e., agreement between *State* field, state from *Latitude* and *Longitude* fields, and state from *API Number* field).

Total Water: The total volume of water used for hydraulic fracturing calculated from the *Total Water Volume* field on each disclosure.

Production type: Identifies the resource intended to be produced at the well (either oil or gas).

Disclosures reported by month: The chart of disclosures over time indicates the frequency with which operators reported hydraulic fracturing information. If a state regulation required operators to disclose information, then the chart shows the voluntarily submitted disclosures separately from the mandatory disclosures.

Geographic Location of Disclosures

This map shows the geographic locations of individual FracFocus 1.0 disclosures as points based on the coordinates in the *Latitude* and *Longitude* fields. The points are shaded red based on the *True Vertical Depth* field. Counties are shaded blue based on the median of the *Total Water Volume* field from FracFocus 1.0 disclosures in that county.

Only disclosures with county locations that were confirmed (i.e., agreement between *County* field, county from *Latitude* and *Longitude* fields, and county from *API Number* field) are shown as points. If all disclosures in a county have unconfirmed locations, the county appears with a light blue hatch (striped) pattern.

Not all disclosures included data in the *Total Water Volume* field. If all of the disclosures in a county lack water volume data, the county appears with a dark blue hatch (striped) pattern.

User Guide for State Summaries

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

This table describes the ingredients most frequently reported in the following fields from FracFocus 1.0 disclosures:

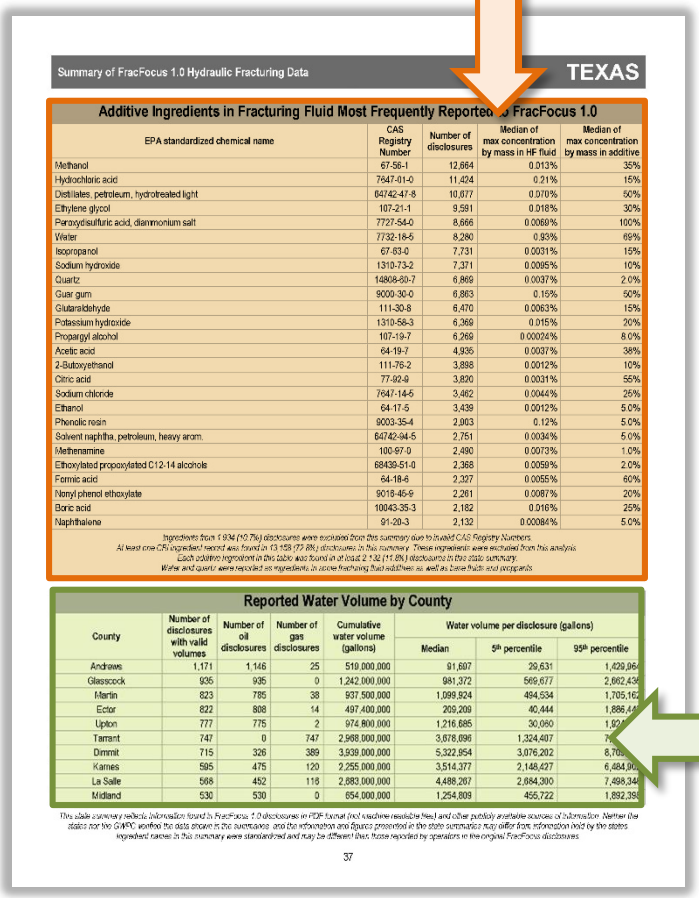
EPA standardized chemical name: The EPA standardized the names of the ingredients reported in disclosures based on the CAS Registry Number. The EPA standardized name is one of several possible names associated with the CAS Registry Number. Ingredient names in the FracFocus PDF disclosures may differ from the names in the state summary.

CAS Registry Number: The Chemical Abstracts Service (CAS) Registry Number uniquely identifies an ingredient. Ingredient records that lacked a CAS Registry Number that could be confirmed with the Chemical Abstracts Service were considered invalid and excluded from the summary.

Number of disclosures: The number of unique disclosures that reported this ingredient. The disclosure must have an ingredient entry with a CAS Registry Number so that the ingredient could be confirmed with the Chemical Abstracts Service.

Median of max concentration by mass in HF fluid: The EPA calculated the median of the values for *Maximum Ingredient Concentration in HF Fluid (% by mass)*, which is a percentage of the entire mass of the fracturing fluid.

Median of max concentration by mass in additive: The EPA calculated the median of the values for *Maximum Ingredient Concentration in Additive (% by mass)*, which is a percentage of the entire mass of the additive, rather than the entire fracturing fluid. Ingredients with a median of 100% are single-ingredient additives.



Summary of FracFocus 1.0 Hydraulic Fracturing Data — TEXAS

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Methanol	67-56-1	12,664	0.013%	35%
Hydrochloric acid	7647-01-0	11,424	0.21%	15%
Distillates, petroleum, hydrotreated light	64742-47-8	10,877	0.070%	50%
Ethylene glycol	107-21-1	9,591	0.018%	30%
Peroxydisulfuric acid, diammonium salt	7727-54-0	8,666	0.0069%	100%
Water	7732-18-5	8,280	0.93%	69%
Isopropanol	67-63-0	7,731	0.0031%	15%
Sodium hydroxide	1310-73-2	7,371	0.0095%	10%
Quartz	14808-60-7	6,869	0.0037%	2.0%
Guar gum	9000-30-0	6,863	0.15%	50%
Glutaraldehyde	111-30-8	6,470	0.0063%	15%
Potassium hydroxide	1310-58-3	6,369	0.015%	30%
Propargyl alcohol	107-19-7	6,269	0.00024%	8.0%
Acetic acid	64-19-7	4,935	0.0037%	38%
2-Butoxyethanol	111-76-2	3,898	0.0012%	10%
Citric acid	77-92-9	3,820	0.0031%	55%
Sodium chloride	7647-14-5	3,462	0.0044%	25%
Ethanol	64-17-5	3,439	0.0012%	5.0%
Phenolic resin	9003-35-4	2,903	0.12%	5.0%
Solvent naphtha, petroleum, heavy arom.	64742-94-5	2,751	0.0034%	5.0%
Methenamine	100-97-0	2,490	0.0073%	1.0%
Ethoxylated propoxylated C12-14 alcohols	68439-51-0	2,368	0.0059%	2.0%
Formic acid	64-18-6	2,327	0.0055%	60%
Nonyl phenol ethoxylate	9018-45-9	2,261	0.0087%	20%
Boric acid	10043-35-3	2,182	0.016%	25%
Naphthalene	91-20-3	2,132	0.00084%	5.0%

Ingredients from 1,934 (10.7%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CAS ingredient record was found in 13,158 (77.8%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 2,132 (11.8%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Andrews	1,171	1,146	25	519,000,000	91,607	29,631	1,429,964
Glasscock	935	935	0	1,242,000,000	981,372	569,677	2,662,436
Martin	823	785	38	937,500,000	1,099,924	494,534	1,705,162
Ector	822	808	14	497,400,000	209,209	40,444	1,886,440
Upton	777	775	2	974,800,000	1,216,685	30,060	1,924
Tarrant	747	0	747	2,968,000,000	3,678,696	1,324,407	7
Dimmit	715	326	389	3,939,000,000	5,322,954	3,076,202	8,703
Karnes	595	475	120	2,255,000,000	3,514,377	2,148,427	6,484,90
La Salle	568	452	116	2,883,000,000	4,488,267	2,684,300	7,498,34
Midland	530	530	0	654,000,000	1,254,809	455,722	1,892,39

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

37

Reported Water Volume by County

This table describes the water volumes reported in FracFocus 1.0 disclosures for the counties with the greatest numbers of disclosures. Only disclosures with confirmed county locations are included (except for Alaska).

County: The county name.

Number of disclosures with valid volumes. The number of disclosures in the county. Valid volumes are those less than 50 million gallons per disclosure.

Number of oil disclosures: The number of disclosures with oil as the reported production type.

Number of gas disclosures: The number of disclosures with gas as the reported production type.

Cumulative water volume (gallons): The sum of all valid water volumes for disclosures in this county.

Median: The median of all valid water volumes for disclosures in this county, in gallons.

5th percentile: The 5th percentile of all valid water volumes for disclosures in this county, in gallons.

95th percentile: The 95th percentile of all valid water volumes for disclosures in this county, in gallons.

User Guide for State Summaries

Interpreting the Additive Ingredients Table of the State Summaries

The Chemical Abstract Service Registry Number allows chemicals to be uniquely identified and validated.

The median of the reported maximum concentrations of methanol in hydraulic fracturing fluid is 0.013% by mass.

Additive Ingredients in Fracturing Fluid Most Frequently Reported in FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Methanol	67-56-1	12,664	0.013%	35%

"Methanol" is the EPA standardized name of the ingredient. The FracFocus PDF disclosures may report other names that correspond with the CAS Registry Number for this chemical such as "methyl alcohol."

Methanol was found in the ingredients lists of 12,664 FracFocus disclosures in this example from Texas.

The median of the reported maximum concentrations of methanol in this additive is 35% by mass.

Interpreting the Water Volumes Table of the State Summaries

Valid water volumes were reported in 1,171 disclosures in Andrews County. Valid volumes are those less than 50 million gallons.

The cumulative water volume calculated from the 1,171 disclosures in Andrews County was approximately 519 million gallons.

Reported Water Volumes by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Andrews	1,171	1,146	25	519,000,000	91,697	29,631	1,429,964

In Andrews County, 1,146 disclosures with valid water volumes reported gas as the production type. Twenty-five disclosures with valid water volumes reported oil as the production type.

In Andrews County, the median water volume of the 1,171 disclosures was 91,697 gallons. Similarly, the 5th and 95th percentile volumes of the 1,171 disclosures were 29,631 and 1,429,964 gallons, respectively.

ALABAMA

State Background

Geology: With the Texas-Louisiana Mississippi Salt Basin in the south and the Black Warrior Basin in the north, Alabama has both on-shore and off-shore conventional oil and gas production.[1,2] Unconventional gas is produced from coalbed methane deposits in the upper Pottsville Formation in the Black Warrior Basin in Alabama.[3] There is potential for shale gas production from the Black Warrior Basin and the Appalachian Thrust Belt.[4,5]

Production: Total oil production (both onshore and offshore) was 10,391 thousand barrels in 2013.[6] Total gas production in 2013 was 196,326 million cubic feet (mmcf), of which 102,842 mmcf were from gas wells, 84,690 mmcf from coalbed wells, and 8,794 mmcf from oil wells (no shale gas production).[7]

Regulatory: State requires operators to disclose ingredients to the state as of 9/10/2013 (400-1-9.04). Reporting to FracFocus is voluntary; 55 disclosures submitted.

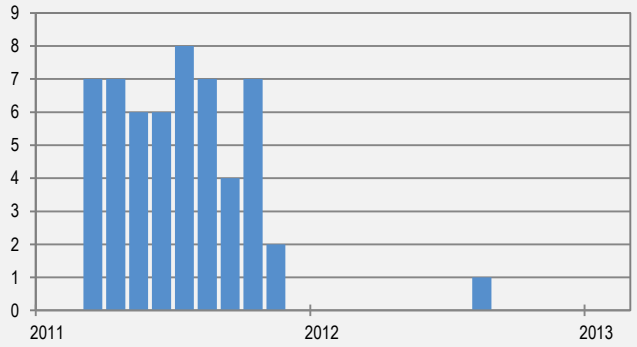
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

Total disclosures: 55 **Total water:** ~2.1 million gallons

Production type: 55 (100.0%) gas, 0 (0.0%) oil

Number of disclosures reported per month



Geographic Location of Disclosures

True Vertical Depth in feet (# of disclosures) *

- Not reported (0)
- < 4,000 (55)
- 4,001-8,000 (0)
- 8,001-12,000 (0)
- > 12,000 (0)
- Other states (0)

Median water volume per disclosure by county, millions of gallons (# of counties) *

- > 5.0 (0)
- 2.0 - 5.0 (0)
- 1.0 - 2.0 (0)
- 0.1 - 1.0 (0)
- ≤ 0.1 (2)
- No disclosures (65)
- Unconfirmed location for all wells (0)
- No volume data for all wells (0)

* Includes data from 55 (100.0%) FracFocus disclsoures that met quality assurance criteria-unique well identification and fracture date, within the date range 1/1/2011 through 2/28/2013, and with confirmed state location.

0 Miles 100

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
2-Butoxyethanol	111-76-2	55	0.011%	19%
2,2-Dibromo-3-nitrilopropionamide	10222-01-2	55	0.0018%	98%
Cinnamaldehyde (3-phenyl-2-propenal)	104-55-2	55	0.0011%	30%
Ethylene glycol	107-21-1	55	0.013%	30%
Formic acid	64-18-6	55	0.0011%	30%
Hydrochloric acid	7647-01-0	55	1.0%	26%
Isopropanol	67-63-0	55	0.044%	30%
Methanol	67-56-1	55	0.015%	10%
Naphthalene	91-20-3	55	0.0022%	1.5%
Polyethylene glycol	25322-68-3	55	0.0013%	70%

No disclosures in this summary contained CBI ingredient records.
Each additive ingredient in this table was found in at least 55 (100.0%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Jefferson	35	0	35	1,157,000	33,335	22,668	40,846
Tuscaloosa	20	0	20	907,700	45,255	35,353	57,480

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

ALASKA

State Background

Geology: Conventional production dominates in the state, and on the North Slope, production comes primarily from the Sadlerochit Group and the Kuparuk Formation.[8] Currently there is no unconventional oil and gas production in Alaska, although potential resources include or may include coalbed methane,[9,10] shale gas,[11,12,13] and shale oil.[14,15]

Production: Alaska produced 187,911 thousand barrels of oil (both onshore and offshore) in 2013.[16] Total onshore gas production in 2013 was 2,882,956 million cubic feet (mmcf) of which 2,818,418 mmcf was from oil wells and only 64,537 mmcf from gas wells.[17] Alaska had no coalbed methane production and no shale gas production..[18,19]

Regulatory: State requires operators to disclose ingredients to the state and FracFocus as of 1/7/2015 (20 AAC 25.283); 37 disclosures submitted.

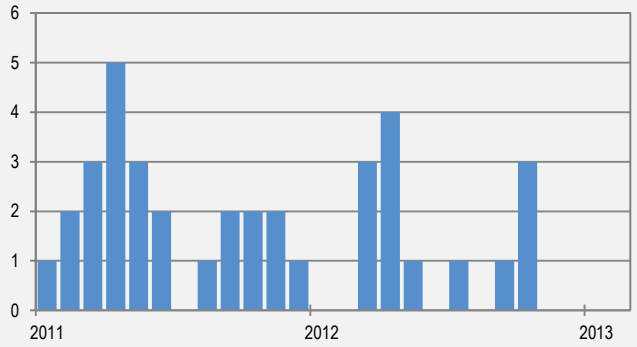
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

Total disclosures: 37 **Total water:** ~13 million gallons

Production type: 0 (0.0%) gas, 37 (100.0%) oil

Number of disclosures reported per month



Geographic Location of Disclosures

True Vertical Depth in feet (# of disclosures) *

- Not reported (0)
- < 4,000 (0)
- 4,001-8,000 (27)
- 8,001-12,000 (10)
- > 12,000 (0)
- Other states (0)

Median water volume per disclosure by county, millions of gallons (# of counties) *

- > 5.0 (0)
- 2.0 - 5.0 (0)
- 1.0 - 2.0 (0)
- 0.1 - 1.0 (0)
- ≤ 0.1 (1)
- No disclosures (26)
- Unconfirmed location for all wells (0)
- No volume data for all wells (0)

* Includes data from 37 (100.0%) FracFocus disclsoures that met quality assurance criteria-unique well identification and fracture date, within the date range 1/1/2011 through 2/28/2013, and with confirmed state location.

Alaska well locations were not subject to all locational QA criteria because their five-digit API codes are not organized by counties.

0 200 Miles

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
2-Butoxyethanol	111-76-2	20	0.026%	30%
2-Methyl-3(2H)-isothiazolone	2682-20-4	20	0.00015%	5.0%
5-Chloro-2-methyl-3(2H)-isothiazolone	26172-55-4	20	0.00029%	10%
Calcium chloride	10043-52-4	20	0.12%	50%
Cristobalite	14464-46-1	20	0.000030%	1.0%
Diatomaceous earth, calcined	91053-39-3	20	0.0018%	60%
Ethylene glycol	107-21-1	20	0.069%	30%
Magnesium chloride	7786-30-3	20	0.00015%	5.0%
Magnesium nitrate	10377-60-3	20	0.00029%	10%
Quartz	14808-60-7	20	0.00011%	1.0%
Sodium hydroxide	1310-73-2	20	0.015%	1.0%
Sodium tetraborate decahydrate	1303-96-4	14	0.19%	30%
Isopropanol	67-63-0	13	0.026%	30%
Guar gum	9000-30-0	10	0.29%	100%
Peroxydisulfuric acid, diammonium salt	7727-54-0	10	0.081%	100%
Distillates, petroleum, hydrotreated light	64742-47-8	9	0.39%	55%
Boric acid	10043-35-3	3	0.023%	100%
C10-C16 ethoxylated alcohol	68002-97-1	3	0.0054%	5.0%
Distillates, petroleum, hydrotreated middle	64742-46-7	3	0.098%	50%
Water	7732-18-5	3	0.00050%	91%
White mineral oil, petroleum	8042-47-5	2	0.63%	30%

Ingredients from 17 (45.9%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 37 (100.0%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 2 (5.4%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
(All)	37	37	0	13,150,000	88,448	36,437	435,638

A specific county could not be confirmed for disclosures in Alaska.

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

ARKANSAS

State Background

Geology: Shale gas is produced in Arkansas in the Arkoma basin, primarily from the Fayetteville Shale.[20,21,22] Between 2001 and 2007, there was also limited coalbed methane gas production in the Arkoma basin.[23,24,25] Unconventional oil reservoirs in Arkansas include the Lower Smackover Brown Dense formation. The West Gulf Coastal Plain in the southern part of the state has oil and gas resources that are produced by conventional means.[26,27]

Production: Gross natural gas withdrawals from Arkansas in 2013 totaled 1,139,654 million cubic feet (mmcf), of which 107,666 mmcf was from gas wells, 2,894 mmcf from oil wells, and 1,029,095 mmcf from shale gas wells.[28] Coalbed methane production in 2012 was an estimated 2,000 mmcf.[29] Oil production in 2013 was 6,640 thousand barrels.[30]

Regulatory: State requires operators to disclose ingredients to the state on as of 1/15/2011 (B-19). Reporting to FracFocus is voluntary; 1,450 disclosures submitted.

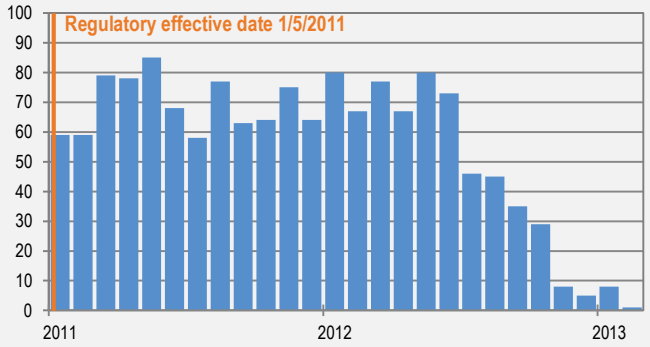
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

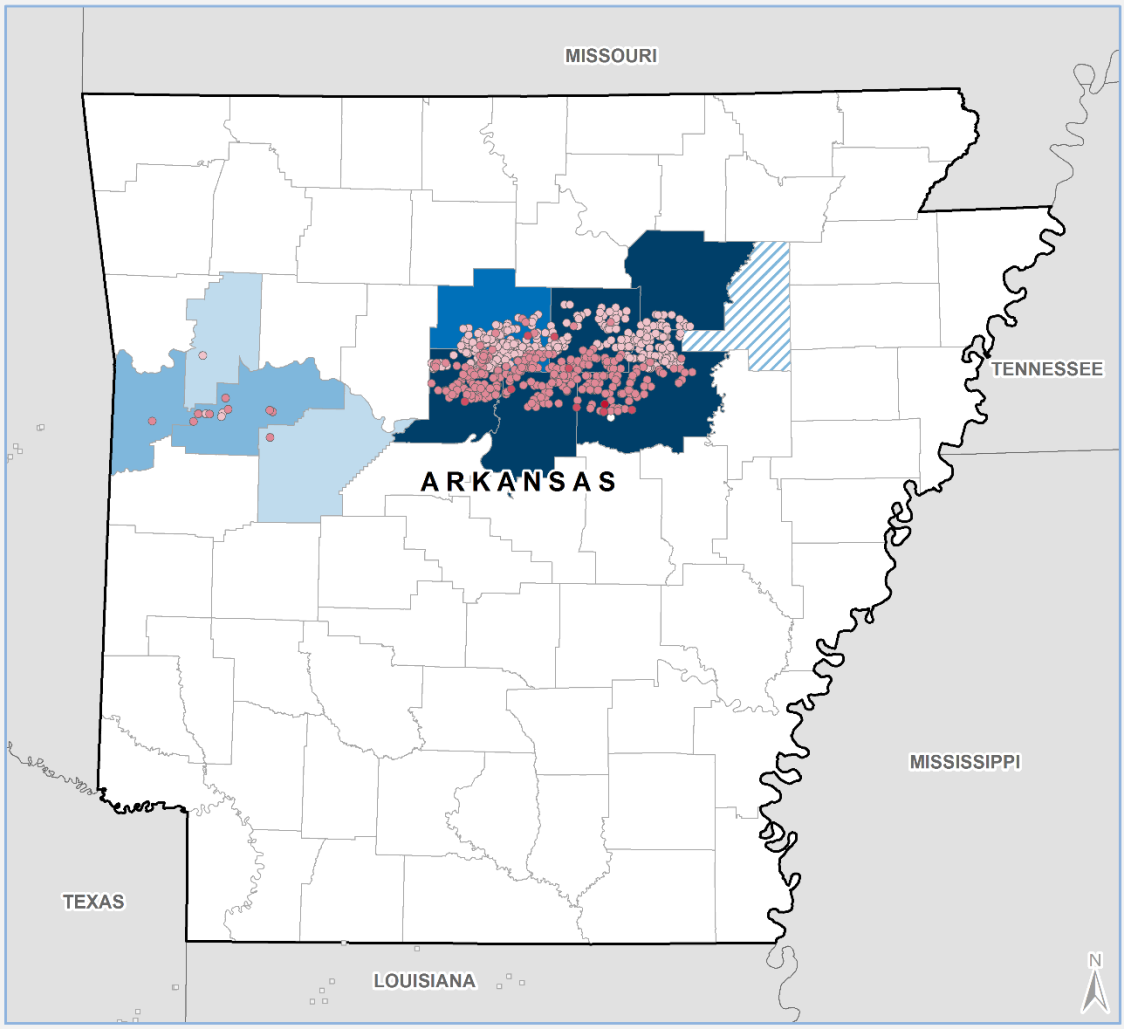
Total disclosures: 1,450 **Total water:** ~7.5 billion gallons

Production type: 1,449 (99.9%) gas, 1 (0.1%) oil

Number of disclosures reported per month



Geographic Location of Disclosures



True Vertical Depth in feet (# of disclosures) *

- Not reported (16)
- < 4,000 (800)
- 4,001-8,000 (602)
- 8,001-12,000 (9)
- > 12,000 (2)
- Other states (22)

Median water volume per disclosure by county, millions of gallons (# of counties) *

- > 5.0 (5)
- 2.0 - 5.0 (1)
- 1.0 - 2.0 (0)
- 0.1 - 1.0 (2)
- ≤ 0.1 (2)
- No disclosures (64)
- Unconfirmed location for all wells (1)
- No volume data for all wells (0)

* Includes data from 1,450 (99.2%) FracFocus disclsoures that met quality assurance criteria-unique well identification and fracture date, within the date range 1/1/2011 through 2/28/2013, and with confirmed state location.

County locations for 21 (1.4%) disclosures were unconfirmed and excluded from county-level analyses.

0 Miles 50

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Methanol	67-56-1	1,333	0.00057%	40%
Hydrochloric acid	7647-01-0	1,330	0.081%	37%
Propargyl alcohol	107-19-7	813	0.000030%	10%
Distillates, petroleum, hydrotreated light	64742-47-8	743	0.010%	30%
Glutaraldehyde	111-30-8	737	0.018%	43%
Ethanol	64-17-5	603	0.00086%	4.0%
Isopropanol	67-63-0	586	0.00030%	10%
Water	7732-18-5	522	0.16%	55%
Sodium erythorbate	6381-77-7	435	0.000030%	100%
Thiourea polymer	68527-49-1	384	0.000060%	30%
Quaternary ammonium compounds, benzyl-C12-16-alkyldimethyl, chlorides	68424-85-1	375	0.0031%	7.5%
Didecyl dimethyl ammonium chloride	7173-51-5	317	0.0045%	8.0%
Ethylene glycol	107-21-1	291	0.0061%	40%
Sodium hydroxide	1310-73-2	285	0.0012%	5.0%
Ammonium chloride	12125-02-9	277	0.0014%	10%
Benzyldimethyldodecylammonium chloride	139-07-1	268	0.0033%	30%
Benzylhexadecyldimethylammonium chloride	122-18-9	268	0.00055%	5.0%
Tetradecyl dimethyl benzyl ammonium chloride	139-08-2	268	0.0011%	10%
Alkenes, C>10 .alpha.-	64743-02-8	241	0.000020%	5.0%
Ethoxylated C14-15 alcohols	68951-67-7	241	0.000090%	30%
Citric acid	77-92-9	231	0.0011%	50%
Acetic acid	64-19-7	230	0.0063%	60%
Ozone	10028-15-6	211	0.00058%	100%
Sodium chlorite	7758-19-2	207	0.0015%	5.0%
Fatty acids, tall-oil	61790-12-3	205	0.00011%	30%
Potassium hydroxide	1310-58-3	204	0.000030%	13%
Sodium chloride	7647-14-5	194	0.012%	25%

Ingredients from 113 (7.8%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 1,135 (78.3%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 194 (13.4%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Van Buren	401	1	400	1,817,000,000	4,341,724	2,455,755	7,247,129
White	309	0	309	1,749,000,000	5,782,854	3,655,427	7,416,763
Conway	302	0	302	1,596,000,000	5,266,774	2,919,365	7,957,921
Cleburne	263	0	263	1,489,000,000	5,974,108	3,401,011	7,538,336
Faulkner	106	0	106	568,000,000	5,289,045	3,204,945	8,067,928
Independence	28	0	28	160,700,000	5,588,037	4,208,795	7,447,169
Logan	10	0	10	4,767,000	185,451	31,370	1,302,000
Sebastian	2	0	2	1,258,000	628,826	194,392	1,063,260
Franklin	1	0	1	6,384	6,384	6,384	6,384

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

CALIFORNIA

State Background

Geology: Natural gas in California is found in geologic basins in the Central Valley, the coastal basins onshore in Northern California, and offshore along the Southern California coast..[31,32] The San Joaquin and Los Angeles basins, long sources of conventional oil, are now also sources of shale oil and gas, including oil production in the Monterey/Santos shale play.[33]

Production: In 2013, California produced 198,754 thousand barrels of crude oil.[34] In 2013, 219,386 million cubic feet (mmcf) of natural gas were produced onshore. This includes 51,625 mmcf from oil wells, 73,493 mmcf from gas wells, and 94,268 mmcf from shale gas wells.[35]

Regulatory: State requires operators to disclose ingredients to the state and FracFocus as of 7/1/2015 (14 CCR 1788); 718 disclosures submitted.

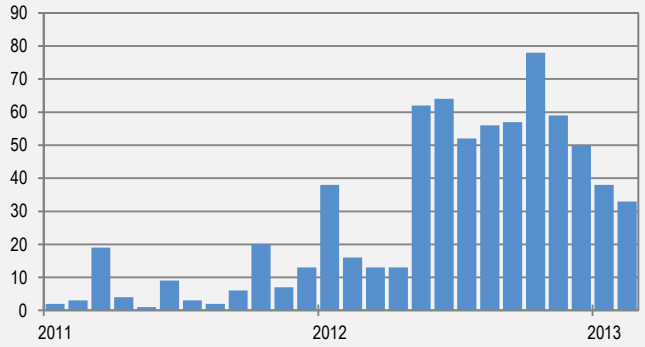
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

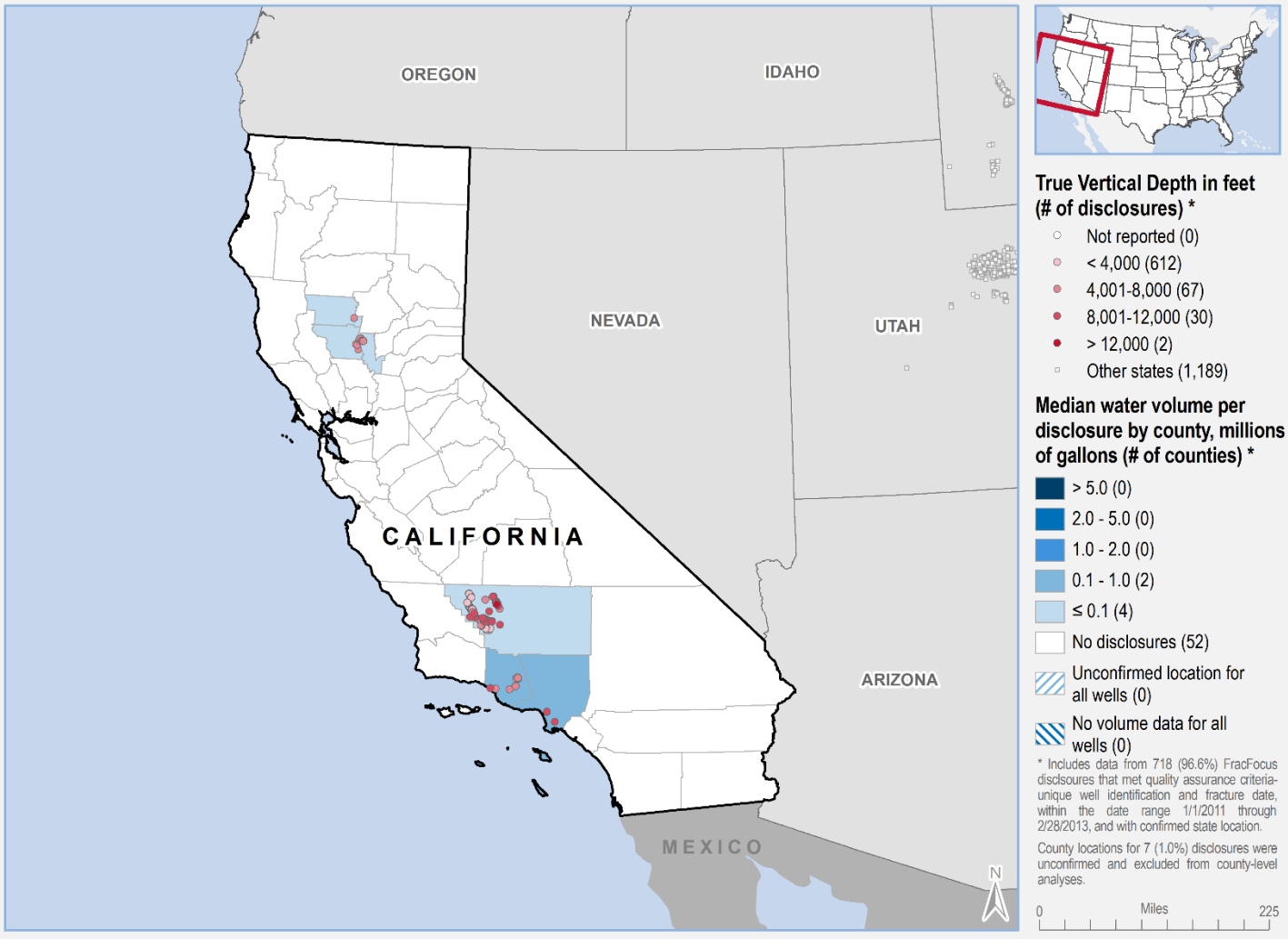
Total disclosures: 718 **Total water:** ~94 million gallons

Production type: 19 (2.6%) gas, 699 (97.4%) oil

Number of disclosures reported per month



Geographic Location of Disclosures



Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Guar gum	9000-30-0	545	0.18%	60%
Quartz	14808-60-7	519	0.013%	1.0%
Peroxydisulfuric acid, diammonium salt	7727-54-0	484	0.0063%	100%
Water	7732-18-5	484	0.058%	97%
Diatomaceous earth, calcined	91053-39-3	417	0.011%	60%
Sodium hydroxide	1310-73-2	403	0.0100%	10%
Hemicellulase Enzyme Concentrate	9025-56-3	395	0.0015%	3.0%
2-Methyl-3(2H)-isothiazolone	2682-20-4	389	0.00012%	5.0%
5-Chloro-2-methyl-3(2H)-isothiazolone	26172-55-4	389	0.00025%	10%
Cristobalite	14464-46-1	389	0.000020%	1.0%
Magnesium chloride	7786-30-3	389	0.00012%	5.0%
Magnesium nitrate	10377-60-3	389	0.00024%	10%
Boron sodium oxide	1330-43-4	361	0.029%	30%
Ethylene glycol	107-21-1	350	0.029%	30%
1,2-Ethanediaminium, N, N'-bis[2-[bis(2-hydroxyethyl)methylammonio]ethyl]-N,N'bis(2-hydroxyethyl)-N,N'-dimethyl-,tetrachloride	138879-94-4	343	0.055%	60%
Distillates, petroleum, hydrotreated light	64742-47-8	322	0.080%	30%
1-Butoxy-2-propanol	5131-66-8	315	0.013%	5.0%
Distillates, petroleum, hydrotreated light paraffinic	64742-55-8	314	0.080%	30%
Isotridecanol, ethoxylated	9043-30-5	312	0.013%	5.0%
Methanol	67-56-1	228	0.051%	60%
Phosphonic acid	13598-36-2	221	0.00021%	1.0%
Carbonic acid, dipotassium salt	584-08-7	165	0.093%	60%
Ethoxylated C14-15 alcohols	68951-67-7	94	0.011%	20%
Potassium chloride	7447-40-7	92	0.0025%	100%
Phenolic resin	9003-35-4	87	0.47%	5.0%
Naphthalene	91-20-3	57	0.00068%	0.0029%
Solvent naphtha, petroleum, heavy arom.	64742-94-5	57	0.0034%	0.014%
Tetrakis(hydroxymethyl)phosphonium sulfate	55566-30-8	55	0.0023%	0.0085%
Potassium hydroxide	1310-58-3	49	0.0052%	1.0%
Methenamine	100-97-0	47	0.0018%	0.010%

Ingredients from 133 (18.5%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 561 (78.1%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 47 (6.5%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Kern	677	677	0	89,130,000	77,238	19,135	328,606
Sutter	15	0	15	373,100	20,622	12,046	40,900
Ventura	12	12	0	3,597,000	350,642	48,682	518,445
Colusa	3	0	3	61,610	15,162	13,612	31,227
Los Angeles	3	3	0	437,400	143,892	127,112	165,778

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

COLORADO

State Background

Geology: Conventional and unconventional oil production in Colorado takes place primarily in the Niobrara Shale formation in the Denver-Julesberg Basin and the Piceance Basin.[36] Conventional and unconventional natural gas production takes place in the San Juan Basin, the Uinta Basin, the Denver Basin, and the Piceance Basin.[37,38] Shale gas plays include the Hilliard-Baxter-Mancos, Lewis, and Mancos. Tight gas plays include the Mesaverda, Mesaverde-Lance-Lewis, Sussex-Shanno, Codell-Niobrara, Muddy J, and Niobrara Chalk.[39,40]

Production: In 2013, 64,964 thousand barrels of crude oil were produced from Colorado.[41] Gross natural gas production in 2013 was 1,604,860 million cubic feet (mmcf) with 801,749 mmcf from gas wells, 106,784 mmcf from oil wells, 247,046 mmcf from shale gas wells, and 449,281 mmcf from coalbed methane wells.[42]

Regulatory: State requires operators to disclose ingredients to FracFocus as of 4/1/2012 (Rule 205A); 4.938 disclosures submitted.

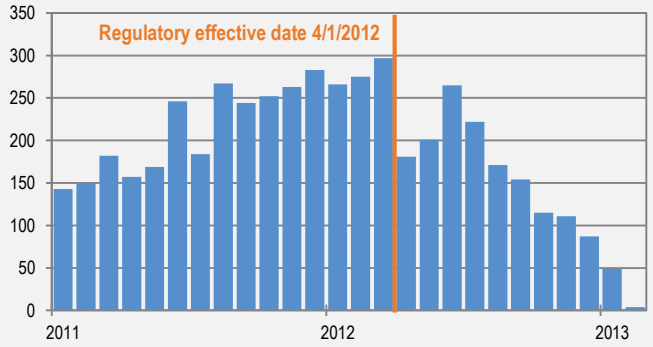
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

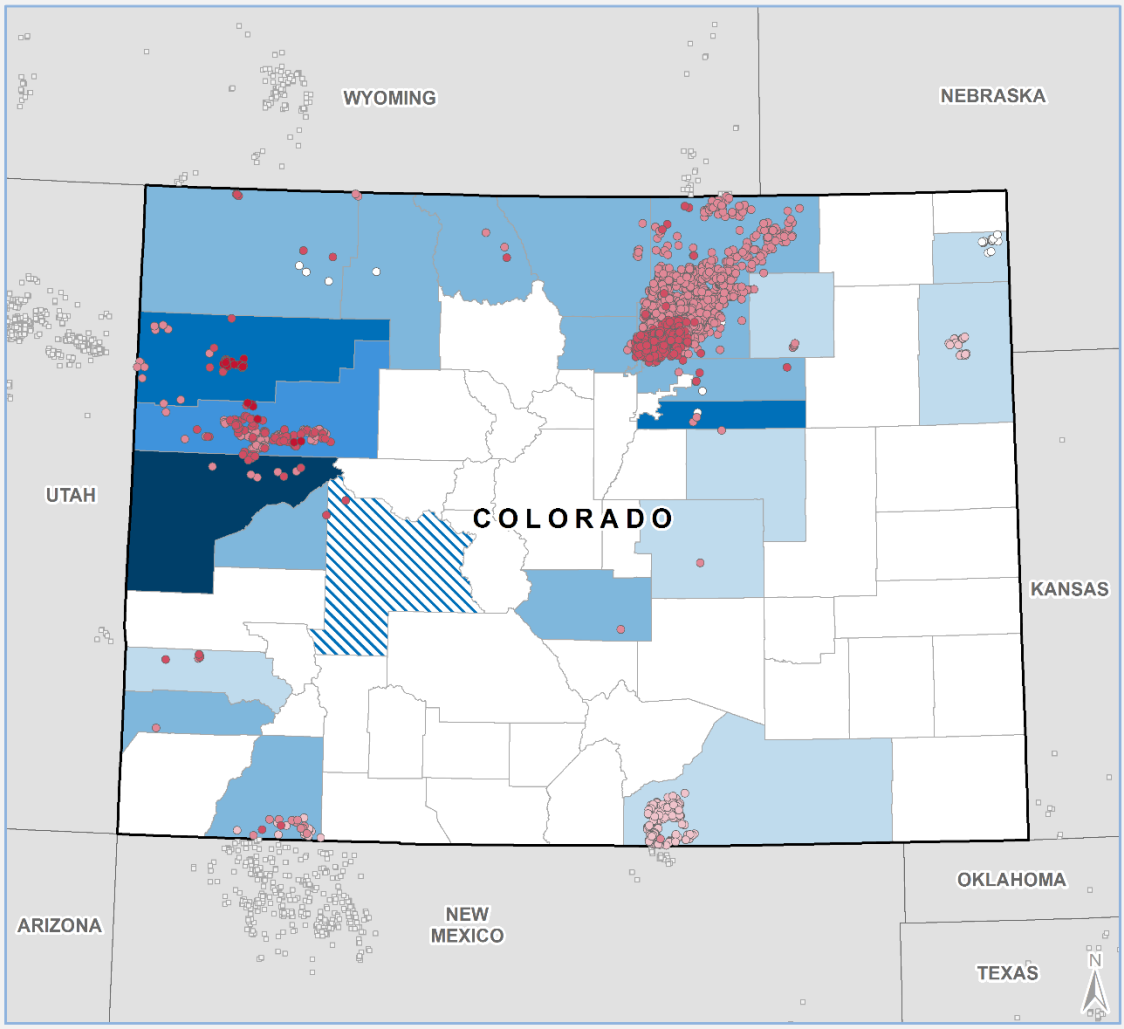
Total disclosures: 4,938 **Total water:** ~6.7 billion gallons

Production type: 4,306 (87.2%) gas, 632 (12.8%) oil

Number of disclosures reported per month



Geographic Location of Disclosures



True Vertical Depth in feet (# of disclosures) *

- Not reported (33)
- < 4,000 (192)
- 4,001-8,000 (3,246)
- 8,001-12,000 (1,293)
- > 12,000 (148)
- Other states (1,960)

Median water volume per disclosure by county, millions of gallons (# of counties) *

- > 5.0 (1)
- 2.0 - 5.0 (2)
- 1.0 - 2.0 (1)
- 0.1 - 1.0 (12)
- ≤ 0.1 (7)
- No disclosures (40)
- Unconfirmed location for all wells (0)
- No volume data for all wells (1)

* Includes data from 4,938 (97.3%) FracFocus disclsoures that met quality assurance criteria-unique well identification and fracture date, within the date range 1/1/2011 through 2/28/2013, and with confirmed state location.

County locations for 26 (0.5%) disclosures were unconfirmed and excluded from county-level analyses.

0 Miles 100

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Distillates, petroleum, hydrotreated light	64742-47-8	3,358	0.015%	30%
Methanol	67-56-1	2,883	0.0045%	30%
Isopropanol	67-63-0	2,586	0.0041%	30%
Hydrochloric acid	7647-01-0	2,408	0.040%	30%
Ethanol	64-17-5	2,258	0.047%	60%
2,2-Dibromo-3-nitrilopropionamide	10222-01-2	2,215	0.0017%	100%
Water	7732-18-5	2,046	0.049%	30%
Sodium chloride	7647-14-5	1,574	0.025%	30%
Solvent naphtha, petroleum, heavy arom.	64742-94-5	1,507	0.013%	30%
Naphthalene	91-20-3	1,363	0.0018%	5.0%
Ammonium chloride	12125-02-9	1,280	0.0043%	27%
Choline chloride	67-48-1	1,235	0.059%	75%
1-Propanol	71-23-8	1,232	0.0099%	30%
1,2,4-Trimethylbenzene	95-63-6	1,211	0.00042%	1.0%
Carbonic acid, dipotassium salt	584-08-7	1,159	0.028%	60%
Poly(oxy-1,2-ethanediyl)-nonylphenyl-hydroxy (mixture)	127087-87-0	1,150	0.0021%	5.0%
Quartz	14808-60-7	1,048	0.0017%	15%
Sodium hypochlorite	7681-52-9	1,046	0.020%	30%
Sodium hydroxide	1310-73-2	996	0.0018%	2.0%
Acetic acid	64-19-7	959	0.0026%	60%
Peroxydisulfuric acid, diammonium salt	7727-54-0	925	0.0089%	100%
1-Benzylquinolinium chloride	15619-48-4	920	0.000060%	10%
Zirconium, acetate lactate oxo ammonium complexes	68909-34-2	849	0.013%	60%
Phenolic resin	9003-35-4	842	0.013%	5.0%
Terpenes and Terpenoids, sweet orange-oil	68647-72-3	836	0.0064%	5.0%
Glycerin, natural	56-81-5	787	0.0084%	30%

Ingredients from 382 (7.7%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 2,645 (53.6%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 787 (15.9%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Weld	3,011	558	2,453	2,335,000,000	407,442	128,100	2,977,508
Garfield	1,355	7	1,348	3,624,000,000	1,707,024	695,047	8,093,060
Las Animas	146	4	142	15,770,000	95,974	20,424	260,255
Rio Blanco	143	10	133	294,700,000	2,248,291	96,911	3,232,073
Larimer	40	12	28	10,830,000	224,906	71,698	470,367
La Plata	39	1	38	6,967,000	196,744	36,136	227,087
Broomfield	24	0	24	9,046,000	397,068	295,096	421,458
Yuma	24	1	23	733,500	29,673	25,626	36,582
Boulder	23	0	23	8,259,000	410,424	129,738	422,881
Mesa	19	0	19	244,100,000	14,542,836	444,333	22,609,230

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

KANSAS

State Background

Geology: Conventional oil and gas production in Kansas takes place in the Hugoton oil fields in the southwestern part of the state, and conventional oil production also takes place in oil fields in the north-central part of the state.[43] Since 2010, producers have been extracting unconventional oil and natural gas from the Mississippian limestone located along the border with Oklahoma.[44] Coalbed methane production in Kansas is concentrated in the Cherokee Platform in the southern part of the state.[45]

Production: Gross natural gas production in 2013 was 292,467 million cubic feet (mmcf), consisting of 264,610 mmcf from gas wells and 28,244 mmcf from coalbed methane wells).[46] Shale gas production was 3,000 mmcf.[47] No shale gas was produced, and no gas was produced from oil wells. The 2013 crude oil production was 46,842 thousand barrels.[48]

Regulatory: State requires operators to disclose ingredients to FracFocus as of 12/2/2013 (KAR 82-3-1400-1402); 136 disclosures submitted.

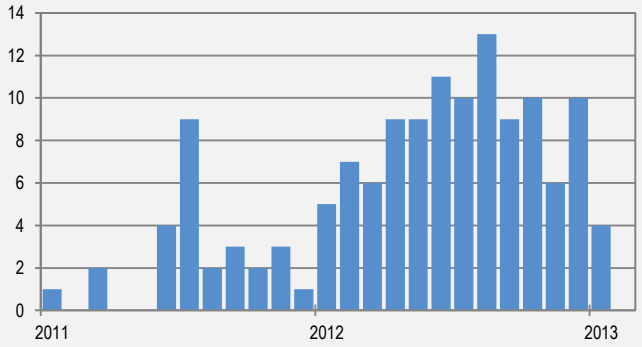
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

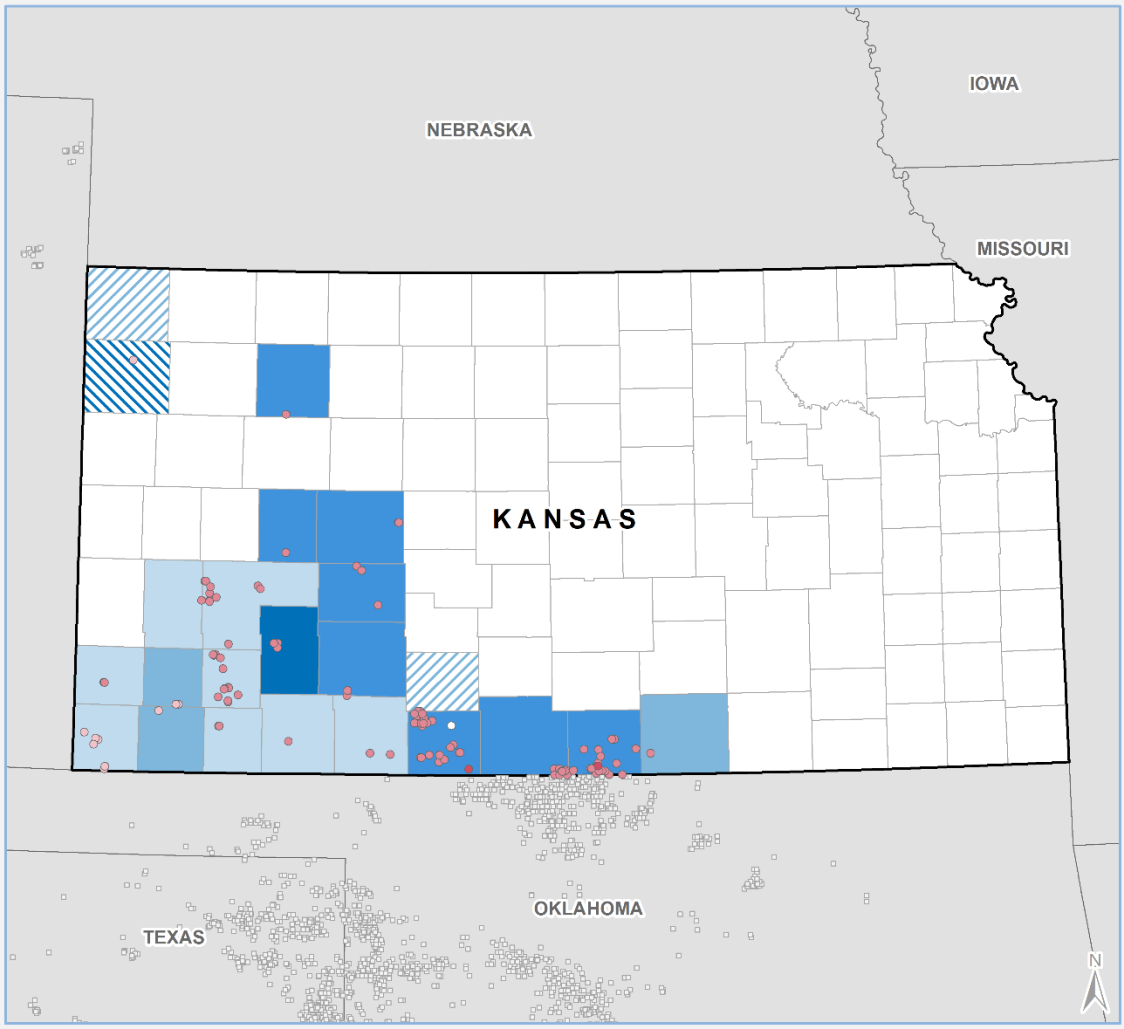
Total disclosures: 136 **Total water:** ~150 million gallons

Production type: 65 (47.8%) gas, 71 (52.2%) oil

Number of disclosures reported per month



Geographic Location of Disclosures



True Vertical Depth in feet (# of disclosures) *

- Not reported (1)
- < 4,000 (10)
- 4,001-8,000 (108)
- 8,001-12,000 (3)
- > 12,000 (0)
- Other states (1,790)

Median water volume per disclosure by county, millions of gallons (# of counties) *

- > 5.0 (0)
- 2.0 - 5.0 (1)
- 1.0 - 2.0 (8)
- 0.1 - 1.0 (3)
- ≤ 0.1 (8)
- No disclosures (82)
- Unconfirmed location for all wells (2)
- No volume data for all wells (1)

* Includes data from 136 (98.6%) FracFocus disclsoures that met quality assurance criteria-unique well identification and fracture date, within the date range 1/1/2011 through 2/28/2013, and with confirmed state location.

County locations for 14 (10.3%) disclosures were unconfirmed and excluded from county-level analyses.

0 Miles 100

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Distillates, petroleum, hydrotreated light	64742-47-8	87	0.022%	30%
Hydrochloric acid	7647-01-0	82	0.39%	15%
Ethanol	64-17-5	78	0.024%	5.0%
Methanol	67-56-1	77	0.0057%	40%
Glutaraldehyde	111-30-8	73	0.012%	30%
Propargyl alcohol	107-19-7	69	0.00014%	10%
Ethylene glycol	107-21-1	61	0.0056%	45%
Quaternary ammonium compounds, benzyl-C12-16-alkyldimethyl, chlorides	68424-85-1	52	0.0020%	10%
Citric acid	77-92-9	45	0.0046%	60%
Solvent naphtha, petroleum, heavy arom.	64742-94-5	42	0.013%	30%
Naphthalene	91-20-3	41	0.0021%	5.0%
1,2,4-Trimethylbenzene	95-63-6	39	0.00042%	1.0%
Poly(oxy-1,2-ethanediyl)-nonylphenyl-hydroxy (mixture)	127087-87-0	39	0.0021%	5.0%
Water	7732-18-5	39	1.1%	80%
Sodium erythorbate	6381-77-7	29	0.0013%	0.058%
Sodium hydroxide	1310-73-2	27	0.00054%	2.0%
Isopropanol	67-63-0	24	0.017%	30%
Quartz	14808-60-7	22	4.7%	92%
Peroxydisulfuric acid, diammonium salt	7727-54-0	21	0.013%	100%
Trisodium phosphate	7601-54-9	19	0.0017%	0.034%
Nonyl phenol ethoxylate	9016-45-9	18	0.0086%	10%
Guar gum	9000-30-0	16	0.0033%	60%
Naphtha, petroleum, hydrotreated heavy	64742-48-9	16	0.0030%	60%
Acrylamide	79-06-1	15	0.000010%	0.000010%
Hydroxylamine hydrochloride	5470-11-1	14	0.00028%	60%
Poly(oxy-1,2-ethanediyl), alpha-hexyl-omega-hydroxy	31726-34-8	13	0.0062%	0.13%
Ethylenediaminetetraacetic acid tetrasodium salt hydrate	64-02-8	12	0.0026%	0.052%

Ingredients from 39 (28.7%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 80 (58.8%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 12 (8.8%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Comanche	29	22	7	53,070,000	1,796,122	1,064,162	2,616,347
Harper	23	19	4	36,660,000	1,839,936	47,855	2,551,977
Barber	14	9	5	19,860,000	1,436,880	212,300	2,260,322
Haskell	14	1	13	205,400	12,306	8,620	24,215
Finney	11	3	8	4,836,000	13,188	10,059	2,333,068
Morton	6	0	6	78,100	11,424	7,709	22,457
Clark	3	1	2	1,557,000	45,864	44,730	1,324,768
Gray	3	3	0	6,519,000	2,227,926	1,882,288	2,424,909
Hodgeman	3	3	0	5,476,000	1,839,978	1,790,202	1,850,068

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

LOUISIANA

State Background

Geology: Underlying Louisiana are the West Gulf Coast Basin and the Texas-Louisiana-Mississippi Salt Basin. Louisiana has long produced oil from conventional sources, both on- and off-shore.[49] Important unconventional resources include the Austin Chalk tight gas play in the central and eastern part of the state, and the stacked Travis Peak and Cotton Valley tight gas plays and Haynesville-Bossier shale play in the northwestern part of the state [50] and the Tuscaloosa Marine Shale in the east-central part of the state.[51]

Production: Gross onshore natural gas production in Louisiana in 2013 was 2,335,825 million cubic feet (mmcf) and included 757,241 mmcf gas from gas wells, 44,213 mmcf from oil wells, and 1,534,372 mmcf from shale gas wells.[52] Oil production was 71,808 thousand barrels in 2013.[53]

Regulatory: State requires operators to disclose ingredients to the state or FracFocus as of 10/20/2011 (LAC 43:XIX.118); 1,038 disclosures submitted.

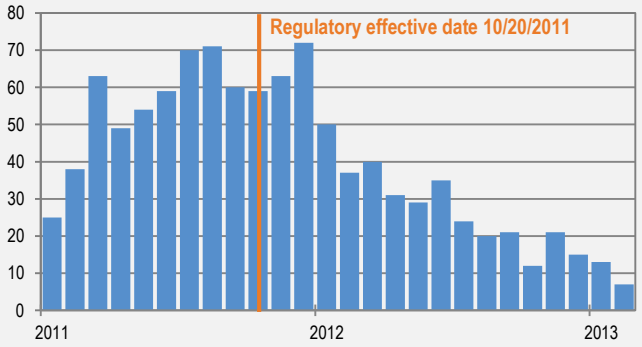
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

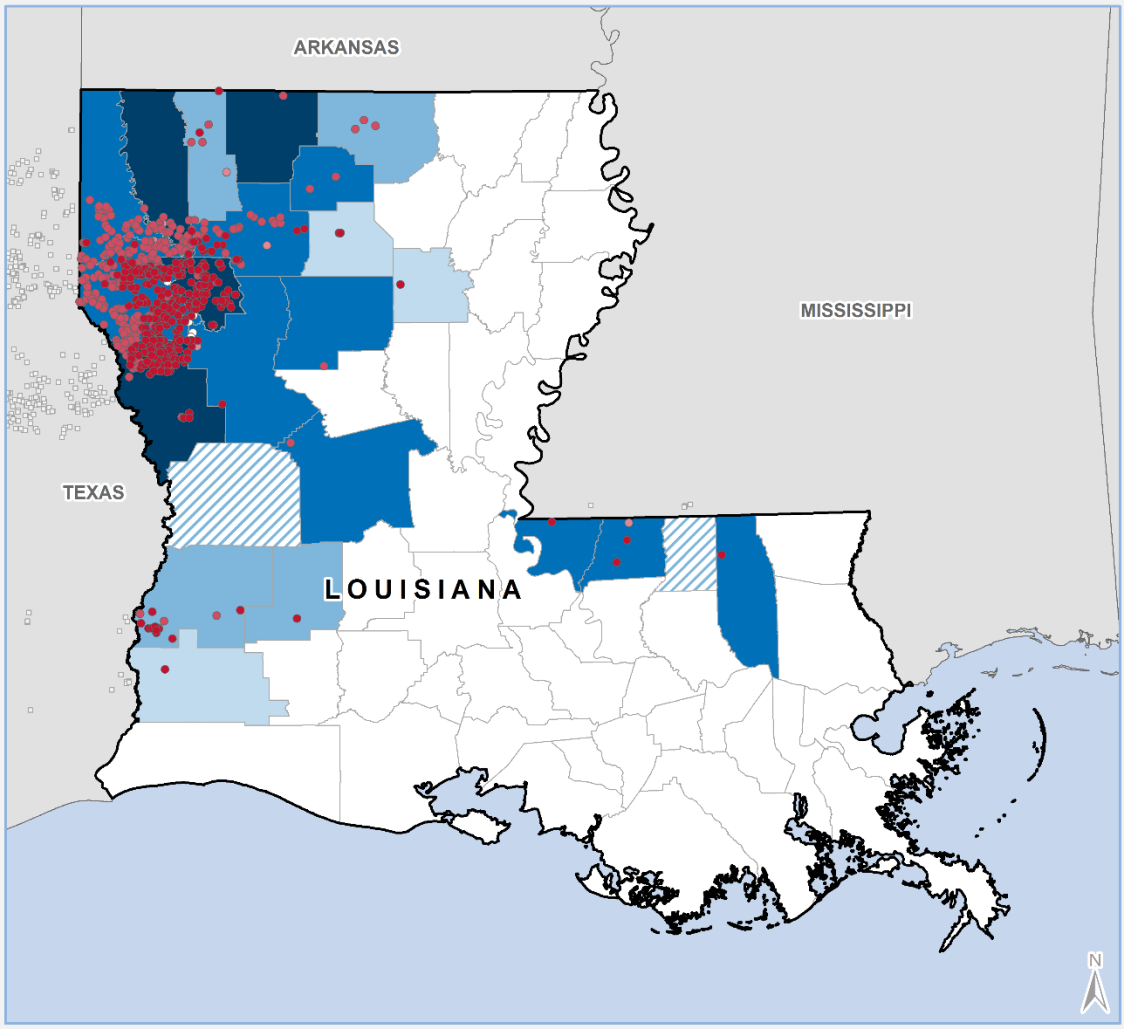
Total disclosures: 1,038 **Total water:** ~5.4 billion gallons

Production type: 1,002 (96.5%) gas, 36 (3.5%) oil

Number of disclosures reported per month



Geographic Location of Disclosures



True Vertical Depth in feet (# of disclosures) *

- Not reported (7)
- < 4,000 (0)
- 4,001-8,000 (9)
- 8,001-12,000 (447)
- > 12,000 (509)
- Other states (338)

Median water volume per disclosure by county, millions of gallons (# of counties) *

- > 5.0 (4)
- 2.0 - 5.0 (10)
- 1.0 - 2.0 (0)
- 0.1 - 1.0 (4)
- ≤ 0.1 (3)
- No disclosures (41)
- Unconfirmed location for all wells (2)
- No volume data for all wells (0)

* Includes data from 1,038 (98.6%) FracFocus disclsoures that met quality assurance criteria-unique well identification and fracture date, within the date range 1/1/2011 through 2/28/2013, and with confirmed state location.

County locations for 66 (6.4%) disclosures were unconfirmed and excluded from county-level analyses.

0 Miles 75

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Distillates, petroleum, hydrotreated light	64742-47-8	844	0.032%	30%
Methanol	67-56-1	596	0.00097%	30%
Hydrochloric acid	7647-01-0	569	0.014%	15%
Sodium hydroxide	1310-73-2	535	0.0085%	25%
Isopropanol	67-63-0	515	0.00054%	10%
Guar gum	9000-30-0	494	0.16%	60%
Ethanol	64-17-5	420	0.00087%	5.0%
Sodium chloride	7647-14-5	408	0.0061%	30%
Water	7732-18-5	384	0.066%	85%
Quartz	14808-60-7	377	0.0037%	2.0%
Glutaraldehyde	111-30-8	364	0.0051%	30%
Sodium chlorite	7758-19-2	352	0.0017%	10%
Ethylene glycol	107-21-1	341	0.0058%	30%
Potassium hydroxide	1310-58-3	340	0.0020%	12%
Propargyl alcohol	107-19-7	299	0.00010%	5.0%
Methenamine	100-97-0	298	0.048%	2.0%
Formic acid	64-18-6	293	0.00079%	85%
Naphthalene	91-20-3	293	0.0016%	1.0%
Acetic acid	64-19-7	284	0.00016%	50%
Peroxydisulfuric acid, diammonium salt	7727-54-0	273	0.00071%	99%
Solvent naphtha, petroleum, heavy arom.	64742-94-5	260	0.011%	5.0%
Naphtha, petroleum, hydrotreated heavy	64742-48-9	228	0.095%	60%
Benzyl chloride	100-44-7	220	0.000015%	1.0%
Quaternary ammonium compounds, benzyl-C12-16-alkyldimethyl, chlorides	68424-85-1	211	0.0017%	10%
2-Butoxyethanol	111-76-2	202	0.0075%	10%
Tri-n-butyl tetradecyl phosphonium chloride	81741-28-8	201	0.0021%	10%
Sodium bromate	7789-38-0	192	0.0092%	100%

Ingredients from 32 (3.1%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 618 (59.5%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 192 (18.5%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
De Soto	457	11	446	2,234,000,000	4,796,568	2,851,654	7,677,568
Red River	153	0	153	1,139,000,000	7,179,763	4,293,341	11,653,648
Sabine	129	4	125	790,500,000	6,424,656	3,557,957	9,120,145
Caddo	80	1	79	311,100,000	4,010,916	167,521	6,956,650
Bienville	56	2	54	217,700,000	4,514,531	86,517	6,986,721
Bossier	42	0	42	220,200,000	5,269,992	92,427	8,328,128
Beauregard	18	3	15	4,763,000	225,936	62,555	532,135
Natchitoches	6	0	6	25,340,000	4,163,259	1,517,208	6,944,319
Webster	6	5	1	2,318,000	273,395	54,306	840,096

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

MICHIGAN

State Background

Geology: Michigan's Trenton/Black River Formation, Traverse, Dundee and Richfield Formations, and Niagara Reef Trend are historically important sources of conventional oil, and the Antrim Shale Niagara Reef Trend have also been important sources of conventional gas.[54] Unconventional production today is focused on the Antrim Shale formation in the Michigan basin in the northern part of the state.[55] The Collingwood shale is also being explored in the northern part of the state.[56]

Production: Gross gas production in Michigan in 2013 was 123,622 million cubic feet (mmcf), which included 17,502 mmcf from gas wells, 4,912 mmcf from oil wells, and 101,208 mmcf from shale gas wells.[57] Oil production in Michigan was 7,701 thousand barrels in 2013.[58]

Regulatory: State requires operators to disclose ingredients to the state as of 6/22/2011 (Supervisor of Wells Instruction 1-2011). Reporting to FracFocus is voluntary; 15 disclosures submitted.

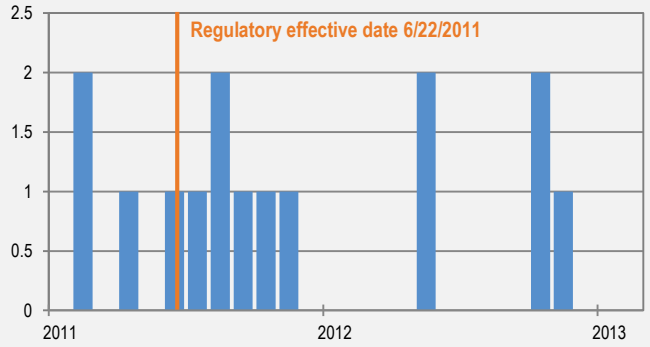
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

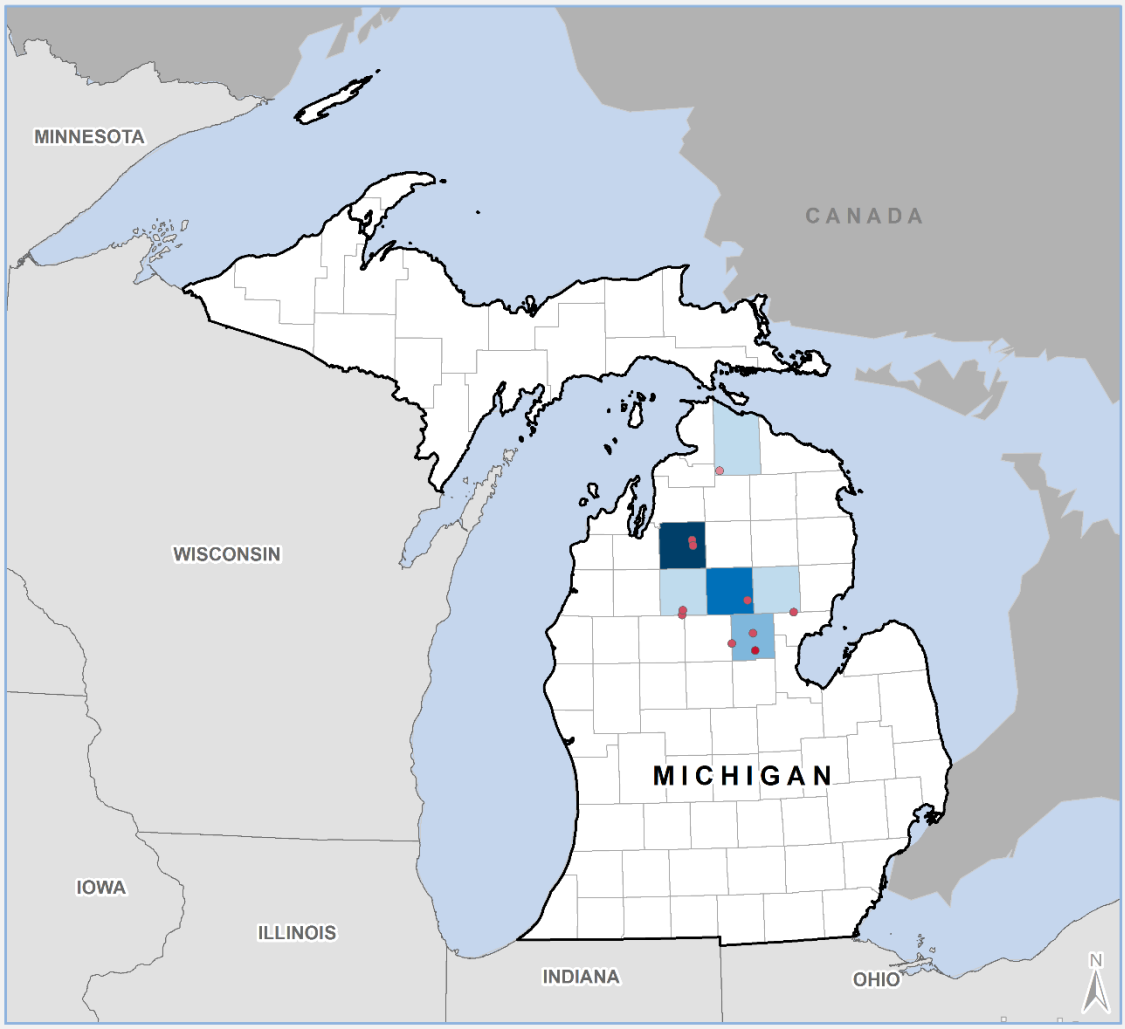
Total disclosures: 15 **Total water:** ~55 million gallons

Production type: 14 (93.3%) gas, 1 (6.7%) oil

Number of disclosures reported per month



Geographic Location of Disclosures



True Vertical Depth in feet (# of disclosures) *

- Not reported (0)
- < 4,000 (0)
- 4,001-8,000 (1)
- 8,001-12,000 (12)
- > 12,000 (2)
- Other states (3)

Median water volume per disclosure by county, millions of gallons (# of counties) *

- > 5.0 (1)
- 2.0 - 5.0 (1)
- 1.0 - 2.0 (0)
- 0.1 - 1.0 (1)
- ≤ 0.1 (3)
- No disclosures (77)
- Unconfirmed location for all wells (0)
- No volume data for all wells (0)

* Includes data from 15 (100.0%) FracFocus disclsoures that met quality assurance criteria-unique well identification and fracture date, within the date range 1/1/2011 through 2/28/2013, and with confirmed state location.

0 Miles 125

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Distillates, petroleum, hydrotreated light	64742-47-8	14	0.0052%	50%
Methanol	67-56-1	13	0.011%	10%
Naphthalene	91-20-3	12	0.0036%	1.5%
2-Butoxyethanol	111-76-2	11	0.011%	7.0%
Isopropanol	67-63-0	11	0.037%	30%
1,2-Propylene glycol	57-55-6	10	0.0%	15%
2,2-Dibromo-3-nitrilopropionamide	10222-01-2	10	0.0046%	20%
Ethylene glycol	107-21-1	10	0.079%	40%
Poly(oxy-1,2-ethanediyl), .alpha.,.alpha.'-[[(9Z)-9-octadecenylimino]di-2,1-ethanediyl]bis[.omega.-hydroxy-	26635-93-8	9	0.0%	5.0%
Peroxydisulfuric acid, diammonium salt	7727-54-0	8	0.020%	100%
Carbon dioxide	124-38-9	7	0.0%	100%
Diethylene glycol monobutyl ether	112-34-5	7	0.0%	100%
Glycerin, natural	56-81-5	7	0.0%	49%
Iron(II) sulfate heptahydrate	7782-63-0	7	0.0%	17%
Nitrogen, liquid	7727-37-9	7	0.0%	100%
Polyethylene glycol	25322-68-3	7	0.014%	60%
Potassium chloride	7447-40-7	7	5.3%	6.2%
Sodium bromate	7789-38-0	7	0.010%	100%
Solvent naphtha, petroleum, heavy aliph.	64742-96-7	7	0.55%	70%
Propargyl alcohol	107-19-7	5	0.00018%	10%
Hydrochloric acid	7647-01-0	4	0.76%	30%
Choline chloride	67-48-1	3	0.077%	80%
Ethanol	64-17-5	3	0.047%	60%
Tri-n-butyl tetradecyl phosphonium chloride	81741-28-8	3	0.0022%	10%
Water	7732-18-5	3	0.85%	50%

Ingredients from 1 (6.7%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 11 (73.3%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 3 (20.0%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Gladwin	4	0	4	2,157,000	360,827	14,730	1,313,607
Kalkaska	4	0	4	48,000,000	10,511,866	6,250,906	19,829,679
Missaukee	4	0	4	87,660	21,971	18,272	25,480
Cheboygan	1	1	0	33,310	33,306	33,306	33,306
Ogemaw	1	0	1	20,700	20,701	20,701	20,701
Roscommon	1	0	1	4,805,000	4,804,620	4,804,620	4,804,620

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

MISSISSIPPI

State Background

Geology: Most conventional oil and gas production in Mississippi occurs in the southern part of the state in the Mississippi Interior Salt Basin.[59,60] The Floyd-Neal/Consuaga shale gas play as well as methane-bearing coalbeds in the Black Warrior Basin extend into Mississippi, but there is no current production.[61,62] The Austin Chalk tight gas play in the Texas-Louisiana-Mississippi Salt Basin extends into the southwestern part of Mississippi as does the Tuscaloosa Marine Shale. [63,64]

Production: Gross natural gas withdrawals from Mississippi in 2013 were 413,329 million cubic feet (mmcf), consisting of 358,096 mmcf from gas wells, 50,629 mmcf from oil wells, and 4,605 mmcf from coalbed methane wells..[65] Shale gas production was 5,000 mmcf. [66]Oil production (both onshore and offshore) was 24,056 thousand barrels in 2013.[67]

Regulatory: State requires operators to disclose ingredients to the state or FracFocus as of 3/4/2013 (Rule 26); 4 disclosures submitted.

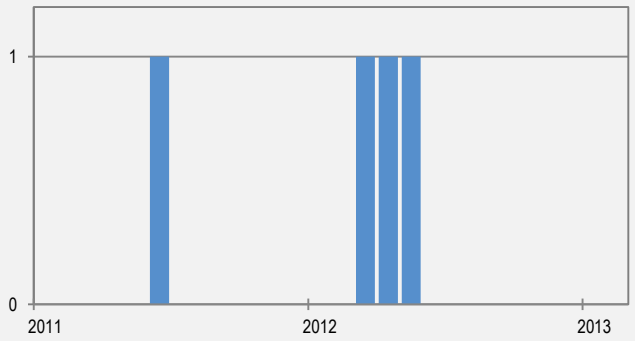
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

Total disclosures: 4 **Total water:** ~35 million gallons

Production type: 0 (0.0%) gas, 4 (100.0%) oil

Number of disclosures reported per month



Geographic Location of Disclosures

True Vertical Depth in feet (# of disclosures) *

- Not reported (0)
- < 4,000 (0)
- 4,001-8,000 (0)
- 8,001-12,000 (3)
- > 12,000 (1)
- Other states (902)

Median water volume per disclosure by county, millions of gallons (# of counties) *

- > 5.0 (2)
- 2.0 - 5.0 (0)
- 1.0 - 2.0 (0)
- 0.1 - 1.0 (0)
- ≤ 0.1 (0)
- No disclosures (80)
- Unconfirmed location for all wells (0)
- No volume data for all wells (0)

* Includes data from 4 (100.0%) FracFocus disclsoures that met quality assurance criteria- unique well identification and fracture date, within the date range 1/1/2011 through 2/28/2013, and with confirmed state location.

0 Miles 75

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Distillates, petroleum, hydrotreated light	64742-47-8	4	0.016%	33%
Ethanol	64-17-5	4	0.015%	60%
Potassium hydroxide	1310-58-3	4	0.0081%	23%
Sodium chlorite	7758-19-2	4	0.0083%	20%
Sodium persulfate	7775-27-1	4	0.00051%	100%
Ethylene glycol	107-21-1	3	0.031%	25%
Methanol	67-56-1	3	0.027%	10%
Ammonium acetate	631-61-8	2	0.0025%	6.0%
Didecyl dimethyl ammonium chloride	7173-51-5	2	0.0013%	10%
Glutaraldehyde	111-30-8	2	0.0039%	30%
Guar gum	9000-30-0	2	0.21%	80%
Potassium metaborate	13709-94-9	2	0.012%	60%
Quartz	14808-60-7	2	0.0018%	5.0%
Quaternary ammonium compounds, benzyl-C12-16-alkyldimethyl, chlorides	68424-85-1	2	0.00065%	5.0%
Sodium chloride	7647-14-5	2	0.012%	30%
Sodium hydroxide	1310-73-2	2	0.0066%	30%
Solvent naphtha, petroleum, heavy aliph.	64742-96-7	2	0.39%	83%
Sulfamic acid	5329-14-6	2	0.0030%	4.0%
Terpenes and Terpenoids, sweet orange-oil	68647-72-3	2	0.0031%	5.0%
Water	7732-18-5	2	0.082%	73%
1-Benzylquinolinium chloride	15619-48-4	1	0.00018%	10%
1,2,4-Trimethylbenzene	95-63-6	1	0.0%	1.0%
Acetic acid	64-19-7	1	0.00015%	60%
Acetic anhydride	108-24-7	1	0.00025%	100%
Hydrochloric acid	7647-01-0	1	0.0081%	30%
Isopropanol	67-63-0	1	0.00055%	30%
Naphtha, petroleum, hydrotreated heavy	64742-48-9	1	0.22%	60%
Naphthalene	91-20-3	1	0.000010%	5.0%
Poly(oxy-1,2-ethanediyl)-nonylphenyl-hydroxy (mixture)	127087-87-0	1	0.000010%	5.0%
Solvent naphtha, petroleum, heavy arom.	64742-94-5	1	0.000050%	30%
Tri-n-butyl tetradecyl phosphonium chloride	81741-28-8	1	0.0026%	10%

At least one CBI ingredient record was found in 4 (100.0%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 1 (25.0%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Amite	3	3	0	28,710,000	11,916,618	4,746,676	12,747,197
Wilkinson	1	1	0	6,431,000	6,430,629	6,430,629	6,430,629

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

MONTANA

State Background

Geology: The Williston Basin in eastern Montana has been a historical source of conventional oil, and oil production has begun in the Upper Devonian–Lower Mississippian Bakken formation.[68,69] Unconventional oil is also produced in the Alberta Basin in the northwestern part of the state.[70] Conventional and unconventional natural gas production occurs in the Williston, Powder River, and Big Horn basins.[71,72,73] Tight gas plays in Montana include the Bowdoin-Greenhorn Judith River-Eagle in the Williston Basin.[74] Limited coalbed methane production takes place in the Powder River Basin.[75,76,77]

Production: Gross natural gas production in Montana in 2013 was 63,242 million cubic feet (mmcf), including 19,831 mmcf from gas wells, 23,152 mmcf from oil wells, 18,636 mmcf from shale gas wells, and 1,623 mmcf from coalbed wells.[78] Oil production was 29,288 thousand barrels in 2013.[79]

Regulatory: State requires operators disclose ingredients to the state or FracFocus as of 8/26/2011 (36.22.1015); 213 disclosures submitted.

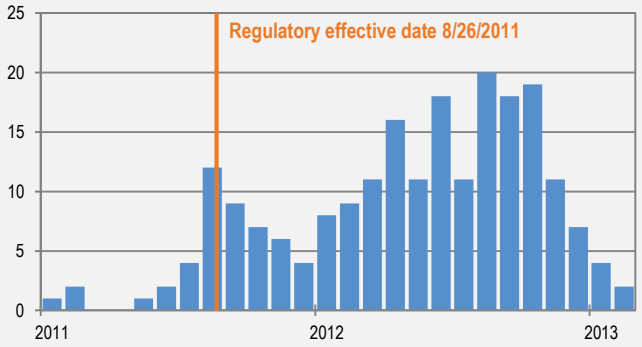
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

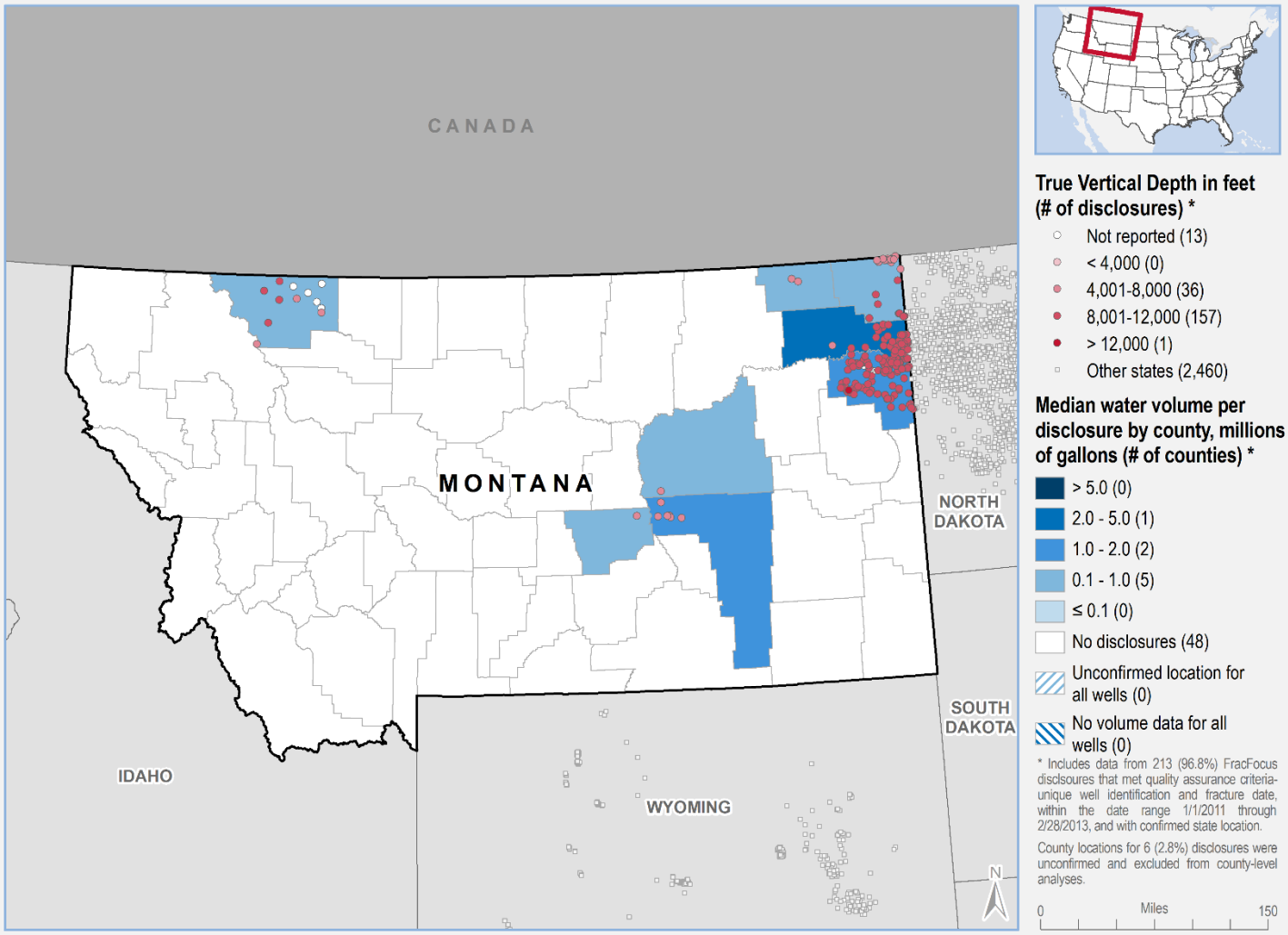
Total disclosures: 213 **Total water:** ~340 million gallons

Production type: 1 (0.5%) gas, 212 (99.5%) oil

Number of disclosures reported per month



Geographic Location of Disclosures



Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Solvent naphtha, petroleum, heavy arom.	64742-94-5	135	0.0042%	5.0%
Quartz	14808-60-7	124	0.010%	15%
Isopropanol	67-63-0	123	0.037%	60%
Methanol	67-56-1	121	0.030%	15%
Peroxydisulfuric acid, diammonium salt	7727-54-0	119	0.0072%	95%
Distillates, petroleum, hydrotreated light	64742-47-8	115	0.013%	30%
Potassium hydroxide	1310-58-3	115	0.0088%	5.0%
Sodium hydroxide	1310-73-2	105	0.013%	5.0%
Ethylene glycol	107-21-1	95	0.043%	30%
Naphthalene	91-20-3	95	0.00082%	1.0%
Tetramethylammonium chloride	75-57-0	85	0.055%	60%
2-Ethylhexanol	104-76-7	83	0.0042%	5.0%
Guar gum	9000-30-0	83	0.21%	50%
2,2-Dibromo-3-nitrilopropionamide	10222-01-2	70	0.0021%	20%
Polyethylene glycol	25322-68-3	69	0.0047%	50%
Water	7732-18-5	65	0.016%	50%
Diethylenetriamine	111-40-0	55	0.0042%	5.0%
Benzene, 1,1'-oxybis-, tetrapropylene derivs., sulfonated	119345-03-8	50	0.0083%	10%
Benzenesulfonic acid, dodecyl-, compd. with N1-(2-aminoethyl)-1,2-ethanediamine	40139-72-8	48	0.025%	30%
Hydrochloric acid	7647-01-0	45	0.18%	15%
Tetrakis(hydroxymethyl)phosphonium sulfate	55566-30-8	43	0.0044%	45%
Carbonic acid, dipotassium salt	584-08-7	42	0.037%	40%
N,N-Dimethyldecylamine oxide	2605-79-0	39	0.015%	0.11%
Sodium bromate	7789-38-0	36	0.0073%	0.057%
Acetic acid	64-19-7	34	0.030%	30%
Formic acid	64-18-6	34	0.0062%	4.3%
Glutaraldehyde	111-30-8	33	0.0035%	30%
Glycerin, natural	56-81-5	33	0.0069%	7.0%

Ingredients from 20 (9.4%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 139 (65.3%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 33 (15.5%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Richland	104	104	0	173,600,000	1,604,648	359,501	3,211,767
Roosevelt	50	50	0	110,100,000	2,427,634	860,538	3,227,131
Sheridan	31	31	0	21,730,000	410,690	236,019	1,712,485
Glacier	12	12	0	10,240,000	950,581	46,805	1,589,657
Rosebud	6	5	1	7,028,000	1,072,667	836,642	1,763,954
Daniels	2	2	0	1,281,000	640,476	403,146	877,805
Garfield	1	1	0	927,400	927,438	927,438	927,438
Musselshell	1	1	0	713,900	713,908	713,908	713,908

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

NEW MEXICO

State Background

Geology: Major unconventional plays in New Mexico include the Avalon-Bone Springs shale oil play in the Permian Basin and the Lewis shale gas play in the San Juan Basin.[80] Most conventional gas production is also in the Permian and San Juan basins.[81] Tight gas plays include the Abo, Morrow, and Penn-Perm Carbonate, and the stacked Mesaverde, Pictured Cliffs, and Dakota in the San Juan Basin.[82] Coalbed methane production takes place in the San Juan Basin and the Raton Basin on the border with Colorado.[83]

Production: Gross natural gas production in New Mexico in 2013 was 1,271,185 million cubic feet (mmcf), including 611,918 mmcf from gas wells, 160,649 mmcf from oil wells, 167,961 mmcf from shale gas wells and 330,658 mmcf from coalbed methane wells.[84] Oil production in 2013 was 100,836 thousand barrels.[85]

Regulatory: State requires operators disclose ingredients to the state as of 2/15/2012 (19.15.16.19 NMAC). Reporting to FracFocus is voluntary; 1,162 disclosures submitted.

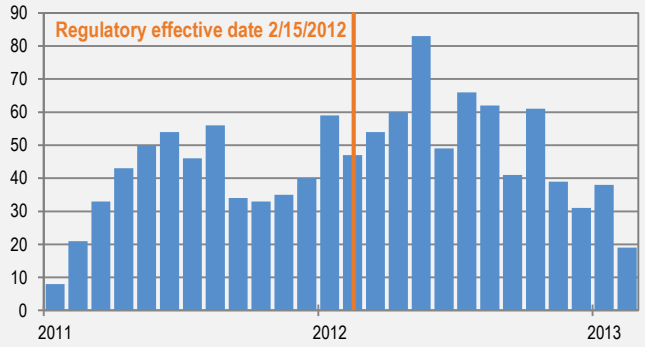
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

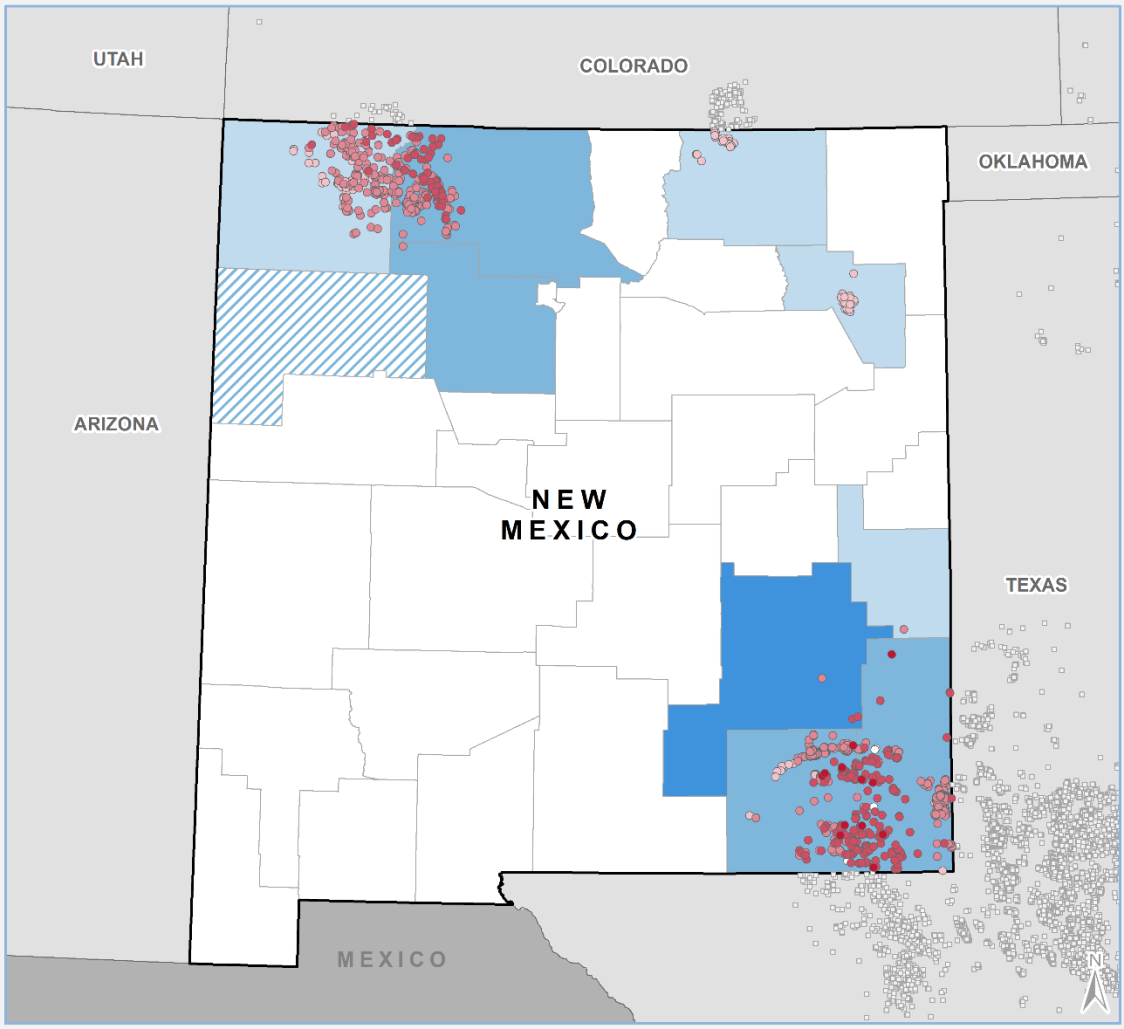
Total disclosures: 1,162 **Total water:** ~790 million gallons

Production type: 416 (35.8%) gas, 746 (64.2%) oil

Number of disclosures reported per month



Geographic Location of Disclosures



True Vertical Depth in feet (# of disclosures) *

- Not reported (5)
- < 4,000 (130)
- 4,001-8,000 (698)
- 8,001-12,000 (301)
- > 12,000 (14)
- Other states (6,072)

Median water volume per disclosure by county, millions of gallons (# of counties) *

- > 5.0 (0)
- 2.0 - 5.0 (0)
- 1.0 - 2.0 (1)
- 0.1 - 1.0 (4)
- ≤ 0.1 (4)
- No disclosures (23)
- Unconfirmed location for all wells (1)
- No volume data for all wells (0)

* Includes data from 1,162 (98.4%) FracFocus disclsoures that met quality assurance criteria-unique well identification and fracture date, within the date range 1/1/2011 through 2/28/2013, and with confirmed state location.

County locations for 14 (1.2%) disclosures were unconfirmed and excluded from county-level analyses.

0 Miles 100

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Methanol	67-56-1	1,012	0.026%	30%
Hydrochloric acid	7647-01-0	880	0.17%	15%
Peroxydisulfuric acid, diammonium salt	7727-54-0	836	0.0053%	100%
Water	7732-18-5	817	0.92%	80%
Quartz	14808-60-7	762	0.00098%	1.0%
Propargyl alcohol	107-19-7	760	0.00022%	10%
Guar gum	9000-30-0	702	0.24%	50%
Distillates, petroleum, hydrotreated light	64742-47-8	699	0.029%	30%
Isopropanol	67-63-0	695	0.0096%	30%
Glutaraldehyde	111-30-8	632	0.0086%	30%
Ethanol	64-17-5	529	0.018%	5.0%
Ethylene glycol	107-21-1	503	0.030%	30%
Citric acid	77-92-9	447	0.0035%	60%
Diatomaceous earth, calcined	91053-39-3	419	0.017%	100%
Phenolic resin	9003-35-4	419	0.20%	5.0%
2-Butoxyethanol	111-76-2	412	0.017%	10%
Choline chloride	67-48-1	384	0.057%	75%
Nonyl phenol ethoxylate	9016-45-9	333	0.0084%	10%
Hemicellulase Enzyme Concentrate	9025-56-3	331	0.0019%	3.0%
Sodium hydroxide	1310-73-2	329	0.011%	10%
Potassium hydroxide	1310-58-3	327	0.0066%	12%
Carbonic acid, dipotassium salt	584-08-7	326	0.064%	60%
Methenamine	100-97-0	324	0.00037%	0.010%
Nitrogen, liquid	7727-37-9	307	23%	100%
2-Mercaptoethanol	60-24-2	306	0.0062%	100%
Sodium tetraborate decahydrate	1303-96-4	297	0.030%	30%
Phosphonic acid	13598-36-2	252	0.00017%	1.0%

Ingredients from 47 (4%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 1,006 (86.6%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 252 (21.7%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Eddy	442	419	23	475,800,000	566,934	60,256	3,590,099
Lea	286	281	5	244,300,000	183,645	53,235	3,730,169
San Juan	188	12	176	24,030,000	72,200	19,998	476,978
Rio Arriba	174	13	161	33,140,000	114,732	24,531	452,176
Colfax	29	7	22	1,470,000	38,640	1,054	113,820
Harding	21	0	21	219,200	6,048	4,662	8,694
Chaves	3	2	1	5,558,000	1,772,439	1,406,084	2,355,707
Roosevelt	1	1	0	79,210	79,212	79,212	79,212
Sandoval	1	1	0	792,600	792,616	792,616	792,616

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

NORTH DAKOTA

State Background

Geology: The Bakken Formation in the Williston Basin in western North Dakota is a source of conventional and unconventional oil and gas production.[86,87] The Upper Devonian–Lower Mississippian Bakken formation includes shale and siltstone, dolostone, and sandstone strata.[88,89] A section of the Judith River Eagle tight gas play, also in the Williston Basin, is located in the southwestern corner of the state.[90]

Production: Gross natural gas production in North Dakota in 2013 was 345,787 million cubic feet (mmcf), including 24,313 mmcf from gas wells, 12,854 mmcf from oil wells, and 308,620 mmcf from shale gas wells.[91] Oil production was 313,905 thousand barrels in 2012.[92]

Regulatory: State requires operators to disclose ingredients as of 4/1/2012 (43-02-03-27.1); 2,254 disclosures submitted.

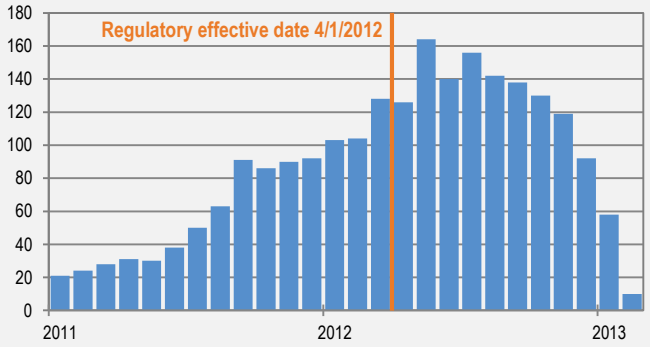
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

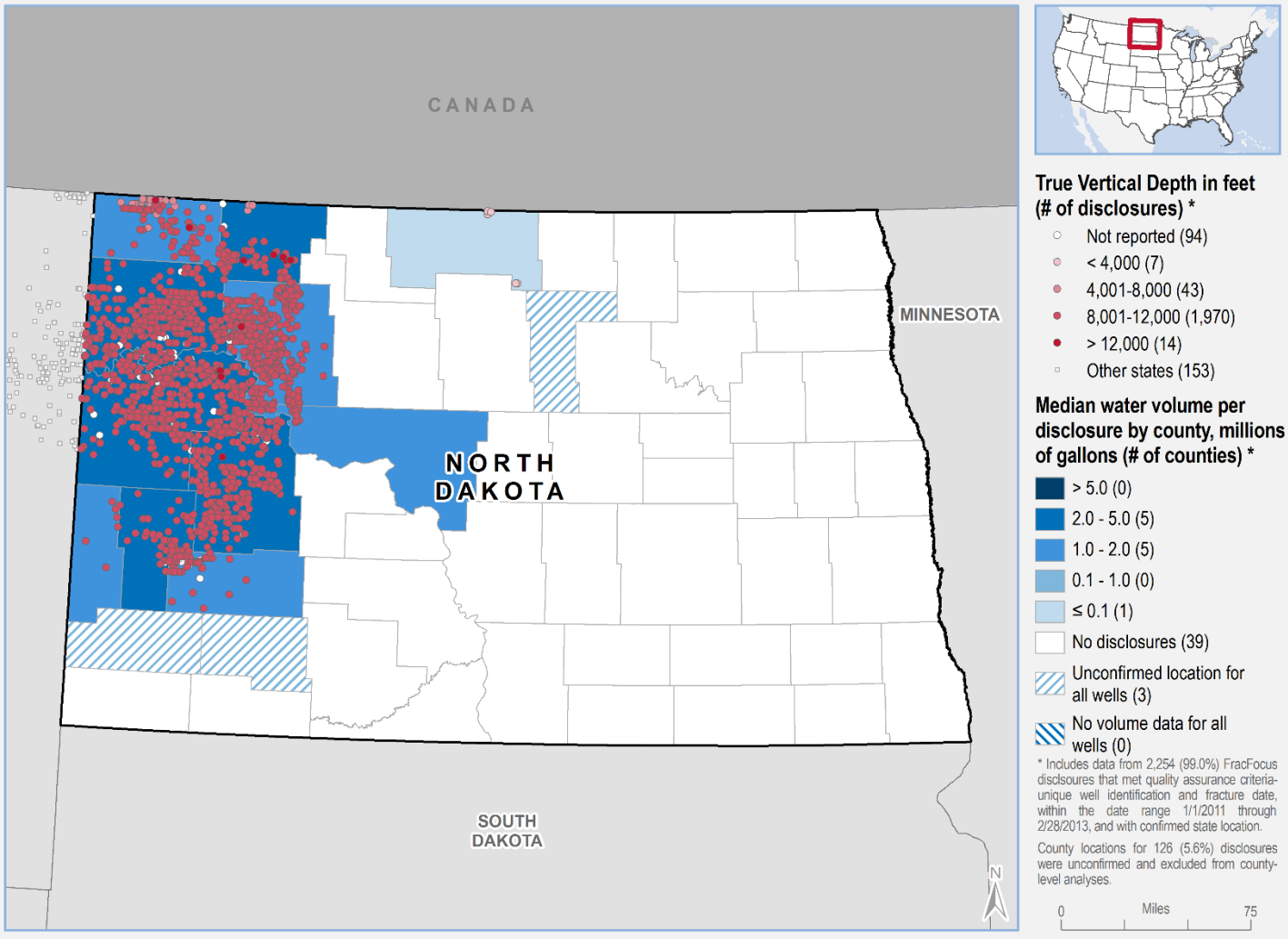
Total disclosures: 2,254 **Total water:** ~4.8 billion gallons

Production type: 14 (0.6%) gas, 2,240 (99.4%) oil

Number of disclosures reported per month



Geographic Location of Disclosures



Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Potassium hydroxide	1310-58-3	1,176	0.0033%	5.0%
Guar gum	9000-30-0	1,094	0.22%	60%
Peroxydisulfuric acid, diammonium salt	7727-54-0	1,089	0.0071%	80%
Methanol	67-56-1	1,059	0.022%	30%
Sodium hydroxide	1310-73-2	1,028	0.019%	30%
Solvent naphtha, petroleum, heavy arom.	64742-94-5	981	0.0047%	5.0%
Distillates, petroleum, hydrotreated light	64742-47-8	943	0.036%	30%
Quartz	14808-60-7	920	0.0041%	15%
Naphthalene	91-20-3	864	0.00090%	1.0%
Isopropanol	67-63-0	739	0.030%	20%
Ethylene glycol	107-21-1	724	0.035%	30%
Water	7732-18-5	582	0.083%	50%
Tetramethylammonium chloride	75-57-0	579	0.054%	1.1%
Polyethylene glycol	25322-68-3	567	0.0046%	20%
Ethanol	64-17-5	545	0.044%	60%
Potassium metaborate	13709-94-9	515	0.016%	60%
1,2,4-Trimethylbenzene	95-63-6	496	0.00075%	1.0%
Sodium chloride	7647-14-5	491	0.073%	30%
Carbonic acid, dipotassium salt	584-08-7	482	0.063%	60%
Sodium chlorite	7758-19-2	482	0.029%	10%
2,2-Dibromo-3-nitrilopropionamide	10222-01-2	468	0.0024%	98%
Formic acid, potassium salt	590-29-4	430	0.039%	60%
Poly(oxy-1,2-ethanediyl)-nonylphenyl-hydroxy (mixture)	127087-87-0	428	0.0037%	5.0%
Tetrakis(hydroxymethyl)phosphonium sulfate	55566-30-8	391	0.0093%	60%
Diethylenetriamine	111-40-0	352	0.0038%	5.0%

Ingredients from 267 (11.8%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 1,325 (58.8%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 352 (15.6%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Mountrail	520	518	2	917,000,000	1,558,022	707,235	3,357,661
McKenzie	483	482	1	1,242,000,000	2,433,648	784,762	4,216,218
Williams	430	427	3	1,163,000,000	2,390,827	907,390	5,878,448
Dunn	331	331	0	630,100,000	2,017,621	409,803	3,361,183
Divide	133	133	0	212,400,000	1,580,796	678,912	2,536,918
Burke	68	68	0	130,000,000	2,181,879	92,238	2,916,078
Stark	67	62	5	97,820,000	1,485,580	687,725	1,903,938
Billings	47	46	1	88,870,000	2,149,224	732,783	2,819,213
Mclean	19	19	0	24,330,000	1,177,851	675,033	1,958,939
Golden Valley	6	5	1	9,149,000	1,514,858	1,123,363	1,980,707
Bottineau	5	5	0	480,000	97,744	83,732	108,279

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

OHIO

State Background

Geology: The Appalachian basin in the eastern part of the state is the source of most of Ohio's conventional gas and oil.[93,94] Limited conventional gas production also takes place in the Michigan basin in the northwest corner of the state.[95] Shale gas plays in the Appalachian Basin in Ohio include the Marcellus, the Utica, and the Devonian Low Thermal Maturity shale gas play.[96,97] Tight gas plays in the Ohio portion of the Appalachian basin include the Berea-Murrysville and the Medina/Clinton-Tuscarora.[98] Ohio's Utica shale is also a source of shale oil.[99]

Production: Gross natural gas production in Ohio in 2013 was 186,181 million cubic feet (mmcf), which included 85,303 mmcf from gas wells, 12,830 mmcf from oil wells, and 88,047 mmcf from shale gas wells. Oil production in Ohio in 2013 was 8,786 thousand barrels.[100]

Regulatory: State requires operators to disclose ingredients to the state or FracFocus as of 9/10/2012 (ORC 1509.10); 148 disclosures submitted.

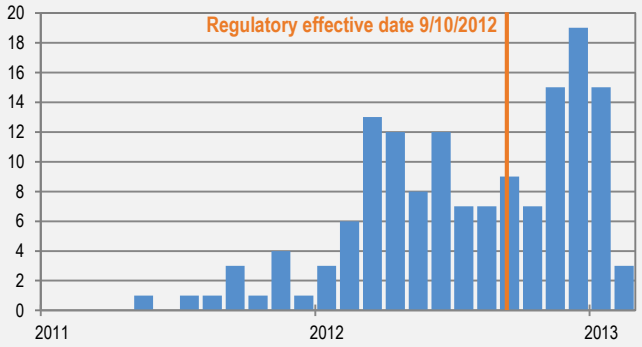
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

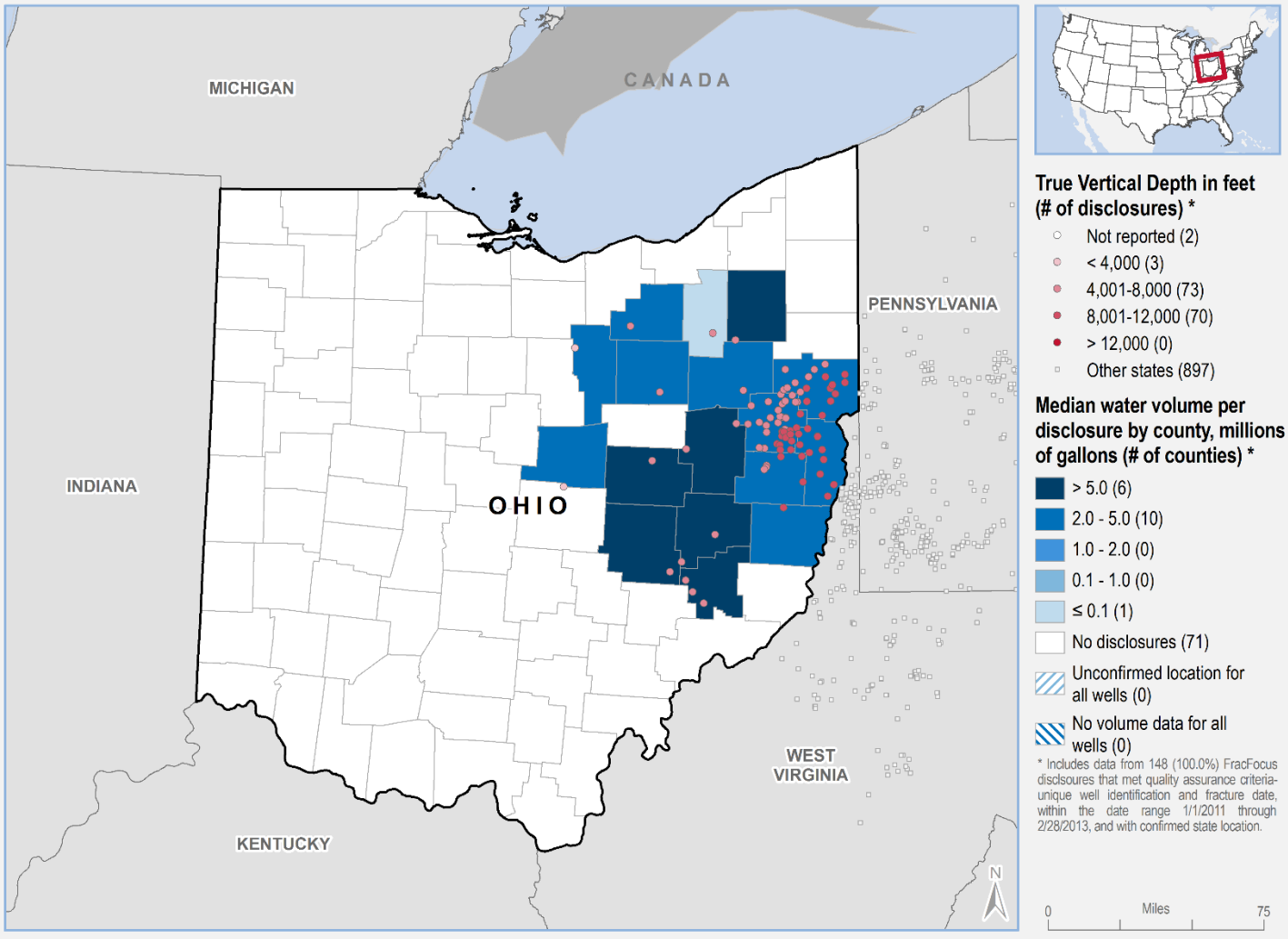
Total disclosures: 148 **Total water:** ~610 million gallons

Production type: 146 (98.6%) gas, 2 (1.4%) oil

Number of disclosures reported per month



Geographic Location of Disclosures



Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Hydrochloric acid	7647-01-0	145	0.11%	15%
Water	7732-18-5	137	0.58%	85%
Distillates, petroleum, hydrotreated light	64742-47-8	122	0.060%	40%
Potassium hydroxide	1310-58-3	106	0.0043%	15%
Glutaraldehyde	111-30-8	105	0.0056%	30%
Citric acid	77-92-9	96	0.0021%	50%
Peroxydisulfuric acid, diammonium salt	7727-54-0	93	0.0035%	100%
Ethanol	64-17-5	87	0.00067%	5.0%
Ethylene glycol	107-21-1	83	0.0050%	35%
Boric acid	10043-35-3	82	0.0028%	20%
Methanol	67-56-1	76	0.017%	68%
Guar gum	9000-30-0	74	0.074%	50%
Propargyl alcohol	107-19-7	72	0.000060%	5.0%
Isopropanol	67-63-0	71	0.00092%	60%
N,N-Dimethylformamide	68-12-2	68	0.00015%	10%
Quartz	14808-60-7	66	0.024%	10%
Choline chloride	67-48-1	55	0.056%	75%
Quaternary ammonium compounds, benzyl-C12-16-alkyldimethyl, chlorides	68424-85-1	54	0.00096%	7.0%
Didecyl dimethyl ammonium chloride	7173-51-5	46	0.0013%	10%
Diethylene glycol	111-46-6	45	0.00072%	5.0%
Carbonic acid, dipotassium salt	584-08-7	44	0.0064%	48%
Sodium hydroxide	1310-73-2	41	0.000080%	1.9%
Ethylenediaminetetraacetic acid tetrasodium salt hydrate	64-02-8	40	0.0017%	41%
Sodium chloride	7647-14-5	40	0.0081%	10%
2-Butoxyethanol	111-76-2	39	0.00057%	10%
Nonyl phenol ethoxylate	9016-45-9	33	0.00017%	10%
Glycine, N,N-bis(carboxymethyl)-, trisodium salt	5064-31-3	28	0.000090%	2.0%
Sodium metaborate tetrahydrate	10555-76-7	28	0.0081%	25%
Ethoxylated propoxylated C12-14 alcohols	68439-51-0	27	0.0028%	2.0%

Ingredients from 2 (1.4%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 126 (85.1%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 27 (18.2%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Carroll	78	0	78	334,800,000	4,104,765	3,127,692	5,738,399
Columbiana	23	0	23	69,110,000	3,213,420	1,709,912	3,850,190
Jefferson	16	0	16	66,340,000	4,257,225	2,942,478	5,471,193
Harrison	12	0	12	50,030,000	4,058,040	3,447,473	5,102,299
Guernsey	3	0	3	16,810,000	5,205,007	3,182,721	8,299,734
Noble	2	0	2	16,630,000	8,317,273	7,767,089	8,867,456
Tuscarawas	2	0	2	13,470,000	6,735,233	5,553,163	7,917,302

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

OKLAHOMA

State Background

Geology: Conventional gas and oil production is widespread throughout Oklahoma, with gas fields predominating in the western part of the state and oil in the east.[101,102] The Cana Woodford shale gas play is located in the Anadarko Basin in the southwestern part of the state, as are the Granite Wash and Red Fork tight gas plays.[103,104] Significant coalbed methane fields are found in the Arkoma Basin and Cherokee Platform in the Eastern part of the state.[105]

Production: Gross natural gas production in Oklahoma in 2013 was 2,143,999 million cubic feet (mmcf), including 1,360,560 mmcf from gas wells, 71,515 mmcf from oil wells, 663,507 mmcf from shale gas wells and 48,417 mmcf from coalbed methane wells.[106] Oil production in 2013 was 114,363 thousand barrels.[107]

Regulatory: State requires operators to disclose ingredients to FracFocus as of 1/1/2013 (OAC 165:10-3-10); 1,909 disclosures submitted.

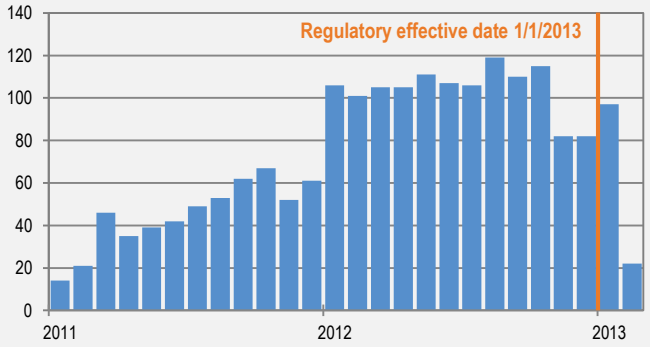
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

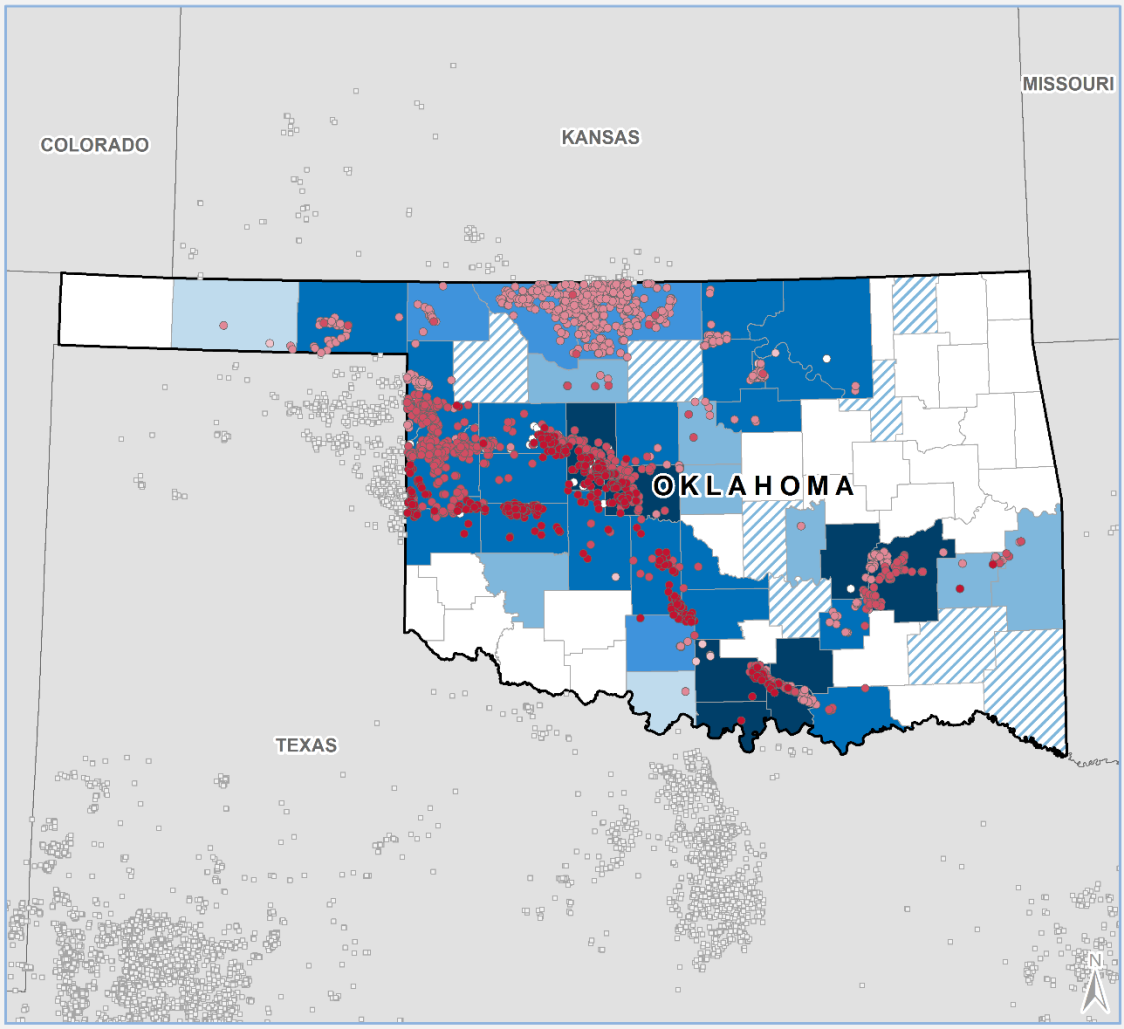
Total disclosures: 1,909 **Total water:** ~6.7 billion gallons

Production type: 945 (49.5%) gas, 964 (50.5%) oil

Number of disclosures reported per month



Geographic Location of Disclosures



True Vertical Depth in feet (# of disclosures) *

- Not reported (46)
- < 4,000 (15)
- 4,001-8,000 (708)
- 8,001-12,000 (566)
- > 12,000 (454)
- Other states (8,824)

Median water volume per disclosure by county, millions of gallons (# of counties) *

- > 5.0 (8)
- 2.0 - 5.0 (19)
- 1.0 - 2.0 (5)
- 0.1 - 1.0 (7)
- ≤ 0.1 (2)
- No disclosures (28)
- Unconfirmed location for all wells (8)
- No volume data for all wells (0)

* Includes data from 1,909 (98.5%) FracFocus disclsoures that met quality assurance criteria-unique well identification and fracture date, within the date range 1/1/2011 through 2/28/2013, and with confirmed state location.

County locations for 116 (6.1%) disclosures were unconfirmed and excluded from county-level analyses.

0 Miles 100

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Hydrochloric acid	7647-01-0	1,372	0.14%	15%
Distillates, petroleum, hydrotreated light	64742-47-8	1,270	0.025%	30%
Methanol	67-56-1	1,270	0.0081%	30%
Glutaraldehyde	111-30-8	989	0.0083%	30%
Water	7732-18-5	957	0.52%	60%
Ethylene glycol	107-21-1	843	0.0031%	30%
Ethanol	64-17-5	838	0.0016%	5.0%
Isopropanol	67-63-0	764	0.0046%	30%
Propargyl alcohol	107-19-7	732	0.00010%	4.0%
Peroxydisulfuric acid, diammonium salt	7727-54-0	713	0.0049%	100%
Citric acid	77-92-9	644	0.0017%	60%
Quaternary ammonium compounds, benzyl-C12-16-alkyldimethyl, chlorides	68424-85-1	597	0.0018%	7.0%
Solvent naphtha, petroleum, heavy arom.	64742-94-5	557	0.0088%	30%
Quartz	14808-60-7	491	0.44%	74%
Sodium hydroxide	1310-73-2	490	0.0043%	10%
Guar gum	9000-30-0	457	0.085%	60%
Naphthalene	91-20-3	448	0.0020%	5.0%
Acetic acid	64-19-7	442	0.0039%	60%
N,N-Dimethylformamide	68-12-2	355	0.00018%	10%
Sodium perborate tetrahydrate	10486-00-7	351	0.0063%	100%
2-Butoxyethanol	111-76-2	348	0.0016%	20%
Didecyl dimethyl ammonium chloride	7173-51-5	343	0.0024%	10%
1,2,4-Trimethylbenzene	95-63-6	308	0.00043%	1.0%
Poly(oxy-1,2-ethanediyl)-nonylphenyl-hydroxy (mixture)	127087-87-0	296	0.0021%	5.0%
Ethoxylated C9-11 alcohols	68439-46-3	275	0.0043%	10%
Sodium chloride	7647-14-5	272	0.014%	30%

Ingredients from 102 (5.3%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 1,252 (65.6%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 272 (14.2%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Alfalfa	199	182	17	385,000,000	1,865,304	1,266,922	2,923,830
Roger Mills	177	79	98	490,200,000	2,488,248	662,273	4,991,475
Woods	166	161	5	327,900,000	1,916,477	1,306,536	2,664,942
Ellis	165	82	83	398,600,000	2,301,505	732,749	4,023,155
Canadian	158	12	146	966,500,000	6,340,910	3,045,404	8,472,344
Pittsburg	106	6	100	756,600,000	6,939,435	3,607,478	11,799,127
Washita	95	75	20	215,800,000	2,510,928	320,170	3,201,844
Grant	89	81	8	165,300,000	1,792,535	1,490,734	2,219,473
Dewey	82	14	68	331,100,000	3,774,240	790,768	6,455,102
Blaine	79	6	73	414,200,000	5,109,410	2,743,823	8,789,371

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

PENNSYLVANIA

State Background

Geology: Shale gas plays in the Appalachian Basin in western Pennsylvania include the Marcellus, the Utica, and the Devonian Low Thermal Maturity shale gas play.[108,109] Tight gas plays are also present in the Appalachian basin in Pennsylvania: the Berea-Murrysville, the Bradford-Venango-Elk, and the Medina/Clinton-Tuscarora.[110] The Appalachian basin is also a region of conventional gas and oil production in Pennsylvania.[111,112]

Production: Gross natural gas production in 2013 in Pennsylvania was 3,259,042 million cubic feet (mmcf), including 207,872 mmcf from gas wells, 2,987 mmcf from oil wells, and 3,048,182 mmcf from shale gas wells.[113] Estimated coalbed methane production was 13,000 mmcf. [114] Oil production in Pennsylvania in 2013 was 4,976 thousand barrels.[115]

Regulatory: State requires operators to disclose ingredients to state as of 2/5/2011 (78.122), and to the state and FracFocus as of 4/14/2012 (58.3222 and 3222.1); 2.483 disclosures submitted.

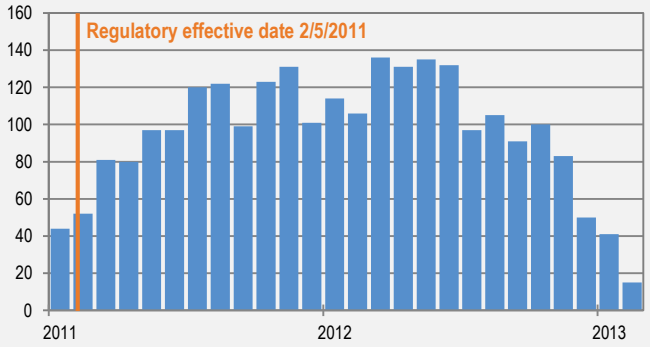
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

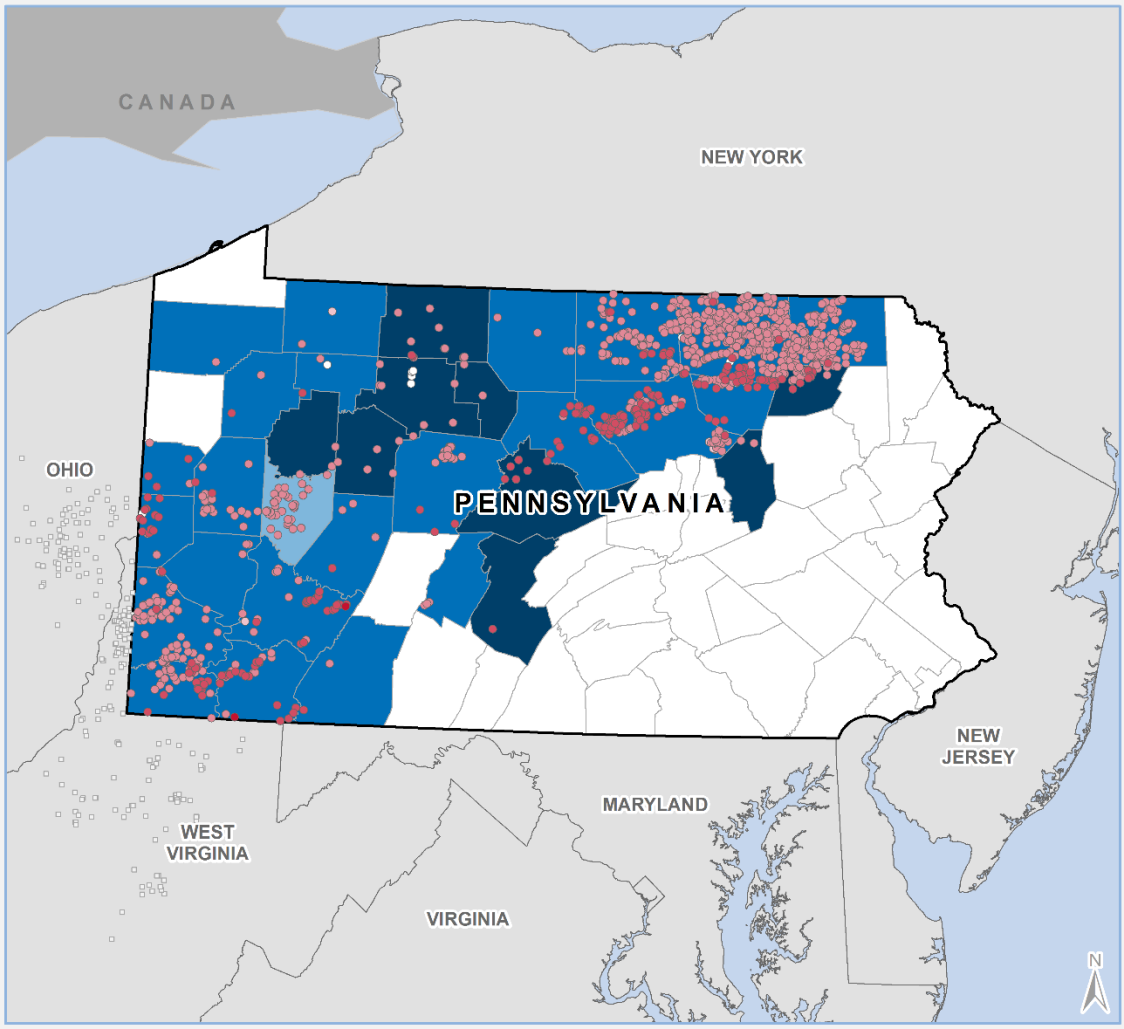
Total disclosures: 2,483 **Total water:** ~11 billion gallons

Production type: 2,482 (100.0%) gas, 1 (0.0%) oil

Number of disclosures reported per month



Geographic Location of Disclosures



True Vertical Depth in feet (# of disclosures) *

- Not reported (19)
- < 4,000 (14)
- 4,001-8,000 (1,851)
- 8,001-12,000 (571)
- > 12,000 (4)
- Other states (407)

Median water volume per disclosure by county, millions of gallons (# of counties) *

- > 5.0 (9)
- 2.0 - 5.0 (23)
- 1.0 - 2.0 (0)
- 0.1 - 1.0 (1)
- ≤ 0.1 (0)
- No disclosures (34)
- Unconfirmed location for all wells (0)
- No volume data for all wells (0)

* Includes data from 2,483 (96.4%) FracFocus disclsoures that met quality assurance criteria-unique well identification and fracture date, within the date range 1/1/2011 through 2/28/2013, and with confirmed state location.

County locations for 24 (1.0%) disclosures were unconfirmed and excluded from county-level analyses.

0 Miles 75

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Hydrochloric acid	7647-01-0	2,279	0.065%	15%
Methanol	67-56-1	1,633	0.00061%	40%
Distillates, petroleum, hydrotreated light	64742-47-8	1,434	0.021%	30%
Propargyl alcohol	107-19-7	1,371	0.000050%	10%
Water	7732-18-5	951	0.26%	84%
Glutaraldehyde	111-30-8	819	0.0040%	30%
Ethylene glycol	107-21-1	807	0.0047%	30%
2,2-Dibromo-3-nitrilopropionamide	10222-01-2	804	0.0050%	20%
Isopropanol	67-63-0	735	0.00029%	15%
Ammonium chloride	12125-02-9	732	0.0022%	10%
Citric acid	77-92-9	701	0.0012%	55%
Polyethylene glycol	25322-68-3	688	0.014%	60%
Guar gum	9000-30-0	538	0.0019%	100%
2-Butoxyethanol	111-76-2	498	0.00011%	15%
Sodium hydroxide	1310-73-2	406	0.0012%	1.0%
Ethanol	64-17-5	388	0.0013%	5.0%
Quaternary ammonium compounds, benzyl-C12-16-alkyldimethyl, chlorides	68424-85-1	373	0.0023%	7.0%
Sodium persulfate	7775-27-1	373	0.000090%	100%
Hemicellulase enzyme	9012-54-8	367	0.000010%	15%
Tri-n-butyl tetradecyl phosphonium chloride	81741-28-8	350	0.0021%	10%
2-Amino-2-methylpropan-1-ol	124-68-5	299	0.00018%	1.0%
3,4,4-Trimethyloxazolidine	75673-43-7	299	0.00090%	5.0%
4,4-Dimethyloxazolidine	51200-87-4	299	0.014%	78%
Didecyl dimethyl ammonium chloride	7173-51-5	296	0.0023%	8.0%
Thiourea polymer	68527-49-1	280	0.00017%	30%
Sodium chloride	7647-14-5	275	0.0050%	7.5%

Ingredients from 101 (4.1%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 1,178 (47.4%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 275 (11.1%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Bradford	513	0	513	2,168,000,000	4,350,571	213,158	7,181,555
Lycoming	361	0	361	1,498,000,000	3,877,797	1,597,625	7,475,978
Susquehanna	327	0	327	1,546,000,000	4,798,290	940,909	7,816,150
Tioga	286	0	286	1,133,000,000	3,598,474	2,285,636	6,572,202
Washington	223	0	223	867,500,000	3,358,519	2,553,790	7,031,557
Greene	157	0	157	781,600,000	4,305,363	2,433,957	10,493,381
Westmoreland	89	0	89	413,900,000	4,382,954	2,602,314	7,766,369
Fayette	65	0	65	243,800,000	3,614,704	1,982,122	5,899,561
Wyoming	59	0	59	319,400,000	5,360,166	1,131,136	9,250,744
Butler	53	0	53	257,000,000	4,748,310	3,075,507	7,167,812

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

TEXAS

State Background

Geology: Conventional oil and gas production is distributed widely across Texas, with oil wells concentrated in the Permian Basin and gas wells concentrated in the Permian, Ft. Worth, Anadarko, and West Gulf Coast basins.[116,117] Shale oil plays include the Eagle Ford, Avalon, and Bone Springs.[118] Shale gas plays in Texas include the Barnett, Barnett-Woodford, Eagle Ford, and Haynesville.[119,120] Tight gas plays include the Cleveland, Granite Wash, Thirty-One, Ozona Canyon, Davis, Austin Chalk, Wilcox Lobo, Olmos, Stuart City-Edwards, Travis Peak, Bossier, Cotton Valley, and Gilmer.[121]

Production: Gross onshore natural gas production in 2013 in Texas was 8,197,219 million cubic feet (mmcf) including 3,033,441 mmcf from gas wells, 1,146,524 mmcf from oil wells, and 4,017,253 mmcf from shale gas wells.[122] Estimated coalbed methane production in Texas was 8,000 mmcf.[123] Oil production (onshore and offshore) in 2013 was 922,136 thousand barrels.[124]

Regulatory: State requires operators to disclose ingredients to FracFocus as of 2/1/2012 (16 TAC 3.29); 18,075 disclosures

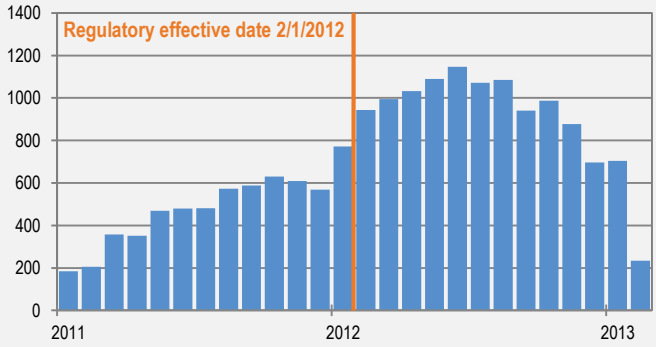
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

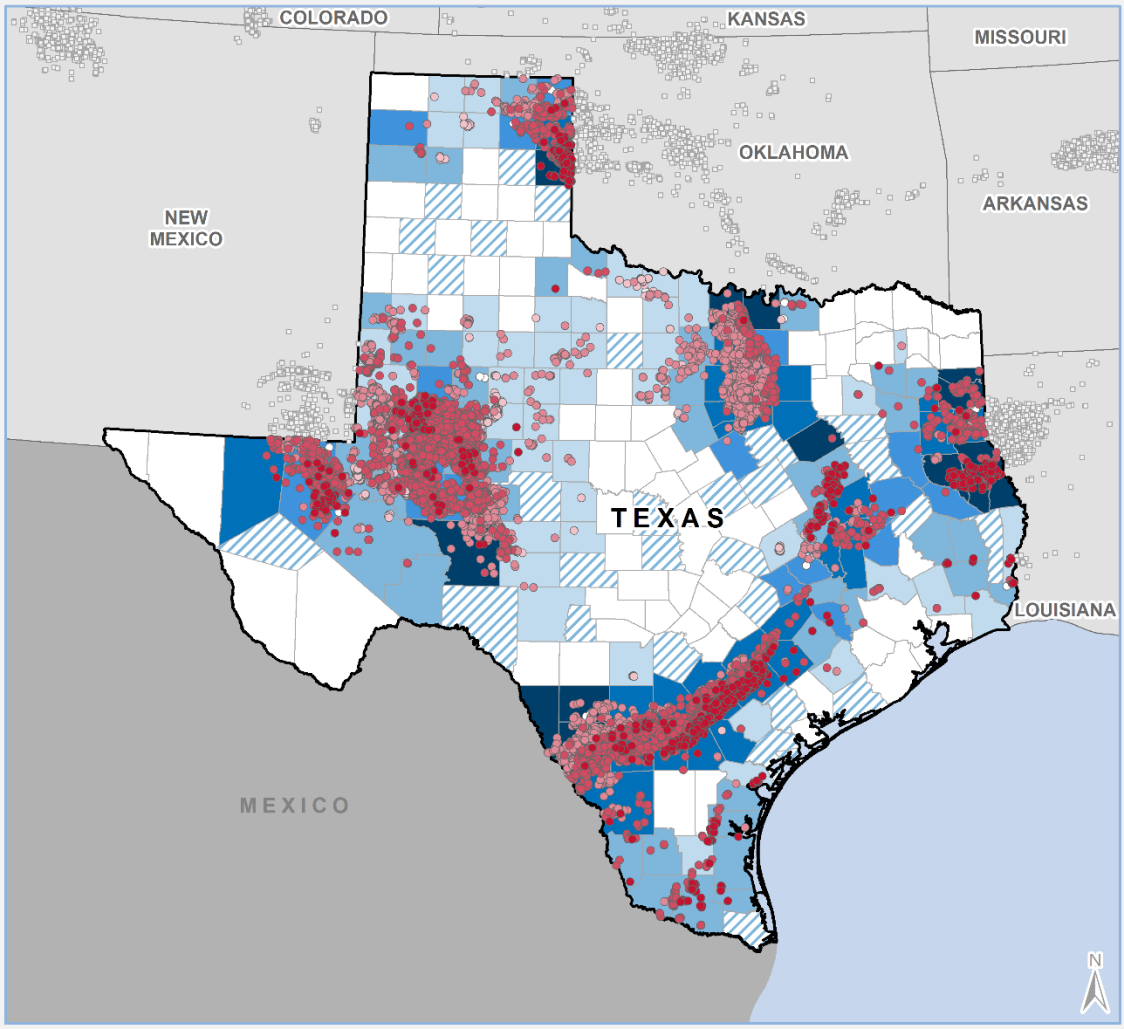
Total disclosures: 18,075 **Total water:** ~45 billion gallons

Production type: 5,177 (28.6%) gas, 12,898 (71.4%) oil

Number of disclosures reported per month



Geographic Location of Disclosures



True Vertical Depth in feet (# of disclosures) *

- Not reported (379)
- < 4,000 (1,043)
- 4,001-8,000 (5,651)
- 8,001-12,000 (8,430)
- > 12,000 (1,508)
- Other states (5,344)

Median water volume per disclosure by county, millions of gallons (# of counties) *

- > 5.0 (14)
- 2.0 - 5.0 (30)
- 1.0 - 2.0 (19)
- 0.1 - 1.0 (44)
- ≤ 0.1 (45)
- No disclosures (73)
- Unconfirmed location for all wells (29)
- No volume data for all wells (0)

* Includes data from 18,075 (98.8%) FracFocus disclsoures that met quality assurance criteria-unique well identification and fracture date, within the date range 1/1/2011 through 2/28/2013, and with confirmed state location.

County locations for 1,064 (5.9%) disclosures were unconfirmed and excluded from county-level analyses.

0 Miles 200

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Methanol	67-56-1	12,664	0.013%	35%
Hydrochloric acid	7647-01-0	11,424	0.21%	15%
Distillates, petroleum, hydrotreated light	64742-47-8	10,677	0.070%	50%
Ethylene glycol	107-21-1	9,591	0.018%	30%
Peroxydisulfuric acid, diammonium salt	7727-54-0	8,666	0.0069%	100%
Water	7732-18-5	8,280	0.93%	69%
Isopropanol	67-63-0	7,731	0.0031%	15%
Sodium hydroxide	1310-73-2	7,371	0.0095%	10%
Quartz	14808-60-7	6,869	0.0037%	2.0%
Guar gum	9000-30-0	6,863	0.15%	50%
Glutaraldehyde	111-30-8	6,470	0.0063%	15%
Potassium hydroxide	1310-58-3	6,369	0.015%	20%
Propargyl alcohol	107-19-7	6,269	0.00024%	8.0%
Acetic acid	64-19-7	4,935	0.0037%	38%
2-Butoxyethanol	111-76-2	3,898	0.0012%	10%
Citric acid	77-92-9	3,820	0.0031%	55%
Sodium chloride	7647-14-5	3,462	0.0044%	25%
Ethanol	64-17-5	3,439	0.0012%	5.0%
Phenolic resin	9003-35-4	2,903	0.12%	5.0%
Solvent naphtha, petroleum, heavy arom.	64742-94-5	2,751	0.0034%	5.0%
Methenamine	100-97-0	2,490	0.0073%	1.0%
Ethoxylated propoxylated C12-14 alcohols	68439-51-0	2,368	0.0059%	2.0%
Formic acid	64-18-6	2,327	0.0055%	60%
Nonyl phenol ethoxylate	9016-45-9	2,261	0.0087%	20%
Boric acid	10043-35-3	2,182	0.016%	25%
Naphthalene	91-20-3	2,132	0.00084%	5.0%

Ingredients from 1,934 (10.7%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 13,158 (72.8%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 2,132 (11.8%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Andrews	1,171	1,146	25	519,000,000	91,697	29,631	1,429,964
Glasscock	935	935	0	1,242,000,000	981,372	569,677	2,662,435
Martin	823	785	38	937,500,000	1,099,924	494,534	1,705,162
Ector	822	808	14	497,400,000	209,209	40,444	1,886,442
Upton	777	775	2	974,800,000	1,216,685	30,060	1,924,754
Tarrant	747	0	747	2,968,000,000	3,678,696	1,324,407	7,575,669
Dimmit	715	326	389	3,939,000,000	5,322,954	3,076,202	8,709,221
Karnes	595	475	120	2,255,000,000	3,514,377	2,148,427	6,484,902
La Salle	568	452	116	2,683,000,000	4,488,267	2,684,300	7,498,348
Midland	530	530	0	654,000,000	1,254,809	455,722	1,892,398

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

UTAH

State Background

Geology: Conventional oil and gas are produced from Utah's Uinta Basin, with additional conventional gas production in the Paradox and Greater Green River basins.[125,126] The Mancos Shale Play in the Uinta Basin is the major source of shale gas in the state.[127] Utah also has two major tight gas plays, the Wasatch-Mesaverde and Mancos-Dakota, both in the Uinta Basin.[128] The Uinta Basin also contains significant coalbeds; formations that have been exploited for methane include the Ferron Sandstone Member of the Mancos Shale and the Blackhawk Formation of the Mesaverde Group.[129,130]

Production: Gross natural gas production in 2013 was 470,863 million cubic feet (mmcf), including 383,216 mmcf from gas wells, 36,737 mmcf from oil wells, 992 mmcf from shale gas wells, and 49,918 mmcf from coalbed methane wells.[131] Oil produced in Utah in 2013 was 35,120 thousand barrels.[132]

Regulatory: State requires operators to disclose ingredients to FracFocus as of 11/1/2012 (R649-3-39); 1,429 disclosures submitted.

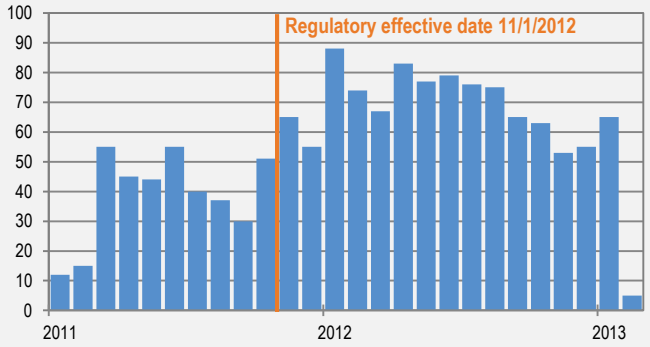
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

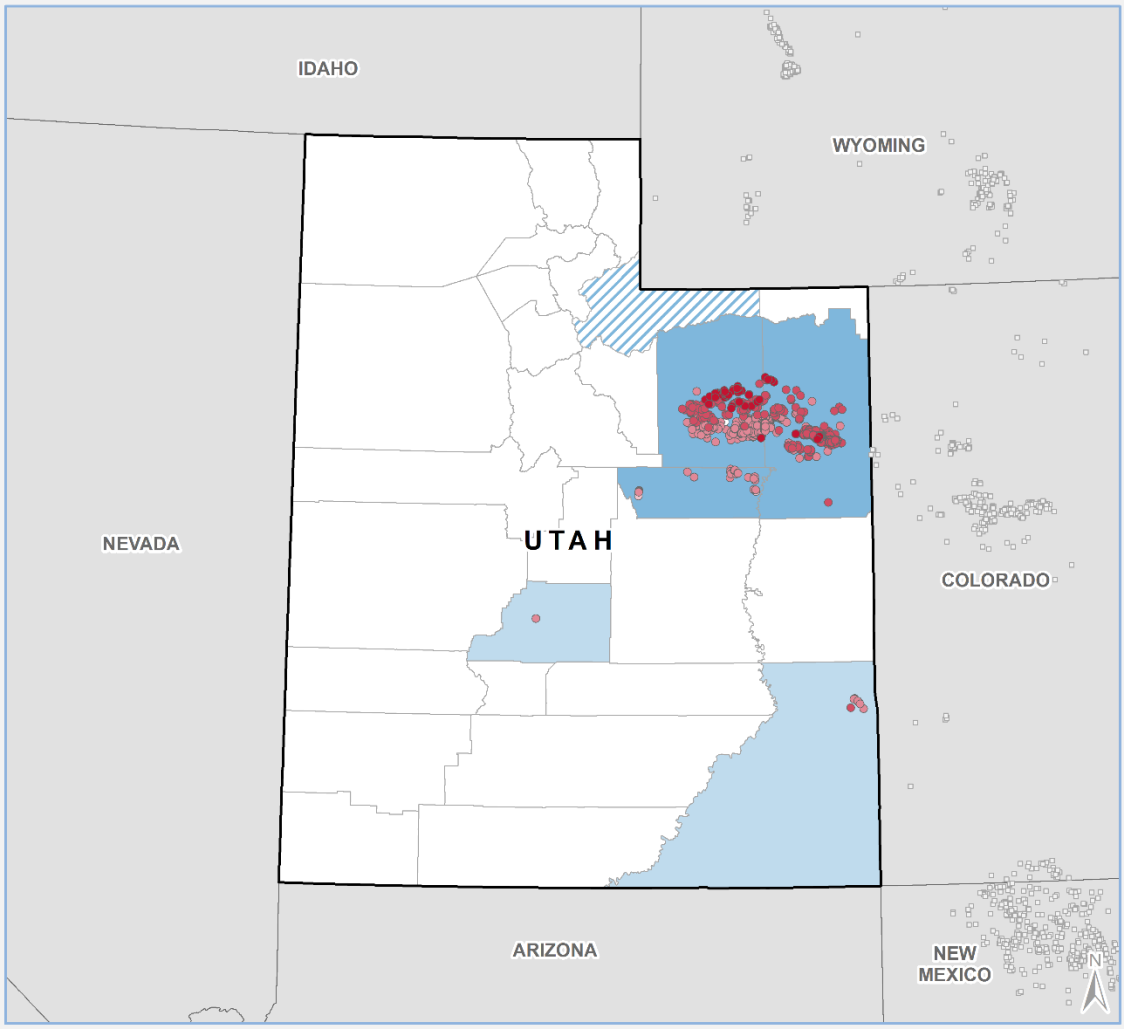
Total disclosures: 1,429 **Total water:** ~530 million gallons

Production type: 762 (53.3%) gas, 667 (46.7%) oil

Number of disclosures reported per month



Geographic Location of Disclosures



True Vertical Depth in feet (# of disclosures) *

- Not reported (2)
- < 4,000 (5)
- 4,001-8,000 (556)
- 8,001-12,000 (804)
- > 12,000 (47)
- Other states (2,815)

Median water volume per disclosure by county, millions of gallons (# of counties) *

- > 5.0 (0)
- 2.0 - 5.0 (0)
- 1.0 - 2.0 (0)
- 0.1 - 1.0 (3)
- ≤ 0.1 (2)
- No disclosures (23)
- Unconfirmed location for all wells (1)
- No volume data for all wells (0)

* Includes data from 1,429 (99.0%) FracFocus disclsoures that met quality assurance criteria-unique well identification and fracture date, within the date range 1/1/2011 through 2/28/2013, and with confirmed state location.

County locations for 15 (1.0%) disclosures were unconfirmed and excluded from county-level analyses.

0 Miles 100

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Ethylene glycol	107-21-1	1,065	0.061%	37%
Hydrochloric acid	7647-01-0	1,064	0.20%	16%
Citric acid	77-92-9	992	0.0049%	60%
Methanol	67-56-1	984	0.018%	30%
Tetrakis(hydroxymethyl)phosphonium sulfate	55566-30-8	945	0.028%	100%
Distillates, petroleum, hydrotreated light	64742-47-8	934	0.016%	30%
Water	7732-18-5	891	0.80%	50%
2-Butoxyethanol	111-76-2	663	0.0067%	7.0%
Isopropanol	67-63-0	661	0.028%	30%
Choline chloride	67-48-1	649	0.050%	80%
Guar gum	9000-30-0	538	0.16%	60%
Quartz	14808-60-7	503	0.012%	1.0%
2-Propenoic acid, polymer with 2-propenamide	9003-06-9	486	0.034%	70%
Peroxydisulfuric acid, diammonium salt	7727-54-0	483	0.0098%	100%
Naphthalene	91-20-3	478	0.0014%	1.5%
Sodium hydroxide	1310-73-2	466	0.013%	10%
Propargyl alcohol	107-19-7	456	0.00015%	5.0%
Nonyl phenol ethoxylate	9016-45-9	447	0.012%	10%
Diatomaceous earth, calcined	91053-39-3	435	0.029%	100%
N,N-Dimethylformamide	68-12-2	410	0.00029%	13%
Phosphonic acid	13598-36-2	395	0.00030%	1.0%
Tar bases, quinoline derivatives, benzyl chloride-quaternized	72480-70-7	376	0.00022%	10%
Poly(oxy-1,2-ethanediyl), alpha-(nonylphenyl)-omega-hydroxy-, branched	68412-54-4	373	0.00011%	5.0%
Cinnamaldehyde (3-phenyl-2-propenal)	104-55-2	368	0.00011%	5.0%
Triethyl phosphate	78-40-0	365	0.000070%	3.0%
Boron sodium oxide	1330-43-4	250	0.038%	30%
1-Butoxy-2-propanol	5131-66-8	217	0.014%	5.0%
Distillates, petroleum, hydrotreated light paraffinic	64742-55-8	217	0.085%	30%
Isotridecanol, ethoxylated	9043-30-5	217	0.014%	5.0%
Aminotrimethylene phosphonic acid	6419-19-8	202	0.0089%	30%

Ingredients from 176 (12.3%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 1,218 (85.2%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 202 (14.1%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Uintah	835	140	695	326,600,000	340,715	81,509	804,497
Duchesne	501	498	3	183,500,000	129,079	18,228	1,297,842
Carbon	60	0	60	14,660,000	234,643	122,492	363,483
San Juan	9	6	3	510,900	54,739	25,469	104,540
Sevier	1	1	0	77,860	77,859	77,859	77,859

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

VIRGINIA

State Background

Geology: The Appalachian Basin, which passes along the western edge of the state, is Virginia's primary source of hydrocarbon resources. Most drilling for conventional oil and gas takes place in the extreme southwestern corner of the state.[133,134] The same is true of shale gas production (from the Marcellus, Devonian Big Sandy, and Greater Siltstone plays),[135] tight gas production (from the Berea-Murrysville play),[136] and coalbed methane production (from formations that include the Pocahontas, the New River/Lee, and the Kanawha/Norton).[137,138,139]

Production: Gross natural gas production in Virginia in 2013 was 139,382 million cubic feet (mmcf), including 26,815 mmcf from gas wells, 9 mmcf from oil wells, 13,016 mmcf from shale gas wells, and 99,542 mmcf from coalbed wells.[140] In 2013, Virginia produced 8 thousand barrels of oil.[141]

Regulatory: FracFocus disclosure is voluntary; 90 disclosures submitted.

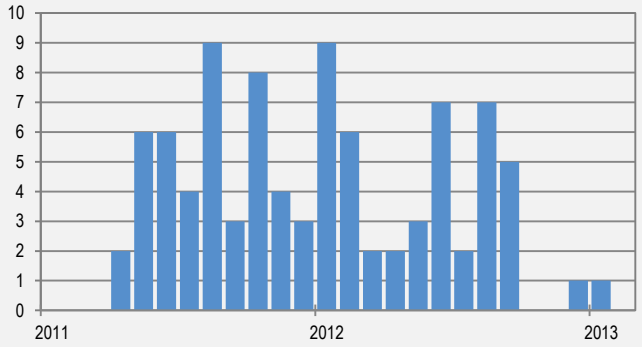
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

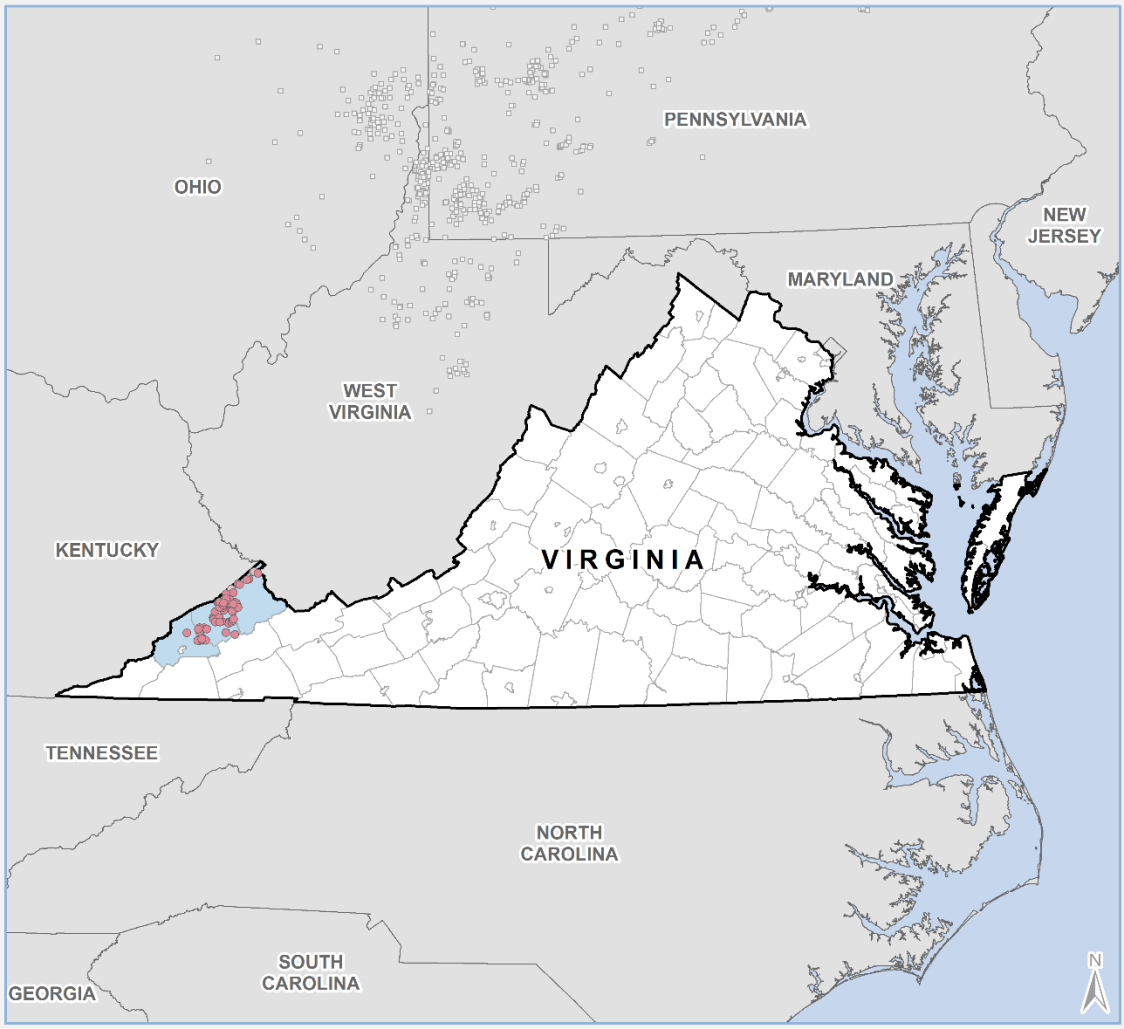
Total disclosures: 90 **Total water:** ~3.0 million gallons

Production type: 90 (100.0%) gas, 0 (0.0%) oil

Number of disclosures reported per month



Geographic Location of Disclosures



True Vertical Depth in feet (# of disclosures) *

- Not reported (0)
- < 4,000 (13)
- 4,001-8,000 (77)
- 8,001-12,000 (0)
- > 12,000 (0)
- Other states (1,216)

Median water volume per disclosure by county, millions of gallons (# of counties) *

- > 5.0 (0)
- 2.0 - 5.0 (0)
- 1.0 - 2.0 (0)
- 0.1 - 1.0 (0)
- ≤ 0.1 (3)
- No disclosures (131)
- Unconfirmed location for all wells (0)
- No volume data for all wells (0)

* Includes data from 90 (100.0%) FracFocus disclsoures that met quality assurance criteria-unique well identification and fracture date, within the date range 1/1/2011 through 2/28/2013, and with confirmed state location.

0 Miles 100

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
2-Butoxyethanol	111-76-2	70	0.00029%	20%
Hydrochloric acid	7647-01-0	68	0.0070%	15%
Citric acid	77-92-9	63	0.00013%	70%
Ethanol	64-17-5	50	0.00015%	15%
Methanol	67-56-1	48	0.00029%	30%
Choline chloride	67-48-1	45	0.00028%	75%
Water	7732-18-5	45	0.00011%	30%
Ammonia	7664-41-7	44	0.000097%	10%
Isopropanol	67-63-0	43	0.00048%	30%
Nonyl phenol ethoxylate	9016-45-9	25	0.000019%	10%
1,2-Propylene glycol	57-55-6	22	0.000014%	40%
2,2-Dibromo-3-nitrilopropionamide	10222-01-2	22	0.000046%	98%
Ethylene glycol	107-21-1	22	0.00029%	40%
Iron(II) sulfate heptahydrate	7782-63-0	22	0.000011%	30%
Propargyl alcohol	107-19-7	22	0.000014%	30%
2-bromo-3-nitrilopropionamide	1113-55-9	11	0.0000020%	5.0%
Hemicellulase enzyme	9012-54-8	11	0.0000070%	15%
Sodium erythorbate	6381-77-7	10	0.00034%	100%
1,2,4-Trimethylbenzene	95-63-6	7	0.0000020%	1.0%
Naphthalene	91-20-3	7	0.0000020%	1.0%
Poly(oxy-1,2-ethanediyl)-nonylphenyl-hydroxy (mixture)	127087-87-	7	0.000021%	10%
Sodium chloride	7647-14-5	7	0.00027%	30%
Solvent naphtha, petroleum, heavy arom.	64742-94-5	7	0.000062%	30%
Aminotrimethylene phosphonic acid	6419-19-8	6	0.0025%	30%
Diatomaceous earth, calcined	91053-39-3	6	0.0084%	100%
Phosphonic acid	13598-36-2	6	0.000084%	1.0%
Quartz	14808-60-7	6	0.000084%	1.0%
Ammonium chloride	12125-02-9	4	0.000073%	10%
Diethylene glycol	111-46-6	4	0.000047%	5.0%
Isooctanol	26952-21-6	4	0.000047%	5.0%
Nitrogen, liquid	7727-37-9	4	100%	100%

Ingredients from 11 (12.2%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 22 (24.4%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 4 (4.4%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Buchanan	36	0	36	1,268,000	33,243	20,559	52,605
Dickenson	34	0	34	1,562,000	37,430	16,865	113,089
Wise	7	0	7	190,700	29,946	9,043	39,421

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

WEST VIRGINIA

State Background

Geology: Conventional oil and gas is produced from the Appalachian Basin, which underlies West Virginia.[142,143] The Appalachian Basin in West Virginia is also a source of shale gas (from the Marcellus, Devonian Big Sandy, Devonian Low Thermal Maturity, and Greater Siltstone plays)[144] and tight gas (from the Berea-Murrysville, Bradford-Venango-Elk, and Medina/Clinton-Tuscarora plays).[145] The Marcellus may also be a source of shale oil.[146] The Appalachian Basin also includes coal resources that support limited coalbed methane production in West Virginia. [147,148,149]

Production: Gross natural gas production in West Virginia in 2013 was 717,892 million cubic feet (mmcf), including 170,067 mmcf from gas wells, and 547,825 mmcf from shale gas wells.[150] Coalbed methane production was 8,000 mmcf in 2013.[151] Oil production was 6,937 thousand barrels in 2013.[152]

Regulatory: State requires operators to disclose ingredients to state as of 12/14/2011 (22-6A-7) and to the state and FracFocus as of 7/1/2013 (35-8-10): 277 disclosures submitted.

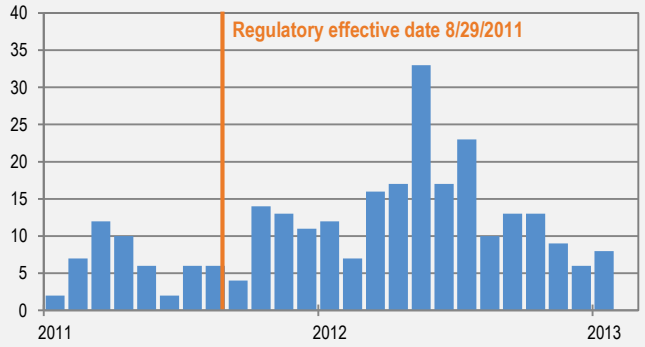
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

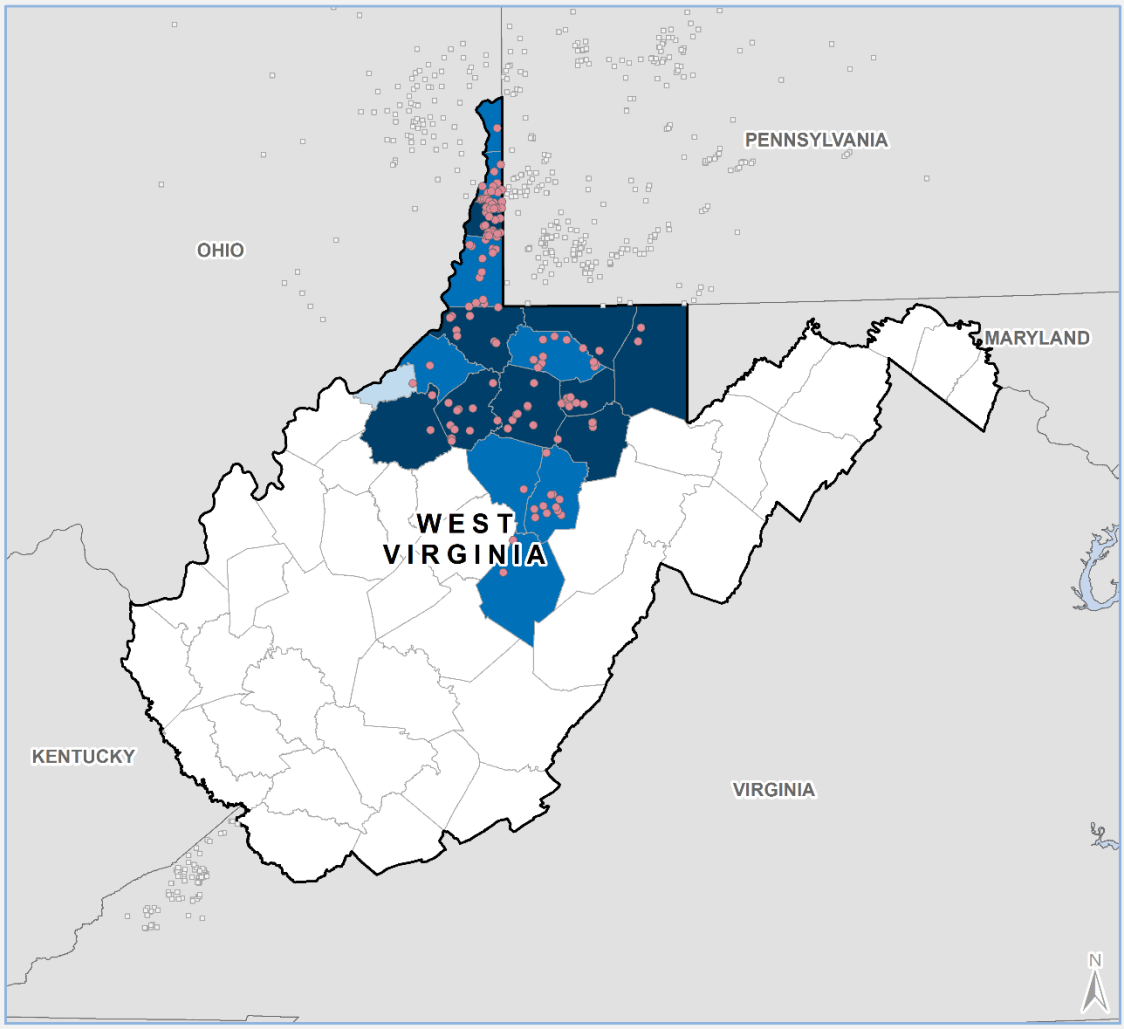
Total disclosures: 277 **Total water:** ~1.4 billion gallons

Production type: 277 (100.0%) gas, 0 (0.0%) oil

Number of disclosures reported per month



Geographic Location of Disclosures



True Vertical Depth in feet (# of disclosures) *

- Not reported (2)
- < 4,000 (0)
- 4,001-8,000 (271)
- 8,001-12,000 (0)
- > 12,000 (0)
- Other states (925)

Median water volume per disclosure by county, millions of gallons (# of counties) *

- > 5.0 (9)
- 2.0 - 5.0 (8)
- 1.0 - 2.0 (0)
- 0.1 - 1.0 (0)
- ≤ 0.1 (1)
- No disclosures (37)
- Unconfirmed location for all wells (0)
- No volume data for all wells (0)

* Includes data from 277 (96.9%) FracFocus disclsoures that met quality assurance criteria-unique well identification and fracture date, within the date range 1/1/2011 through 2/28/2013, and with confirmed state location.

County locations for 4 (1.4%) disclosures were unconfirmed and excluded from county-level analyses.

0 Miles 75

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Hydrochloric acid	7647-01-0	229	0.088%	15%
Distillates, petroleum, hydrotreated light	64742-47-8	196	0.025%	30%
Water	7732-18-5	172	0.55%	85%
Glutaraldehyde	111-30-8	169	0.0074%	60%
Methanol	67-56-1	153	0.00045%	40%
Ethylene glycol	107-21-1	141	0.0026%	35%
Propargyl alcohol	107-19-7	138	0.000090%	8.0%
Ethanol	64-17-5	130	0.0014%	5.0%
Peroxydisulfuric acid, diammonium salt	7727-54-0	128	0.0019%	100%
Citric acid	77-92-9	98	0.0028%	50%
Sodium erythorbate	6381-77-7	76	0.00042%	100%
Isopropanol	67-63-0	74	0.000080%	7.0%
2-Butoxyethanol	111-76-2	62	0.000080%	7.0%
Ethoxylated C12-16 alcohols	68551-12-2	57	0.0066%	7.0%
Guar gum	9000-30-0	55	0.024%	50%
Quartz	14808-60-7	53	10%	99%
Quaternary ammonium compounds, benzyl-C12-16-alkyldimethyl, chlorides	68424-85-1	53	0.00097%	7.0%
Sodium chloride	7647-14-5	53	0.0081%	10%
Ammonium chloride	12125-02-9	50	0.0057%	7.0%
Didecyl dimethyl ammonium chloride	7173-51-5	49	0.0014%	10%
Poly(oxy-1,2-ethanediyl), alpha-(nonylphenyl)-omega-hydroxy-, branched	68412-54-4	46	0.00011%	10%
2,2-Dibromo-3-nitrilopropionamide	10222-01-2	43	0.0082%	30%
N,N-Dimethylformamide	68-12-2	42	0.00043%	40%
Tar bases, quinoline derivatives, benzyl chloride-quaternized	72480-70-7	40	0.00012%	13%
Potassium hydroxide	1310-58-3	36	0.0011%	23%

Ingredients from 38 (13.7%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 109 (39.4%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 36 (13.0%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Ohio	45	0	45	245,200,000	5,509,812	3,406,789	7,881,980
Marshall	36	0	36	169,000,000	4,596,144	3,217,379	6,367,568
Doddridge	34	0	34	180,900,000	5,281,962	2,200,764	7,939,842
Marion	31	0	31	140,200,000	4,718,028	2,231,481	6,620,712
Wetzel	29	0	29	156,500,000	5,288,881	3,922,061	7,170,799
Brooke	26	0	26	109,500,000	4,222,596	3,128,344	5,722,616
Taylor	19	0	19	105,800,000	5,849,046	3,646,583	7,669,007
Upshur	17	0	17	69,820,000	4,081,094	643,516	7,880,985
Harrison	16	0	16	98,360,000	5,923,491	4,334,106	8,748,747
Barbour	7	0	7	39,820,000	5,299,900	2,721,541	8,103,067

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

WYOMING

State Background

Geology: Conventional oil and gas is produced across Wyoming, including the Wind River, Greater Green River, Hanna-Carbon, Bighorn, Powder River, and Denver basins.[153,154] The Powder River Basin is a major source of coal bed methane production; other coalbed methane resources are found in the Greater Green River, Wind River, and Hanna-Carbon basins.[155,156] Shale gas is produced from the Hilliard-Baxter-Mancos play.[157] Tight gas plays include the Mesaverde-Lance-Lewis, the Cretaceous, the Cretaceous-Lower Tertiary, and the Codell-Niobrara.[158]

Production: Gross natural gas production in 2013 in Wyoming was 2,047,757 million cubic feet (mmcf) including 1,673,667 mmcf from gas wells, 29,134 mmcf from oil wells, 16,175 mmcf from shale gas wells, and 328,780 mmcf from coalbed methane wells.[159] Crude oil production in 2013 was 63,372 thousand barrels.[160]

Regulatory: State requires operators to disclose ingredients to the state as of 8/17/2010 (WY code Ch. 3, Sec. 45). Reporting to FracFocus is voluntary: 1,457 disclosures submitted.

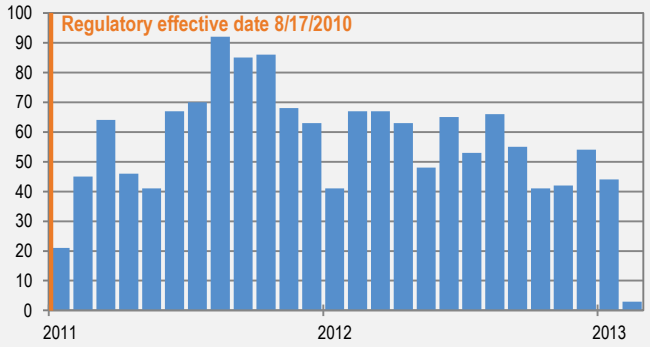
Data Reported to FracFocus 1.0

Disclosures with fracture dates from 1/1/2011 through 2/28/2013

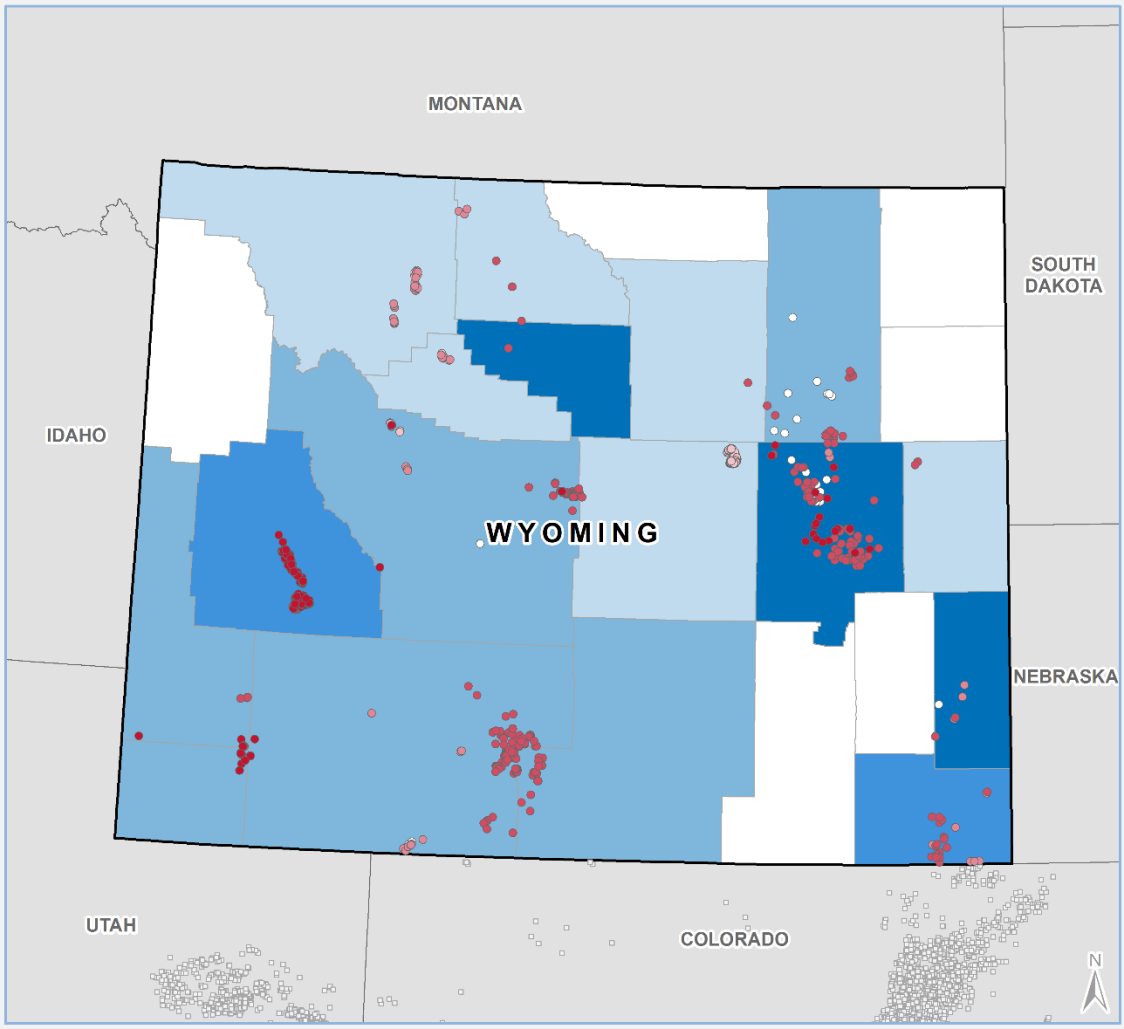
Total disclosures: 1,457 **Total water:** ~1.1 billion gallons

Production type: 1,018 (69.9%) gas, 439 (30.1%) oil

Number of disclosures reported per month



Geographic Location of Disclosures



True Vertical Depth in feet (# of disclosures) *

- Not reported (51)
- < 4,000 (273)
- 4,001-8,000 (104)
- 8,001-12,000 (511)
- > 12,000 (476)
- Other states (4,217)

Median water volume per disclosure by county, millions of gallons (# of counties) *

- > 5.0 (0)
- 2.0 - 5.0 (3)
- 1.0 - 2.0 (2)
- 0.1 - 1.0 (6)
- ≤ 0.1 (6)
- No disclosures (6)
- Unconfirmed location for all wells (0)
- No volume data for all wells (0)

* Includes data from 1,457 (97.5%) FracFocus disclsoures that met quality assurance criteria-unique well identification and fracture date, within the date range 1/1/2011 through 2/28/2013, and with confirmed state location.

County locations for 42 (2.9%) disclosures were unconfirmed and excluded from county-level analyses.

0 Miles 100

Additive Ingredients in Fracturing Fluid Most Frequently Reported to FracFocus 1.0

EPA standardized chemical name	CAS Registry Number	Number of disclosures	Median of max concentration by mass in HF fluid	Median of max concentration by mass in additive
Guar gum	9000-30-0	823	0.24%	60%
Peroxydisulfuric acid, diammonium salt	7727-54-0	771	0.0098%	100%
Sodium hydroxide	1310-73-2	688	0.024%	30%
Distillates, petroleum, hydrotreated light	64742-47-8	612	0.0067%	30%
Isopropanol	67-63-0	516	0.035%	30%
Methanol	67-56-1	460	0.029%	35%
Solvent naphtha, petroleum, heavy arom.	64742-94-5	415	0.0087%	10%
Naphtha, petroleum, hydrotreated heavy	64742-48-9	384	0.21%	60%
Acetic acid	64-19-7	375	0.0042%	30%
Formic acid, potassium salt	590-29-4	361	0.050%	60%
Quartz	14808-60-7	356	0.0011%	15%
Ammonium acetate	631-61-8	323	0.013%	100%
Tetramethylammonium chloride	75-57-0	315	0.094%	40%
Sodium persulfate	7775-27-1	308	0.0035%	100%
Ethanol	64-17-5	298	0.047%	60%
Sodium hypochlorite	7681-52-9	282	0.0094%	30%
Sodium chloride	7647-14-5	274	0.031%	30%
Sodium chlorite	7758-19-2	271	0.0095%	10%
Sodium tetraborate decahydrate	1303-96-4	265	0.048%	30%
Glutaraldehyde	111-30-8	260	0.0070%	25%
Bronopol	52-51-7	255	0.0015%	100%
Methenamine	100-97-0	252	0.092%	2.0%
N,N-Dimethyldecylamine oxide	2605-79-0	236	0.023%	10%
Naphthalene	91-20-3	227	0.0035%	5.0%
Triethanolamine	102-71-6	224	0.088%	100%
Tetrakis(hydroxymethyl)phosphonium sulfate	55566-30-8	220	0.0072%	100%

Ingredients from 259 (17.8%) disclosures were excluded from this summary due to invalid CAS Registry Numbers.
At least one CBI ingredient record was found in 1,050 (72.1%) disclosures in this summary. These ingredients were excluded from this analysis.
Each additive ingredient in this table was found in at least 220 (15.1%) disclosures in this state summary.
Water and quartz were reported as ingredients in some fracturing fluid additives as well as base fluids and proppants.

Reported Water Volume by County

County	Number of disclosures with valid volumes	Number of oil disclosures	Number of gas disclosures	Cumulative water volume (gallons)	Water volume per disclosure (gallons)		
					Median	5th percentile	95th percentile
Sublette	474	0	474	629,600,000	1,099,287	675,704	3,464,024
Sweetwater	321	5	316	84,850,000	229,974	79,090	435,011
Natrona	226	222	4	3,664,000	5,648	5,032	7,685
Converse	98	41	57	230,100,000	2,303,838	866,463	4,693,910
Fremont	85	37	48	56,370,000	273,651	13,706	1,875,955
Park	56	56	0	1,803,000	28,412	15,488	41,300
Carbon	48	0	48	8,910,000	182,173	70,660	285,534
Campbell	28	17	11	27,760,000	964,350	166,791	2,092,830
Laramie	23	15	8	36,630,000	1,561,077	77,990	3,326,760

This state summary reflects information found in FracFocus 1.0 disclosures in PDF format (not machine readable files) and other publicly available sources of information. Neither the states nor the GWPC verified the data shown in the summaries, and the information and figures presented in the state summaries may differ from information held by the states. Ingredient names in this summary were standardized and may be different than those reported by operators in the original FracFocus disclosures.

References for State Summaries of FracFocus Hydraulic Fracturing Data

[1] U.S. Energy Information Administration (EIA). 2013. Gas Production in Conventional Fields, Lower 48 States. http://www.eia.gov/oil_gas/rpd/conventional_gas.pdf Accessed April 18, 2014

[2] U.S. EIA. 2013. Alabama: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=AL. Accessed April 7, 2014

[3] Pashin, J., D.E. Raymond. No date. Glacial-Eustatic Control of Coalbed Methane Reservoir Distribution. (Pottsville Formation; Lower Pennslvanian) in the Black Warrior Basin of Alabama. Geological Survey of Alabama. http://www.gsa.state.al.us/CO2/SECARB2/secarb2_files/0413%20Pashin.pdf . Accessed on April 14, 2014.

[4] Institude for Energy Research. 2013. Sweet Crude Alabama: Another U.S. State Benefits from Energy Boom. Posted March 25, 2013 at http://www.instituteforenergyresearch.org/2013/03/25/want-affordable-energy-ask-alabama/ Accessed April 14, 2014.

[5] Pashin, Jack C. 2008. Gas Shale Potential of Alabama. In Proceedings of the 2008 International Coalbed and Shale Gas Symposium. http://www.gsa.state.al.us/gsa/0808Pashin.pdf . Accessed November 8, 2013

[6] U.S. EIA. 2015. Petroleum and other Liquids. Volume in Annual Thousand Barrels. Data Series: Crude Oil Production. Release date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm. Accessed March 6, 2015.

[7] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Volume in million cubic feet. Area: Alabama. Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_sal_a.htm. Accessed March 6, 2015.

[8] Alaska Oil and Gas Conservation Commission. 2015. Division of Oil and Gas http://www.dog.dnr.alaska.gov/GIS/ActivityMaps.htm#resource. Accessed March 2, 2015.

[9] Flores, R.M., G.D. Stricker and S.A. Kinney. 1977. United States Geological Survey (USGS). Alaska Coal Geology, Resources, and Coalbed Methane Potential. http://pubs.usgs.gov/dds/dds-077/dds77text.html#heading154714632 Accessed. April 14, 2014

[10] U.S. Geological Survey. 2005. Alaska Coal Geology, Resources, and Coalbed Methane Potential. http://pubs.usgs.gov/dds/dds-077/dds77text.html#heading127857128 Accessed April 15, 2014.

[11] LNG World News. 2012. USGS: Alaskan North Slope May Hold Up to 80 Tcf of Shale Gas. Posted Feb. 28, 2014 at http://www.lngworldnews.com/usgs-alaskan-north-slope-may-hold-up-to-80-tcf-of-shale-gas/. Accessed April 14, 2014

[12] Stanley, R.G., Pierce, B.S., and Houseknecht, D.W. 2011. U.S. Geological Survey 2011 Assessment of Undiscovered Oil and Gas Resources of the Cook Inlet Region, South-Central Alaska: U.S. Geological Survey Open-File Report 2011–1237, 37 p., available at http://pubs.usgs.gov/of/2011/1237/. Accessed Nov. 8, 2013.

[13] Houseknecht, David W. 2012. Assessment of Potential Oil and Gas Resources in Source Rocks (Shale) of the Alaska North Slope 2012 – Overview of Geology and Results. U.S. Geological Survey. http://energy.usgs.gov/Portals/0/Rooms/audiovisual/AK_ShaleResourcesRelease_pdfweb_mar2012.pdf. Accessed Nov. 8, 2013.

[14] Stanley, R.G., Pierce, B.S., and Houseknecht, D.W. 2011. U.S. Geological Survey 2011 Assessment of Undiscovered Oil and Gas Resources of the Cook Inlet Region, South-Central Alaska: U.S. Geological Survey Open-File Report 2011–1237, 37 p., available at http://pubs.usgs.gov/of/2011/1237/. Accessed Nov. 8, 2013.

[15] Houseknecht, David W. 2012. Assessment of Potential Oil and Gas Resources in Source Rocks (Shale) of the Alaska North Slope 2012 – Overview of Geology and Results. U.S. Geological Survey. http://energy.usgs.gov/Portals/0/Rooms/audiovisual/AK_ShaleResourcesRelease_pdfweb_mar2012.pdf. Accessed Nov. 8, 2013.

[16] U.S. EIA. 2015. Petroleum and other Liquids. Crude Oil Production. Volume in Annual Thousand Barrels. Release date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm . Accessed March 6, 2015.

[17] U.S. EIA. 2015. Natural Gas. Gross Withdrawals and Production. Volume in Million Cubic Feet. Data Series: Gross Withdrawals from Gas Wells. Area: Alaska. Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_sak_a.htm Accessed March .

[18] U.S. EIA. 2015. Natural Gas. Gross Withdrawals and Production. Volume in Million Cubic Feet. Data Series: Gross Withdrawals from Gas Wells. Area: Alaska. Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_sak_a.htm Accessed March 6, 2015.

[19] U.S. EIA. 2014. Natural Gas. Shale Gas. Volume in Billion Cubic Feet. Period. Annual. http://www.eia.gov/dnav/ng/ng_prod_shalegas_s1_a.htm Release date: December 4, 2014. Accessed March 6, 2015.

[20] U.S. EIA. 2013. Profile Analysis. Accessed April 7, 2014. http://www.eia.gov/state/analysis.cfm?sid=AR

[21] Arkansas Geological Survey. 2014. http://www.geology.ar.gov/energy/natural_gas.htm Accessed April 14, 2014.

[22] Fayetteville Shale Economic Impact Study. 2006. University of Arkansas. Website accessed on April 1, 2014 at http://cber.uark.edu/FayettevilleShaleEconomicImpactStudy.pdf

[23] U.S. EIA. 2013. Profile Analysis. Accessed April 7, 2014. http://www.eia.gov/state/analysis.cfm?sid=AR

[24] Arkansas Geological Survey. 2014. http://www.geology.ar.gov/energy/natural_gas.htm Accessed April 14, 2014.

[25] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Volumes in Million Cubic Feet. Arkansas. Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_sar_a.htm Accessed March 6, 2015.

[26] Arkansas Geological Survey. 2014. http://www.geology.ar.gov/energy/natural_gas.htm Accessed April 14, 2014.

[27] Arkansas Geological Survey. 2014. http://www.geology.ar.gov/energy/oil.htm Accessed April 14, 2014.

[28] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Volumes in Million Cubic Feet. Arkansas. Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_sar_a.htm Accessed March 6, 2015.

[29] U.S. EIA 2014. Natural Gas: Coalbed Methane. Volumes in billion cubic feet. Period: Annual. Release date December 4, 2014. http://www.eia.gov/dnav/ng/ng_enr_coalbed_dcu_SAR_a.htm. Accessed March 6, 2015

[30] U.S. EIA. 2015. Crude Oil Production. Period- Annual- Unit: Thousand Barrels. Release date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm Accessed March 6, 2015.
[31] U.S. EIA. 2013. California: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=CA Accessed April 7, 2014
[32] U.S. EIA. 2013. Gas Production in Conventional Fields, Lower 48 States. http://www.eia.gov/oil_gas/rpd/conventional_gas.pdf Accessed April 18, 2014
[33] U.S. EIA. 2011. *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays.* July 2011. Prepared by Intek, Inc., in December 2010 for EIA Office of Energy Analysis. http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf. Accessed Nov. 8 2013.
[34] U.S. EIA. 2015. Petroleum and other Liquids. Crude Oil Production. Annual-Thousand Barrels. Release date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm . Accessed March 6, 2015.
[35] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Volume in million cubic Feet. Area: California. Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_sca_a.htm Accessed March 6, 2015.
[36] U.S. EIA. 2013. Colorado: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=CO Accessed April 7, 2014
[37] U.S. EIA. 2013. Colorado: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=CO Accessed April 7, 2014
[38] U.S. EIA. 2013. Gas Production in Conventional Fields, Lower 48 States. http://www.eia.gov/oil_gas/rpd/conventional_gas.pdf Accessed April 18, 2014
[39] U.S. EIA. 2011. *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays.* July 2011. Prepared by Intek, Inc., in December 2010 for EIA Office of Energy Analysis. http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf. Accessed Nov. 8, 2013.
[40] U.S. EIA. 2010. Major Tight Gas Plays, Lower 48 States. Updated June 6, 2010. www.eia.gov/oil_gas/rpd/tight_gas.pdf. Accessed Nov. 8, 2013.
[41] U.S. EIA. 2015. Petroleum and other Liquids. Volume in Annual-Thousand Barrels. Crude Oil Production. Release date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm Accessed March 6, 2015.
[42] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Volume in million cubic feet. Area: Colorado. Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_sco_a.htm . Accessed March 6, 2015.
[43] U.S. EIA. 2013. Kansas. Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=KS. Accessed April 6, 2014.
[44] Evans, Catherine S., and K. David Newell. 2013. The Mississippian Limestone Play in Kansas: Oil and Gas in a Complex Geologic Setting. Kansas Geological Survey. Public Information Circular 33. March 2013. 6 pp. http://www.kgs.ku.edu/Publications/PIC/PIC33.pdf Accessed Nov. 8, 2013.
[45] Newell, K.D. , R.S. Sawin and L.L. Brady. 2012. Natural Gas from Coal in Eastern Kansas. Kansas Geological Survey, Public Information Circular (PIC) 19. http://www.kgs.ku.edu/Publications/pic19/pic19_1.html Accessed April 14, 2014.
[46] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Volumes in Million Cubic Feet. Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_sks_a.htm . Accessed March 6, 2015.
[47] U.S., EIA 2014. Natural Gas: Shale Gas Production. Period – Annual. Release date December 4, 2014. http://www.eia.gov/dnav/ng/ng_prod_shalegas_s1_a.htm. Accessed March 6, 2015.
[48] U.S. EIA. 2015. Crude Oil Production. Period-Unit: Annual-Thousand Barrels. Release date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm Accessed March 6, 2015.
[49] U.S. EIA. 2013. Louisiana: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=LA Accessed April 7, 2014
[50] U.S.EIA. 2011. *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays.* July 2011. Prepared by Intek, Inc., in December 2010 for EIA Office of Energy Analysis. http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf. Accessed Nov. 8, 2013.
[51] Louisiana Department of Natural Resources. 2015. Tuscaloosa Marine Shale http://dnr.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&pid=909. Accessed March 2, 2015
[52] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Area: Louisiana. Period: Annual. Updated February 27, 2015.. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_sla_a.htm . Accessed March 6, 2015.
[53] U.S. EIA. 2015. Petroleum and Other Liquids. Crude Oil Production. Period-Unit Annual Thousand Barrels. Release date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm . Accessed March 6, 2015.
[54] Michigan Oil & Gas Producers Education Foundation (no date). Site accessed April 17, 2014 http://www.mogpef.org/Exploration/GeologicalFormationsinMichigan.aspx
[55] U.S. EIA. 2011. *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays.* July 2011. Prepared by Intek, Inc., in December 2010 for EIA Office of Energy Analysis. http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf. Accessed Nov. 8, 2013.
[56] U.S. EIA. 2013. Michigan: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=MI Accessed April 7, 2014
[57] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Michigan. Volumes in Million Cubic Feet. Release Date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_smi_a.htm Accessed March 6, 2015.
[58] U.S. EIA. 2015. Petroleum and Other Liquids. Crude Oil Production. Period-Unit. Annual Thousand Barrels. Release Date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm Accessed March 6, 2015.
[59] Mississippi Department of Environmental Quality, Surface Geology Division. 2009. Structural Features of Mississippi (map). http://www.deq.state.ms.us/Mdeq.nsf/pdf/Geology_StructureFeatMS072009/$File/Struc_Feat_MS.pdf?OpenElement. Accessed April 18, 2014.
[60] U.S. EIA. 2013. Mississippi: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=MS Accessed April 7, 2014
[61] U.S. EIA. 2011. *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays.* July 2011. Prepared by Intek, Inc., in December 2010 for EIA Office of Energy Analysis. http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf. Accessed Nov. 8, 2013.
[62] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Volumes in Million Cubic Feet. Mississippi. Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_sms_a.htm Accessed March 6, 2015.
[63] U.S. EIA. 2010. Major Tight Gas Plays, Lower 48 States. Updated June 6, 2010. www.eia.gov/oil_gas/rpd/tight_gas.pdf. Accessed Nov. 8, 2013
[64] Louisiana Department of Natural Resources. 2015. Tuscaloosa Marine Shale http://dnr.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&pid=909. Accessed March 2, 2015

[65] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Volumes in Million Cubic Feet. Mississippi. Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_sms_a.htm Accessed March 6, 2015.
[66] U.S. EIA 2014. Natural Gas: Shale Gas Production. Period: Annual. Volumes in Billion Cubic Feet. Release date December 4, 2014. http://www.eia.gov/dnav/ng/ng_prod_shalegas_s1_a.htm. Accessed March 6, 2015.
[67] U.S. EIA. 2015. Petroleum and Other Liquids. Crude Oil Production. Period: Annual-Thousand Barrels. Release date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm Accessed March 6, 2015.
[68] U.S. EIA. 2013. Montana: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=MT Accessed April 7, 2014
[69] USGS. 2008. Assessment of Undiscovered Oil Resources in the Devonian-Mississippian Bakken Formation, Williston Basin Province, Montana and North Dakota, http://pubs.usgs.gov/fs/2008/3021/pdf/FS08-3021_508.pdf. Accessed April 18, 2014
[70] U.S. EIA. 2013. Montana: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=MT Accessed April 7, 2014
[71] U.S. EIA. 2013. Gas Production in Conventional Fields, Lower 48 States. http://www.eia.gov/oil_gas/rpd/conventional_gas.pdf Accessed April 18, 2014
[72] U.S. EIA. 2013. Montana: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=MT Accessed April 7, 2014
[73] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Volumes in Million Cubic Feet. Area: Montana. Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_smt_a.htm . Accessed March 6, 2015.
[74] U.S. EIA. 2010. Major Tight Gas Plays, Lower 48 States. Updated June 6, 2010. www.eia.gov/oil_gas/rpd/tight_gas.pdf. Accessed Nov. 8, 2013.
[75] ALL Consulting. 2002. Handbook on Best Management Practices and Mitigation Strategies for Coal Bed Methane in the Montana Portion of the Powder River Basin. http://bogc.dnrc.mt.gov/PDF/BMPHandbookFinal.pdf. Accessed April 18, 2014.
[76] U.S. EIA. 2013. Coalbed Methane Fields, Lower 48 States. http://www.eia.gov/oil_gas/rpd/coalbed_gas.pdf Accessed April 18, 2014
[77] U.S. EIA. 2013. Montana: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=MT Accessed April 7, 2014
[78] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Volumes in Million Cubic Feet. Area: Montana. Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_smt_a.htm . Accessed March 6, 2015.
[79] U.S. EIA. 2015. Petroleum and Other Liquids. Crude Oil Production. Montana. Period-Unit. Annual Thousand Barrels. Release date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm Accessed March 6, 2015.
[80] U.S. EIA. 2011. *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays.* July 2011. Prepared by Intek, Inc., in December 2010 for EIA Office of Energy Analysis. http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf. Accessed April 18, 2014.
[81] U.S. EIA. 2013. Gas Production in Conventional Fields, Lower 48 States. http://www.eia.gov/oil_gas/rpd/conventional_gas.pdf. Accessed April 18, 2014
[82] U.S. EIA. 2010. Major Tight Gas Plays, Lower 48 States. Updated June 6, 2010. www.eia.gov/oil_gas/rpd/tight_gas.pdf. Accessed Nov. 8, 2013.
[83] U.S. EIA. 2009. Coalbed Methane Fields, Lower 48 States. Updated Apr. 8, 2009. http://www.eia.gov/oil_gas/rpd/coalbed_gas.jpg. Accessed Nov. 12, 2013.
[84] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Volumes in Million Cubic Feet. Area: New Mexico. Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_snm_a.htm . Accessed March 6, 2015.
[85] U.S. EIA. 2015. Petroleum and Other Liquids. Crude Oil Production. Period-Unit: Annual-Thousand Barrels. Release date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm Accessed March 6, 2015.
[86] U.S. EIA. 2013. North Dakota: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=ND Accessed April 7, 2014
[87] U.S. EIA. 2013. Gas Production in Conventional Fields, Lower 48 States. http://www.eia.gov/oil_gas/rpd/conventional_gas.pdf. Accessed April 18, 2014
[88] USGS. 2008. Assessment of Undiscovered Oil Resources in the Devonian-Mississippian Bakken Formation, Williston Basin Province, Montana and North Dakota, http://pubs.usgs.gov/fs/2008/3021/pdf/FS08-3021_508.pdf. Accessed April 18, 2014
[89] U.S. EIA. 2011. Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays. July 2011. Prepared by Intek, Inc., in December 2010 for EIA Office of Energy Analysis. http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf. Accessed Nov. 8, 2013
[90] U.S. EIA. 2010. Major Tight Gas Plays, Lower 48 States. Updated June 6, 2010. www.eia.gov/oil_gas/rpd/tight_gas.pdf. Accessed April 8, 2014.
[91] U.S. EIA. 2015 Natural Gas Gross Withdrawals and Production. Volumes in Million Cubic Feet. Area: North Dakota. Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_snd_a.htm. Accessed March 6, 2015.
[92] U.S. EIA. 2015. Petroleum and Other Liquids. Crude Oil Production. Period-Unit: Annual-Thousand Barrels. Release date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm Accessed March 6, 2015.
[93] U.S. EIA. 2013. Ohio: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=OH Accessed April 7, 2014
[94] U.S. EIA. 2009. Gas Production in Conventional Fields, Lower 48 States. http://www.eia.gov/oil_gas/rpd/conventional_gas.pdf Accessed April 14, 2014.
[95] U.S. EIA. 2009. Gas Production in Conventional Fields, Lower 48 States. http://www.eia.gov/oil_gas/rpd/conventional_gas.pdf Accessed April 14, 2014.
[96] U.S. EIA. 2011. *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays.* July 2011. Prepared by Intek, Inc., in December 2010 for EIA Office of Energy Analysis. http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf. Accessed Nov. 8, 2013
[97] Ohio EPA. 2014. Drilling for Natural Gas in the Marcellus and Utica Shales: Environmental Regulatory Basics. http://oilandgas.ohiodnr.gov/portals/oilgas/pdf/EPA-fact-sheets/DrillingforNaturalGasintheMarcellusandUticaShales_EnvironmentalRegulatoryBasics.pdf Accessed April 14, 2014.
[98] U.S. EIA. 2010. Major Tight Gas Plays, Lower 48 States. Released June 6, 2010. www.eia.gov/oil_gas/rpd/tight_gas.pdf. Accessed April 8, 2014.
[99] USGS. 2012. Assessment of Undiscovered Oil and Gas Resources of the Ordovician Utica Shale of the Appalachian Basin Province, 2012. http://pubs.usgs.gov/fs/2012/3116/. Accessed April 18, 2014.
[100] U.S. EIA. 2015. Petroleum and Other Liquids. Crude Oil Production. Period-Unit: Annual-Thousand Barrels. Release date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm Accessed March 6, 2015.

[101] U.S. EIA. 2013. Oklahoma: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=OK. Accessed April 7, 2014
[102] U.S. EIA. 2009. Gas Production in Conventional Fields, Lower 48 States. http://www.eia.gov/oil_gas/rpd/conventional_gas.pdf Accessed April 14, 2014.
[103] U.S.EIA. 2011. *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays.* July 2011. Prepared by Intek, Inc., in December 2010 for EIA Office of Energy Analysis. http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf. Accessed Nov. 8, 2013.
[104] U.S. EIA. 2010. Major Tight Gas Plays, Lower 48 States. Updated June 6, 2010. www.eia.gov/oil_gas/rpd/tight_gas.pdf. Accessed Nov. 8, 2013.
[105] U.S. EIA. 2009. Coalbed Methane Fields, Lower 48 States. Updated Apr. 8, 2009. http://www.eia.gov/oil_gas/rpd/coalbed_gas.jpg. Accessed Nov. 12, 2013.
[106] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Area: Oklahoma. Period: Annual. Updated February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_sok_a.htm. Accessed March 6, 2015.
[107] U.S. EIA. 2015. Petroleum and Other Liquids. Crude Oil Production. Period-Unit Annual Thousand Barrels. Release date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm . Accessed March 6, 2015.
[108] U.S. EIA. 2011. *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays.* July 2011. Prepared by Intek, Inc., in December 2010 for EIA Office of Energy Analysis. http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf. Accessed Nov. 8, 2013
[109] Ohio EPA. 2014. Drilling for Natural Gas in the Marcellus and Utica Shales: Environmental Regulatory Basics. http://oilandgas.ohiodnr.gov/portals/oilgas/pdf/EPA-fact-sheets/DrillingforNaturalGasintheMarcellusandUticaShales_EnvironmentalRegulatoryBasics.pdf Accessed April 14, 2014.
[110] U.S. EIA. 2010. Major Tight Gas Plays, Lower 48 States. Updated June 6, 2010. www.eia.gov/oil_gas/rpd/tight_gas.pdf. Accessed Nov. 8, 2013.
[111] U.S. EIA. 2013. Gas Production in Conventional Fields, Lower 48 States. http://www.eia.gov/oil_gas/rpd/conventional_gas.pdf Accessed April 18, 2014
[112] U.S. EIA. 2013. Pennsylvania: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=PA Accessed April 7, 2014
[113] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Area: Pennsylvania. Period: Annual. Updated February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_spa_a.htm . Accessed March 6, 2015.
[114] U.S. EIA 2014. Natural Gas: Coalbed Methane. Period: Annual. Volumes in Billion Cubic Feet. Release date December 4, 2014. http://www.eia.gov/dnav/ng/ng_enr_coalbed_dcu_SPA_a.htm. Accessed March 6, 2015.
[115] U.S. EIA. 2015. Petroleum and Other Liquids. Crude Oil Production. Period-Unit Annual Thousand Barrels. Release date February 27, 3015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm . Accessed March 6, 2015.
[116] U.S. EIA. 2013. Texas. Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=TX Accessed April 6, 2014
[117] U.S. EIA. 2009. Gas Production in Conventional Fields, Lower 48 States. http://www.eia.gov/oil_gas/rpd/conventional_gas.pdf Accessed April 14, 2014.
[118] U.S. EIA. 2011. *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays.* July 2011. Prepared by Intek, Inc., in December 2010 for EIA Office of Energy Analysis. http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf. Accessed Nov. 8, 2013.
[119] U.S. EIA. 2011. *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays.* July 2011. Prepared by Intek, Inc., in December 2010 for EIA Office of Energy Analysis. http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf. Accessed Nov. 8, 2013.
[120] U.S. EIA. 2010. Major Tight Gas Plays, Lower 48 States. Updated June 6, 2010. www.eia.gov/oil_gas/rpd/tight_gas.pdf. Accessed Nov. 8, 2013.
[121] U.S. EIA. 2010. Major Tight Gas Plays, Lower 48 States. Updated June 6, 2010. www.eia.gov/oil_gas/rpd/tight_gas.pdf. Accessed Nov. 8, 2013.
[122] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Area: Texas. Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_stx_a.htm . Accessed March 6, 2015.
[123] U.S. EIA 2014. Natural Gas: Coalbed Methane. Period: Annual. Volumes in Billion Cubic Feet. Release date December 4, 2014. http://www.eia.gov/dnav/ng/ng_enr_coalbed_dcu_STX_a.htm. Accessed March 6, 2015.
[124] U.S. EIA. 2015. Petroleum and Other Liquids. Crude Oil Production. Period-Unit Annual Thousand Barrels. Release date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm . Accessed March 6, 2015.
[125] U.S. EIA. 2013. Utah: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=UT. Accessed April 7, 2014
[126] U.S. EIA. 2009. Gas Production in Conventional Fields, Lower 48 States. http://www.eia.gov/oil_gas/rpd/conventional_gas.pdf Accessed April 14, 2014.
[127] U.S.EIA. 2011. *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays.* July 2011. Prepared by Intek, Inc., in December 2010 for EIA Office of Energy Analysis. http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf. Accessed Nov. 8, 2013.
[128] U.S. EIA. 2010. Major Tight Gas Plays, Lower 48 States. Updated June 6, 2010. www.eia.gov/oil_gas/rpd/tight_gas.pdf. Accessed Nov. 8, 2013.
[129] U.S. EPA. 2004. Evaluation of Impacts to Underground Sources June 2004 of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs, Attachment 4. The Uinta Basin http://www.epa.gov/ogwdw/uic/pdfs/cbmstudy_attach_uic_attach04_uinta.pdf Accessed April 14, 2014
[130] U.S. EIA. 2009. Coalbed Methane Fields, Lower 48 States. Updated Apr. 8, 2009. http://www.eia.gov/oil_gas/rpd/coalbed_gas.jpg. Accessed Nov. 12, 2013.
[131] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Area: Utah Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_sut_a.htm . Accessed March 6, 2015.
[132] U.S. EIA. 2015. Petroleum and Other Liquids. Crude Oil Production. Period-Unit Annual Thousand Barrels. Release date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm . Accessed March 6, 2015.
[133] U.S. EIA. 2013. Gas Production in Conventional Fields, Lower 48 States. http://www.eia.gov/oil_gas/rpd/conventional_gas.pdf Accessed April 18, 2014
[134] U.S. EIA. 2013. Virginia: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=VA Accessed April 7, 2014
[135] U.S.EIA. 2011. *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays.* July 2011. Prepared by Intek, Inc., in December 2010 for EIA Office of Energy Analysis. http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf. Accessed Nov. 8, 2013.
[136] U.S. EIA. 2010. Major Tight Gas Plays, Lower 48 States. Updated June 6, 2010. www.eia.gov/oil_gas/rpd/tight_gas.pdf. Accessed Nov. 8, 2013.

[137] U.S. EIA. 2009. Coalbed Methane Fields, Lower 48 States. Updated Apr. 8, 2009. http://www.eia.gov/oil_gas/rpd/coalbed_gas.jpg. Accessed Nov. 12, 2013.
[138] U.S. EIA. 2007. U.S. Coalbed Methane. Panel 1 of 2. Map. http://www.eia.gov/oil_gas/rpd/cbmusa1.pdf . Accessed Nov. 13, 2013.
[139] U.S. EPA. 2004. Evaluation of Impacts to Underground Sources June 2004 of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs. Attachment 6. The Central Appalachian Coal Basin http://www.epa.gov/ogwdw/uic/pdfs/cbmstudy_attach_uic_attach06_cent_appalach.pdf. Accessed April 18, 2014
[140] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Area: Virginia. Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_sva_a.htm . Accessed March 6, 2015.
[141] U.S. EIA. 2015. Petroleum and Other Liquids. Crude Oil Production. Period-Unit Annual Thousand Barrels. Release date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm . Accessed March 6, 2015.
[142] U.S. EIA. 2013. Gas Production in Conventional Fields, Lower 48 States. http://www.eia.gov/oil_gas/rpd/conventional_gas.pdf Accessed April 18, 2014
[143] U.S. EIA. 2013. West Virginia: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=WV Accessed April 7, 2014
[144] U.S. EIA. 2011. *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays.* July 2011. Prepared by Intek, Inc., in December 2010 for EIA Office of Energy Analysis. http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf. Accessed Nov. 8, 2013.
[145] U.S. EIA. 2010. Major Tight Gas Plays, Lower 48 States. Updated June 6, 2010. www.eia.gov/oil_gas/rpd/tight_gas.pdf. Accessed Nov. 8, 2013.
[146] U.S. EIA. 2013. West Virginia: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=WV Accessed April 7, 2014
[147] U.S. EIA. 2009. Coalbed Methane Fields, Lower 48 States. Updated Apr. 8, 2009. http://www.eia.gov/oil_gas/rpd/coalbed_gas.jpg. Accessed Nov. 12, 2013.
[148] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Area: West Virginia. Period: Annual. Release date. February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_swv_a.htm Accessed March 6, 2015.
[149] U.S. EIA. 2013. West Virginia: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=WV Accessed April 7, 2014
[150] U.S. EIA. 2015. Natural Gas Gross Withdrawals and Production. Area: West Virginia. Period: Annual. Release date February 27, 2015. http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_swv_a.htm . Accessed March 6, 2015.
[151] U.S. EIA. 2015. West Virginia CoalBed Methane profile. *http://www.eia.gov/dnav/ng/ng_enr_coalbed_dcu_swv_a.htm* Accessed March 6, 2015.
[152] U.S. EIA. 2015. Petroleum and Other Liquids. Crude Oil Production. Period-Unit Annual Thousand Barrels. Release date February 27, 2015. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm . Accessed March 6, 2015.
[153] U.S. EIA. 2013. Gas Production in Conventional Fields, Lower 48 States. http://www.eia.gov/oil_gas/rpd/conventional_gas.pdf. Accessed April 18, 2014
[154] U.S. EIA. 2014. Wyoming: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=WY. Accessed April 7, 2014.
[155] U.S. EIA. 2014. Wyoming: Profile Analysis. http://www.eia.gov/state/analysis.cfm?sid=WY. Accessed April 7, 2014.
[156] U.S. EIA. 2009. Coalbed Methane Fields, Lower 48 States. Updated Apr. 8, 2009. http://www.eia.gov/oil_gas/rpd/coalbed_gas.jpg. Accessed Nov. 12, 2013.
[157] U.S.EIA. 2011. *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays.* July 2011. Prepared by Intek, Inc., in December 2010 for EIA Office of Energy Analysis. http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf. Accessed Nov. 8, 2013.
[158] U.S. EIA. 2010. Major Tight Gas Plays, Lower 48 States. Updated June 6, 2010. www.eia.gov/oil_gas/rpd/tight_gas.pdf. Accessed Nov. 8, 2013.
[159] U.S. EIA. Natural Gas Gross Withdrawals and Production. Area: Wyoming Period: Annual. Release date. February 27, 2015. . http://www.eia.gov/dnav/ng/ng_prod_sum_dcu_swy_a.htm . Accessed March 6, 2015.
[160] U.S. EIA. Petroleum and Other Liquids. Crude Oil Production. Period-Unit Annual Thousand Barrels. Release date February 27, 2014.. http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm . Accessed March 6, 2015