

2014

DISCLOSING THE FACTS:

TRANSPARENCY AND RISK IN HYDRAULIC FRACTURING



A COLLABORATIVE PROJECT OF:



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EXECUTIVE SUMMARY

Disclosing the Facts 2014 is the third in a series of investor reports intended to promote improved operational practices among oil and gas companies engaged in horizontal drilling and hydraulic fracturing. Hydraulic fracturing operations use high volumes of water and toxic chemicals, release significant levels of greenhouse gas and other emissions, and have the potential to adversely impact local communities when not properly managed. These issues may translate into financial risks to companies and shareholders in the form of fines, regulations, resource constraints, or threats to their social license to operate. Following the maxim of “what gets measured, gets managed”, this report encourages oil and gas companies to increase disclosures about their use of current best practices to minimize the environmental risks and community impacts of their “fracking” activities. Disclosure of best management practices and associated key performance indicators is the primary means by which investors may gauge how companies are managing the business risks associated with their environmental and community impacts.

This 2014 scorecard benchmarks the public disclosures of 30 oil and gas companies on 35 key performance indicators. It serves to distinguish companies disclosing more about their practices and impacts from those disclosing less. The scorecard assesses five areas of environmental, social, and governance metrics emphasizing, on a play-by-play basis, quantitative disclosures for: (1) toxic chemicals; (2) water and waste management; (3) air emissions; (4) community impacts; and (5) management accountability.¹ It relies solely on publicly available information companies provide on their websites or in financial statements or other reports linked from their websites.

As was the case with the 2013 scorecard, the results of this year’s scorecard demonstrate a widespread industry trend of underperformance in disclosing key performance metrics. Across the board, companies are failing to provide investors and the public with sufficient quantitative information to understand and compare the risks and opportunities presented by these companies’ shale play operations.

Although industry-wide performance continues to lag investor expectations, several companies have significantly improved their disclosures over the past year. This change is consistent with continued investor, public, and regulatory scrutiny of hydraulic fracturing activities as well as a broader pattern of innovation within the industry, where companies deploy better practices and other companies follow in what we hope is a “race to the top” for best performance. Investors plan to continue pressing companies to adopt effective practices for managing risks and impacts, and thus capturing the full value of their hydraulic fracturing operations.

KEY FINDINGS

1. Failure to quantitatively disclose key performance metrics remains the industry-wide standard.

Across the industry, companies are failing to provide investors and other key stakeholders with quantitative, play-by-play disclosure of operational impacts and best management practices. Existing company disclosures remain mostly qualitative and narrative, or focus anecdotally on just one or a few of their multiple plays, making systematic comparisons across companies difficult.

2. A small group of companies has dramatically improved disclosure. BHP Billiton emerged as the highest scoring company this year. BHP Billiton is the first company to score points on more than half of the report’s indicators, rising from near the bottom of 2013’s rankings to the top this year. Hess, the second-highest scorer, doubled its score from 2013 and EQT, the third-ranked company, tripled its score. Finally, Noble Energy nearly doubled its score to tie for fifth in this year’s rankings. These four companies accounted for approximately two-thirds of the total overall improvement in industry scores. Encana and Apache, leaders in 2013, round out the top 20% of this year’s industry leaders. Encana ranked fourth and Apache tied for fifth. Most other companies changed their scores only marginally or not at all.

1. “Play-by-play” disclosure refers to a company reporting the distinct operational practices and impacts that are occurring at each play in which a company is operating, as distinct from reporting at an aggregate level such as company- or country-wide.

3. **Broad policies, not play-by-play quantitative performance metrics, are the most commonly reported indicators.**

The scorecard includes a mix of quantitative indicators and non-quantitative best practice indicators. The five most commonly reported indicators are policies to: substitute pipelines for trucks to reduce traffic and emissions (20 companies); use non-potable water sources (e.g., treatment plant effluent and briny subsurface waters) where possible instead of fresh water (18 companies); use health, environment, and safety (HES) metrics in setting executive compensation (18 companies); use infrared cameras to some degree in detecting air contaminant leaks (16 companies); and, avoid use of diesel fuel in fracturing fluids (14 companies).

4. **Companies still fail to disclose comprehensive systems for identifying community concerns and corporate responses.**

Although the number of companies that scored any points in this category increased to 13 from a mere six in 2013, companies continue to score worst on their disclosed policies and practices to address the community impacts of their operations. Companies primarily improved disclosure regarding traffic congestion and management systems for tracking community concerns. Still largely absent, however, are discussions by companies of which impacts are of greatest concern in the communities in which they are operating, and the companies' specific practices to address those concerns.

**CORE RECOMMENDATION:
COMPANIES SHOULD INCREASE
QUANTITATIVE REPORTING**

As stated in our previous assessments, narrative reporting— anecdotal reporting of activities in one or two plays—and aggregated company-wide reporting of impacts on a national or company-wide level, do not sufficiently inform investors about how effectively companies are managing the risks and opportunities associated with their operations. Companies should report data associated with their operational impacts using quantitative metrics, on a play-by-play basis, in order for investors to be able to rigorously assess company practices.

CONCLUSION

As evidenced by continuing controversy around shale energy development in Colorado, California, New York, Eastern Canada, and elsewhere, oil and gas companies have still not managed to allay public concerns about the risks associated with their operations and continue to face potential loss of their social license to operate. We believe companies implementing current best practices in operations and providing thoroughly transparent information about these efforts will: enhance the likelihood of securing and maintaining their social license to operate; reduce regulatory and reputational risks; and reduce liabilities associated with poor performance, spills, contamination, and lawsuits, thereby increasing their access to capital.

SCORECARD

(Out Of 35 Possible Points**)

COMPANY	2014 SCORE	2013 SCORE
BHP Billiton Ltd.	18	2
Hess Corp.	17	8
EQT Corp.	16	5
Encana Corp.	15	14
Apache Corp.	13	10
Noble Energy, Inc.	13	7
EOG Resources, Inc.	9	6
<i>Penn Virginia Corp.</i>	9	–
Range Resources Corp.	9	3
Royal Dutch Shell plc	9	7
Ultra Petroleum Corp.	9*	10
Cabot Oil & Gas Corp.	8	5
Anadarko Petroleum Corp.	7	4
Chesapeake Energy Corp.	7	5
<i>Exco Resources, Inc.</i>	7	–
Occidental Petroleum Corp.	7	2
BP plc	6	2
Chevron Corp.	6	3
ConocoPhillips Corp.	5	5
CONSOL Energy, Inc.	5	5
Devon Energy Corp.	5	4
Exxon Mobil Corp.	5	2
<i>Newfield Exploration Co.</i>	4	–
Talisman Energy, Inc.	4	3
WPX Energy, Inc.	3	3
<i>Whiting Petroleum Corp.</i>	3	–
Southwestern Energy Co.	2	2
QEP Resources, Inc.	1	1
<i>Carrizo Oil & Gas, Inc.</i>	0	–
<i>Continental Resources, Inc.</i>	0	–

Italicized companies were not included in *Disclosing the Facts 2013* and so have no 2013 score.

* In 2013, Ultra was active in a single play only. In 2014, Ultra is a multi-play company. Its lower score in 2014 indicates a failure to expand its reporting to reflect its increased activity.

** 2013 had a total of 32 possible points.



IMAGE: U.S. Energy Information Administration

Source: U.S. Energy Information Administration based on data from various published studies.
 Updated: May 9, 2011

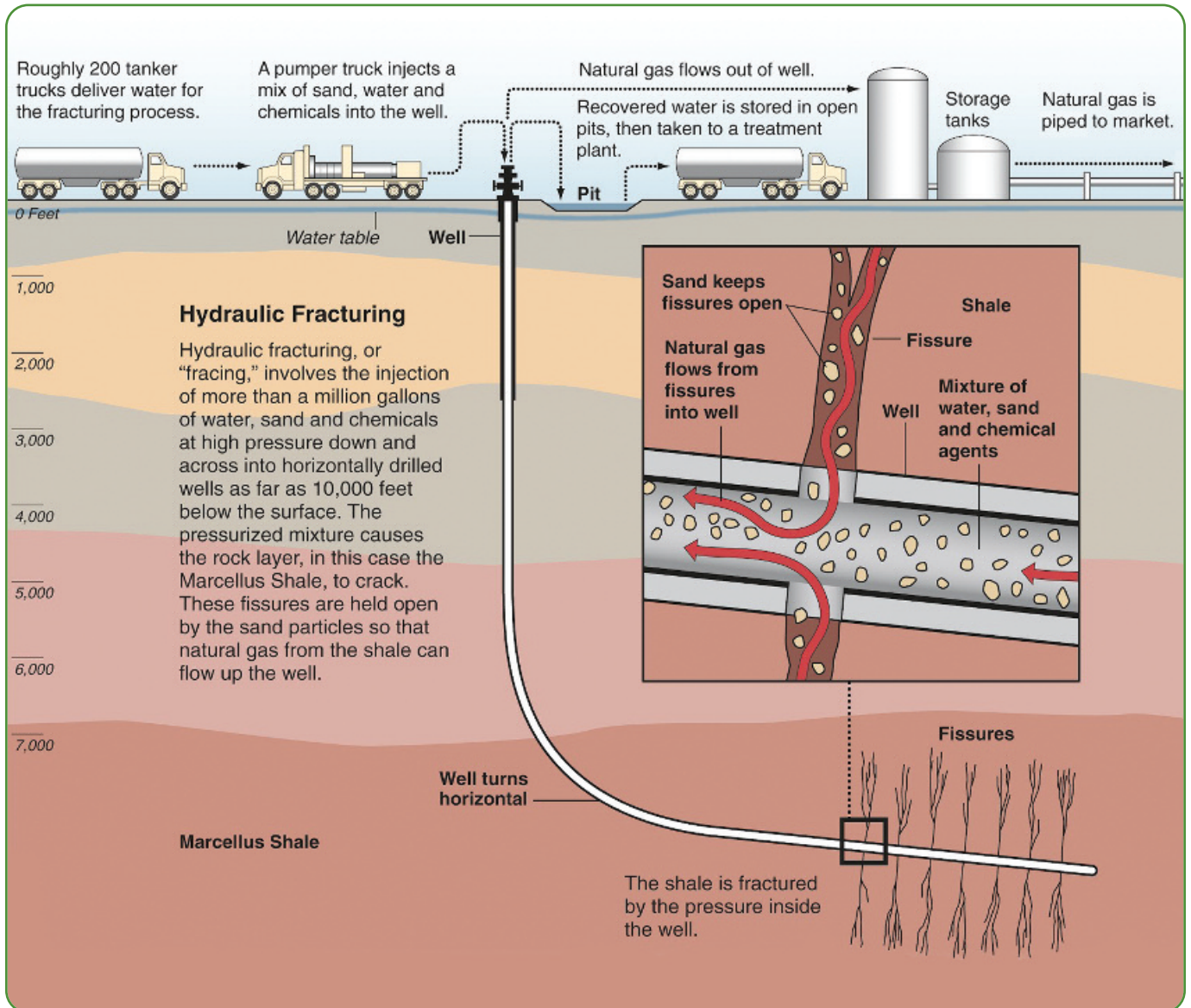


IMAGE: Al Granberg / Propublica.org

INTRODUCTION

Investors continue to be concerned about the financial risks associated with hydraulic fracturing operations and their potential adverse impacts on the environment and local communities. Since 2009, institutional investors in the U.S. and Canada have been pressing companies—through dialogues and, when necessary, shareholder proposals—to be more transparent about how they manage and mitigate the environmental risks and community impacts inherent to hydraulic fracturing operations. Investors require rigorous, relevant information in order to make informed investment decisions; hence this report emphasizes quantitative reporting. Investors also believe that companies implementing best practices in operations and providing transparent information about these efforts will reduce regulatory and reputational risks; enhance the likelihood of securing and maintaining their social license to operate; and reduce liabilities associated with poor performance, spills, contamination, and lawsuits, thereby increasing access to capital.

Disclosing the Facts 2014 is the third in a series of reports intended to encourage oil and gas companies engaged in horizontal drilling and hydraulic fracturing to adopt best practices in managing risks and provide quantitative reporting on operational metrics, including companies' specific practices and improvements. These reports serve to inform shareholders and oil and gas production companies about effective risk management practices, how they are being implemented by individual companies, and how the industry as a whole is performing against these key risk management indicators. These reports also serve to facilitate shareholder engagements with companies by clearly establishing investor expectations and providing a framework for investors and companies to work together to better meet these expectations.

The first report in the series, *Extracting the Facts: An Investor Guide to Disclosing Risks from Hydraulic Fracturing Operations*,² offers best practice recommendations to oil and gas companies for reporting and reducing risks and impacts from natural gas operations. The report, published in 2011, has been supported by investors in North America, Europe, and Australia managing more than \$1.3 trillion in assets. It offers a framework for assessment of core management goals, current best practices, and key performance indicators for reporting progress.

Building on *Extracting the Facts*, the second report, *Disclosing the Facts: Transparency and Risk in Hydraulic Fracturing Operations*³ (“DTF 2013”), benchmarks 24 oil and gas companies on their disclosures against 32 performance indicators across five areas of environmental, social, and governance metrics. The report focuses on the need for quantitative disclosures and region-specific reporting where relevant, with the goal of increasing company and investor attention to localized risk. *DTF 2013* demonstrates the industry-wide failure to provide investors and the public with the information necessary to evaluate whether companies are effectively managing the risks and impacts associated with their hydraulic fracturing operations.

Disclosing the Facts 2014 (“DTF 2014”) updates *DTF 2013*. The report assesses 30 companies on 35 indicators in five issue areas. In addition to evaluating how well these oil and gas companies are disclosing best management practices and impacts across their operations, the report highlights recent and emerging trends that directly impact companies engaged in hydraulic fracturing and evaluates how well oil and gas companies are addressing these growing nationwide concerns. Developments addressed by the 2014 report include: regulators' tightening of controls on air emissions, especially fugitive emissions (i.e. leaks); high profile contamination incidents and accidents continuing to undercut industry safety claims and feed local fears; growing evidence of links between deep well

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2. Investor Environmental Health Network and Interfaith Center on Corporate Responsibility, *Extracting the Facts: An Investor Guide to Disclosing Risks from Hydraulic Fracturing Operations* (2011), <http://www.iehn.org/documents/frackguidance.pdf>. An eighteen-month investor dialogue with oil and gas companies, convened by Boston Common Asset Management and Apache Corporation and supported by members of the Interfaith Center on Corporate Responsibility (ICCR) and Ceres, provided a venue for extended conversations concerning risks, management practices, and disclosures associated with hydraulic fracturing operations and a forum for industry experts to review draft practices and indicators. The dialogue became the foundation for *Extracting the Facts*, which identifies 12 core management goals, best management practices, and key performance indicators on which investors require disclosure to adequately assess risk management practices. *Extracting the Facts* was intended to promote a “race to the top”, encouraging companies to be more transparent and strive for and report on best practices. It urges companies to implement best management practices or to explain why such practices cannot be carried out. Furthermore, it emphasizes the importance of going beyond compliance with existing regulations since the current regulatory framework, particularly at the state level, varies in stringency and, as evident from local bans and moratoria, may not be trusted by local communities.
 3. As You Sow, Boston Common Asset Management, Green Century Capital Management and the Investor Environmental Health Network, *Disclosing the Facts: Transparency and Risk in Hydraulic Fracturing Operations* (2013), www.disclosingthefacts.org.

injection of fluid wastes and nearby seismic events, with accompanying tightening of state regulations; elevated attention to water use for hydraulic fracturing as drought and water risk persist in many regions; confirmed or strengthened local government regulatory authority regarding hydraulic fracturing operations in certain states; and litigant success in court cases that may foreshadow increased litigation risks for companies.

Overall, these reports conclude that the hydraulic fracturing industry as a whole is failing to meaningfully address on-going public concerns as illustrated by continuous media attention, an increasing number of studies into health and pollution impacts, continued calls for bans and moratoria, and uneven but improving state regulations. Although companies have begun responding to these growing concerns by providing some voluntary disclosures, the lack of quantitative reporting on risk management, pollution metrics, operational improvements, or actions to reduce environmental and community impacts makes it challenging for investors and other key stakeholders to objectively evaluate the risks of hydraulic fracturing operations. Following the proverb of “what gets measured, gets managed”, investors and other key stakeholders are concerned at this lack of data and will continue to press for more transparent and rigorous reporting from companies engaged in hydraulic fracturing.

SCORECARD

OVERVIEW

Disclosure is critical—as it is the primary vehicle by which investors gain insight into the extent to which companies are adopting best management practices and reducing key risks. Risk management policies are most meaningful to investors when data assessing the policies’ effectiveness is disclosed. Some companies may, in fact, be implementing best practices on a broad scale but—absent disclosure—investors are left in the dark about the impacts of their efforts.

DTF 2014 scores 30 oil and gas companies on their performance on 35 disclosure indicators derived from Extracting the Facts. Each company is scored based solely on documents and information available on, or linked from, its public website.⁴ The indicators include practices found in cutting-edge regulations recently adopted or proposed in various jurisdictions and are grouped into five areas of risk management: (1) Toxic chemicals; (2) Water management: sourcing, well integrity, waste management, and water quality monitoring; (3) Air emissions; (4) Community impacts; and (5) Management and accountability.

The scorecard places special emphasis on the quantitative reporting of activities and impacts on a play-by-play⁵ basis due to the local impacts of hydraulic fracturing operations. While we recognize that companies must have company-wide policies and risk management practices in place to guide operations across all plays, play-by-play reporting is critical for investors to be able to understand how companies manage risks that manifest on a localized level, including water quantity and quality, air quality, waste management, and community impacts. *DTF 2014*’s focus on play-by-play reporting also reflects the regional and local variations among plays, as well as the reality of diverse regulatory systems where onshore oil and gas exploration and production in the U.S. is largely state— as opposed to federally—regulated.

While seeking to maintain consistency across scorecards, *DTF 2014* expands on *DTF 2013* by including companies that have recently emerged as significant players in the industry and refining key questions to reflect evolving practices and expectations, particularly in the area of methane leakage. The number of companies evaluated has been expanded from 24 to 30 to include at least the top three producers in the most developed shale oil and gas plays. The number of questions has increased from 32 to 35, reflecting modifications in questions related to management of air emissions. These changes are detailed in Appendix C—Methodology.

4. See Appendices B and C for details on indicators and scoring methodology.

5. The U.S. Geological Survey defines a “play” as “a set of known or postulated oil and/or gas accumulations sharing similar geologic, geographic, and temporal properties.” See <http://proceedings.esri.com/library/userconf/proc02/pap0826/p0826.htm>. Examples include the Barnett Shale, the Marcellus Shale, and the Bakken formation. Many plays extend across state or provincial boundaries.

COMPANY PERFORMANCE ON RISK MANAGEMENT DISCLOSURE INDICATORS

The following discussion analyzes the five areas of risk management against which company disclosures are evaluated in the scorecard. It presents an analysis as to why these issues constitute risks and are of concern to investors, discusses how companies scored on the indicators, makes recommendations for further action, and provides examples of notable practices and disclosures of various companies.

In the following sections, only companies that scored at least one point in a section are listed in the accompanying charts. Any company not listed in a chart scored no points in that section.

1. TOXIC CHEMICALS

Issue

The high volume of toxic chemicals used in hydraulic fracturing has generated significant public concern and become a flashpoint for public controversy due to the potential of these chemicals to pollute ground water and other drinking water sources and affect worker and public health. Consequently, investors are seeking increased information about how companies manage toxic chemicals.

Using the least toxic chemicals functionally effective in hydraulic fracturing operations reduces risks related to water contamination, health, and improper disposal. Current best practice is to reduce the toxicity and amount of fracturing fluids used and to provide comprehensive disclosure of chemical use and efforts to reduce such use.

Questions

To understand company practices on managing toxic chemicals, the scorecard asks whether the company provides quantitative reporting on its progress in reducing the toxicity of hydraulic fracturing additives, has a practice to not use diesel or BTEX in its fracturing fluids, and clearly states on its website that FracFocus reports may exclude chemicals protected by claims of confidential business information.⁶

Scores and discussion

Our review of company disclosures indicates that many companies communicate some kind of intent to reduce the toxicity of their fracturing fluids—indicating a general awareness in the industry about these concerns—but very few provide data that would allow investors or other stakeholders to evaluate the effectiveness of these initiatives in reducing toxic chemical use in hydraulic fracturing operations, including baseline toxicity, type of toxicity reductions, and percentage and total amount of chemical reductions.

Eliminating harmful chemicals: While some companies state in general terms that they are seeking lower toxicity additives, only 3 companies—Chevron, EQT, and Hess—quantitatively report toxicity reductions, although the companies vary in the detail reported.

Eliminating diesel and BTEX chemicals: Fourteen (14) companies, nearly half of our sample, report eliminating diesel from their fracturing fluids, but only 7 report eliminating the suite of benzene, toluene, ethylbenzene, and xylene (BTEX) chemicals. This difference is likely because the Safe Drinking Water Act excludes from permit requirements all fluids and proppant agents used for hydraulic fracturing except diesel, thereby posing a regulatory burden for companies that choose to use diesel.⁷ The number of companies not using diesel is likely greater than 14 as an

6. FracFocus (www.fracfocus.org) is the principal vehicle by which companies report chemical use on a well-by-well basis. For additional discussion about the limitations and evolution of FracFocus, see *DTF 2013* note 10.

7. See <http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/upload/signedmemoactivitiesusingdieselfuels.pdf>, page 2 and, more generally, <http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/hydraulic-fracturing.cfm>.

independent analysis of the FracFocus database shows that diesel has only been used in several hundred of the thousands of wells reported to the database.⁸

Disclosure of toxic chemicals and CBI claims: Companies have substantially increased reporting on the fracturing chemicals they use, posting the information to FracFocus. However some chemicals whose identities are claimed as confidential business information by chemical suppliers or companies are not disclosed on FracFocus. The extent to which companies shroud the identity of chemicals with claims of confidentiality has become a key point of controversy in the public debate around hydraulic fracturing. Local communities justifiably want to know what kinds of chemicals are being pumped, sometimes literally, into their backyards, and individuals being treated by healthcare providers need to understand if and when chemicals are impacting their health.⁹ The industry has faced heightened suspicions for refusing to provide such information. Investors are concerned that companies' credibility can be damaged if, on their websites, they claim to fully disclose chemicals on FracFocus, but the actual listings conceal chemical identities behind claims of confidential business information. Thus, the last question in the scorecard's toxicity section asks whether the company clearly states on its website that its FracFocus reports exclude chemicals claimed to be confidential business information. Only 7 of the companies surveyed clearly provide such a statement.

Changes in scores from DTF 2013

Hess is the only company to receive credit on all four toxic chemical indicators. The number of companies reporting non-use of diesel jumped from 9 to 14. The number reporting non-use of BTEX chemicals and the number clearly addressing exemptions for confidential business information both rose from 4 to 7.

TOXICS COMPANY	Quantitative Reporting Toxicity Reduction	No Diesel Fuel in Fracturing Fluids	No BTEX in Fracturing Fluids	Website Disclaimer CBI Exclusion	TOTAL
Hess Energy	✓	✓	✓	✓	4
Apache		✓	✓	✓	3
BHP Billiton		✓	✓	✓	3
Cabot		✓	✓	✓	3
EQT	✓	✓			2
Occidental Petroleum		✓	✓		2
Range Resources		✓	✓		2
Shell		✓		✓	2
Ultra Petroleum		✓	✓		2
Anadarko		✓			1
BP				✓	1
Chevron	✓				1
Encana		✓			1
EOG				✓	1
ExxonMobil		✓			1
Noble Energy		✓			1
QEP		✓			1

Companies that did not receive points for any indicator in this category are not included in this chart. They are Carrizo, Cheseapeake, ConocoPhillips, CONSOL, Continental Resources, Devon, Exco Resources, Newfield Resources, Penn Virginia, Southwestern Energy, Talisman, and Whiting Oil & Gas.

8. Most of the reported uses are of kerosene, which has been classified by EPA as a "diesel fuel" for regulatory purposes. See <http://blog.skytruth.org/2012/10/the-exception-to-exception-still.html>.

9. There has been controversy over whether health care providers can disclose chemical information that may be considered confidential business information by a company. See, for example, "Judge defeats challenge to 'medical gag order' on health risks from fracking", October 31, 2013, <http://rt.com/usa/medical-gag-rule-risks-fracking-053/>; "NC senate outlaws disclosure of fracking fluid secrets", May 22, 2014, <http://www.reuters.com/article/2014/05/22/us-usa-fracking-secrets-idUSBREA4L0YC20140522>; and "Governor McCrory signs senate fracking bill into law", June 4, 2014, <http://www.wncn.com/story/25690814/gov-mccrory-signs-enate-fracking-bill-into-law>.

Recommendations and notable practices

Managing chemical-related risks can be one of the most important steps a company takes to maintain its social license to operate, reduce its impacts on communities and the environment, and protect its bottom line. To ensure these outcomes, investors recommend that companies:

- **Reduce the toxicity of fracturing fluids.** Companies should actively seek alternatives that satisfy their functional needs while reducing potential harms. To comprehensively reduce the toxicity of fracturing fluid, companies should dedicate staff or consultants to continually evaluate chemical additive use and industry developments and, where relevant, ask their contractors or chemical suppliers to provide reduced toxicity options in requests for proposals (“RFPs”) and other procurements. Companies can also join industry initiatives promoting this goal. In support of toxicity reduction, major chemical suppliers to oil and gas companies have developed toxicity scoring systems which rank the toxicity of their products, enabling oil and gas companies to select safer chemicals to meet their needs.¹⁰

Many companies have taken some action to reduce chemical toxicity.

- *Range Resources* states that it “has replaced an antimicrobial [chemical] with a naturally-occurring nitrate-reducing bacteria, which is biodegradable and nonhazardous, in our Pennsylvania operations.”¹¹
 - *BHP Billiton* reports that, in the Permian Basin, it uses an ozone-based oxidation process to kill bacteria, eliminating the need to use a biocide and another chemical.¹²
 - *EQT* reports that “traditional biocides have been replaced with a variety of environmentally friendly, non-chemical alternatives.”¹³
 - *Encana*, which uses a scoring system for its Responsible Products Program, expanded the scope of its program in 2013 to address drilling fluids in addition to fracturing additives.¹⁴
 - *Anadarko* has developed a Chemical Assessment Rating Evaluator (CARE), which will provide its staff with a quantitative tool for improving the environmental profile of its hydraulic fracturing fluids.¹⁵
 - *Apache* has taken the lead in organizing an American Chemical Society Green Chemistry Institute Roundtable on Hydraulic Fracturing, the overall mission of which is to integrate green chemistry and engineering principles into the chemical supply chain for hydraulic fracturing.¹⁶ This science-based collaboration will promote development of, and information sharing about, less hazardous chemical alternatives.
- **Report quantitatively on progress in toxicity reduction.** Companies should publicly report progress in reducing the toxicity of chemicals used in their hydraulic fracturing operations, particularly chemicals used in fracturing fluids.
 - *Hess* reports that it reduced biocide use by 50% in 2013 compared to 2012.¹⁷
 - *EQT* reports that it has reduced acid use by 50%.¹⁸

10. See Tim Verslycke, et al., “The Chemistry Scoring Index (CSI): A Hazard-Based Scoring and Ranking Tool for Chemicals and Products Used in the Oil and Gas Industry”, *Sustainability* 6, no. 7 (2014), <http://www.mdpi.com/2071-1050/6/7/3993>, and Richard Liroff, “5 ways to clean up fracking’s chemical act”, <http://www.greenbiz.com/blog/2012/09/21/5-ways-clean-frackings-chemical-act>.

11. Range Resources Corporate Responsibility Report, page 6, http://rangeresponsibility.com/pdf/Range_Resources_CR_Report.pdf.

12. BHP Billiton, “Case Study: Responsibly managing hydraulic fracturing”, http://www.bhpbilliton.com/home/society/reports/Documents/2014/140912_ResponsiblyManagingHydraulicFracturingCaseStudy.pdf.

13. EQT 2014 Corporate Social Responsibility Report, page 16, <http://www.eqt.com/docs/pdf/2014%20EQT%20CSR%20Report.pdf>.

14. Encana 2013 Sustainability Report, page 25, <http://www.encana.com/pdf/sustainability/corporate/reports/sustainability-report-2013.pdf>.

15. <http://www.anadarko.com/Operations/Pages/HydraulicFracturing.aspx>

16. http://www.apachecorp.com/Sustainability/Environment/Chemicals/Hydraulic_fracturing_roundtable/index.aspx

17. Hess 2013 Corporate Sustainability Report, pages 45-46, <http://www.hess.com/docs/default-source/sustainability/hess-corporation-2013-csr.pdf?sfvrsn=2>.

18. EQT 2014 Social Responsibility Report, page 16. The baseline year for this statistic is not provided.

- As noted in *DTF 2013*, in the Marcellus, *Chevron* reduced the number of hazardous chemicals it uses by approximately 77%.¹⁹
- **Clarify when CBI claims prevent full disclosure of chemicals used.** Where CBI claims prevent the disclosure of certain chemicals, it is incumbent on companies to make that limitation clear. Further, oil and gas companies should be aware of all the chemicals they are using in their wells, executing nondisclosure agreements with their suppliers if absolutely necessary to learn chemical identities.
 - In 2014, a U.S. Department of Energy advisory panel assessing FracFocus noted that trade secrecy claims were made for 16% of the chemicals reported in FracFocus during the second half of 2013.²⁰ The panel urged a change in the format of FracFocus that could substantially reduce trade secrecy claims; the administrators of FracFocus are working to respond to the Department of Energy’s recommendations.²¹
 - *Baker Hughes* has announced support for such revised reporting and communicated a goal of 100% disclosure.²²

2. WATER AND WASTE MANAGEMENT

Issue

Due to the high volume of water and toxic chemicals used during hydraulic fracturing, concerns about the impacts on water quality and availability are a major risk to companies and their investors. Hydraulic fracturing operations for horizontally drilled wells typically use millions of gallons of water per well for fracturing. While the actual fracturing process in shale formations typically occurs significantly below potable water resources, wells are generally drilled through or near drinking water sources (such as aquifers) in order to reach target zones for the oil and/or gas resource. This presents a potential for migration of methane or other pollutants into ground water if the wellbore leaks or allows pollutants, including methane from non-targeted methane-bearing formations, to travel along the outside of the well casing.^{23, 24}

19. See *DTF 2013* note 21 and associated text. The baseline year for this statistic is not provided.

20. U.S. Department of Energy, “Secretary of Energy Advisory Board Task Force Report on FracFocus 2.0”, February 24, 2014, <http://energy.gov/sites/prod/files/2014/03/f8/FracFocus%20TF%20Report%20Final%20Draft.pdf>.

21. The Groundwater Protection Council (GWPC) and the Interstate Oil and Gas Compact Commission (IOGCC) are developing “V3.0” to respond to the many recommendations of the Department of Energy advisory panel.

22. In the revised format suggested by the U.S. Department of Energy advisory panel and Baker Hughes, chemicals would not be directly associated with the products of which they are a part, making it more difficult to discern the formulas of individual products while still providing for disclosure of the chemicals. See “Baker Hughes Hydraulic Fracturing Chemical Disclosure Policy”, <http://www.bakerhughes.com/products-and-services/pressure-pumping/hydraulic-fracturing/environmental-solutions-and-chemical-disclosure/disclosure>. See also Richard Liroff, “Baker Hughes clues in, reveals formerly secret frack chemicals”, <http://www.greenbiz.com/blog/2014/05/02/baker-hughes-clues-reveals-formerly-secret-frack-chemicals>.

23. Other potential risk pathways can occur when a fracture intersects a natural fault/fracture, another well fracture, or offset wells that are improperly constructed or abandoned. Well integrity, defined as the quality of well construction, appears to be a more sizeable risk than the fractures themselves. For additional information, see *DTF 2013* note 24.

24. The scientific and regulatory data regarding the magnitude of risk provide a mixed picture. Some studies show contamination from fracturing operations and others do not. For a sampling of these studies, see *DTF 2013* note 26. As a recent example, a 2014 university report funded by local government, which focused on 37 wells near an 11 billion gallon reservoir in Pennsylvania, found no harm during three years of testing. See “Beaver Run water untainted by shale gas wells, tests show”, Pittsburgh Tribune-Review, August 3, 2014, <http://triblive.com/news/westmoreland/6540290-74/reservoir-iup-beaver#axzz3A6XISUet>. In contrast, in August 2014, Pennsylvania’s Department of Environmental Protection released details of 240 private water supplies where damage since 2007 has been linked to oil and gas operations though not necessarily to the hydraulic fracturing process per se. See “DEP releases updated details on water contamination near drilling sites”, Pittsburgh Post-Gazette, September 9, 2014, <http://powersource.post-gazette.com/powersource/consumers-powersource/2014/09/10/New-study-cites-health-risks-for-those-living-near-shale-gas-wells/stories/201409100179>. A September 2014 analysis of eight contamination cases in Pennsylvania and Texas indicates that identified impacts most likely stemmed from well integrity problems (i.e. issues with pipes and/or cement). Nevertheless, the high pressure associated with hydraulic fracturing may contribute to increased leakage from well casings and cement. See “Well leaks, not fracking, are linked to fouled water”, New York Times, September 15, 2014, <http://www.nytimes.com/2014/09/16/science/study-points-to-well-leaks-not-fracking-for-water-contamination.html>. Another study, published in September 2014 by the U.S. Department of Energy National Energy Technology Laboratory, tracked Marcellus Shale fractures in two Pennsylvania wells and found they ended 5,000 feet below drinking water aquifers, with no detectable upward migration of gas or fluids. See “NETL releases hydraulic fracturing study”, <http://energy.gov/fe/articles/netl-releases-hydraulic-fracturing-study>.

The highest risk pathway for water contamination is spills and leaks on the surface that may contaminate local surface waters. After the fracturing process is completed, water mixed with chemicals and contaminants—some that were added intentionally to aid the fracturing process and others that are picked up along the way from the geologic formation (such as high levels of brine, toxic metals, and in some regions naturally occurring radioactive materials)—return to the surface for storage, treatment, reuse, and/or disposal, posing risks to surface water quality. Failure to properly handle and dispose of this water poses significant risks for contaminating surface water.

Management of water risks at each stage of drilling and completion must be a core priority for companies. In evaluating corporate disclosures on water management practices, play-by-play reporting is critical as water concerns are primarily local in nature. Only by reviewing quantitative data on a company’s management practices in light of regional hydrological conditions can investors and community members properly assess “water risk” and analyze relative performance. In some cases, water risk can vary even within plays, where the plays are several hundred square miles across and cut across diverse hydrological systems.

Questions

Due to the large number of questions regarding water and waste management, questions, scores, recommendations, and notable practices are presented in subsections below.

WATER AND WASTE ISSUES												
COMPANY	Well Integrity	Pre-drill H2O monitor [^]	Post-drill H2O monitor [^]	Total water use [^]	Flowback water reuse % [^]	Water source types [^]	Non-potable water policy	Water intensity [^]	Closed tank water store [^]	Closed loop drilling residuals [^]	NORMS disclosure	TOTAL
Hess Energy	✓	✓	✓	✓	✓		✓		✓	✓		8
Penn Virginia	✓	✓	✓				✓		✓	✓	✓	7
BHP Billiton				✓		✓	✓	✓		✓	✓	6
EQT		✓			✓					✓	✓	4
Noble Energy	✓	✓					✓			✓		4
Apache	✓						✓				✓	3
Encana	✓	✓					✓					3
Exco Resources	✓						✓	✓				3
Shell		✓	✓				✓		✓			3
Ultra Petroleum*							✓		✓		✓	3
Cabot	✓							✓	✓			2
Chesapeake							✓	✓				2
CONSOL							✓			✓		2
EOG	✓						✓					2
Range Resources							✓				✓	2
WPX	✓	✓										2
BP		✓										1
Chevron							✓					1
ConocoPhillips							✓					1
Devon							✓					1
Newfield Resources							✓					1
Occidental Petroleum							✓					1
Talisman		✓										1

Companies that did not receive points for any indicator in this category are not included in this chart. They are Anadarko, Carrizo, Continental Resources, ExxonMobil, QEP, Southwestern Energy, and Whiting Oil & Gas.

“^” = Question requests disclosure by play.

WELL INTEGRITY: Proper construction of wells—“well integrity”—is widely viewed by experts as a key factor in reducing risks to ground water from hydraulic fracturing operations, although the methods for constructing wells and monitoring well integrity have been improving.²⁵ The quality of the cementing job can be critical to whether leakage occurs outside the well casing. Studies indicate a need for requirements that ensure adequate casing and cement jobs such as cement bond logs and other methods of testing.²⁶ In line with expert opinion about the centrality of well integrity to risk reduction, some states have taken steps to tighten well integrity standards.²⁷

Question: The scorecard asks whether companies report practices to test well integrity, in addition to pressure testing (which is an essential but not complete indicator of potential problems). Such additional practices include temperature, acoustic, or ultrasonic methods.

Scores & notable practices: Nine (9) companies reference the use of one or more of such monitoring methods. Three (3) notable reporting practices include:

- *Penn Virginia Corporation*, currently active primarily in the Eagle Ford Shale in Texas, states, “we routinely run cement bond logs, an acoustic testing method, to provide further confidence in the strength and integrity of the cement casing strings.”²⁸
- *Noble Energy* states that prior to any drilling activity, its Wellbore Integrity team evaluates the infrastructure of nearby oil and gas wells, including casing integrity, cement coverage, and equipment quality, to identify any potential pathway for gas and fluids from its operations to move to the surface and into nearby aquifers. If a risk is identified, Noble Energy remediates or, when necessary, plugs and abandons the well.²⁹
- As noted in *DTF 2013*, *WPX Energy* stands out from other companies with regard to the detail it provides on well integrity and water monitoring practices as part of the risk discussion in its annual 10-K report to the U.S. Securities and Exchange Commission.³⁰

25. The published literature contains diverse estimates of the frequency of problems with well construction. Wells are constructed with multiple pipe and cement barriers, so even if one barrier fails, the well may not pose a risk to the environment. However, poor cementing jobs in regions where methane occurs close to the surface may allow methane to move upward through the outermost portion of the well bore into drinking water aquifers or may allow it to escape to the atmosphere. It is generally believed that risks increase as wells age and that even when constructed properly, earlier generations of wells are riskier than newer wells because the oil and gas industry has continually improved its cementing practices over time. In addition to the sources cited in *DTF 2013* notes 24 and 28, see George E. King and Randy L. Valencia, “Environmental Risk and Well Integrity of Plugged and Abandoned Wells”, Society of Petroleum Engineers, October 27, 2014, <https://www.onepetro.org/conference-paper/SPE-170949-MS>; Maurice B. Dusseault, Richard E. Jackson, and Daniel MacDonald, “Towards a Road Map for Mitigating the Rates and Occurrences of Long-Term Wellbore Leakage”, May 22, 2014, http://www.geofirma.com/Links/Wellbore_Leakage_Study%20compressed.pdf; Richard J. Davies, et al., “Oil and gas wells and their integrity: Implications for shale and unconventional resource exploitation”, *Marine and Petroleum Geology* 56 (2014), <http://www.sciencedirect.com/science/article/pii/S0264817214000609>; Maurice Dusseault and Richard Jackson, “Seepage pathway assessment for natural gas to shallow groundwater during well stimulation, production, and after abandonment” (Presented at GeoMontreal 2013); Anthony R. Ingraffea, et al., “Assessment and risk analysis of casing and cement impairment in oil and gas wells in Pennsylvania, 2000-2012”, *Proceedings of the National Academy of Sciences of the United States* 111, no. 30 (2014), <http://www.pnas.org/content/early/2014/06/25/1323422111.full.pdf+html>; and Mary Kang, “CO₂, methane, and brine leakage through subsurface pathways: exploring modeling, measurement, and policy options”, *Princeton University* (2014), <http://arks.princeton.edu/ark:/88435/dsp019s1616326>. A 2014 study of cement formulations used in the Marcellus Shale concluded that one type of cementing system was more successful in sealing off potential sources of leakage than another. See Jessica McDaniel and Larry Watters, “Cement Sheath Durability: Increasing Cement Sheath Integrity to Reduce Gas Migration in the Marcellus Shale Play”, *Society of Petroleum Engineers* (2014), <https://www.onepetro.org/conference-paper/SPE-168650-MS>.

26. See *DTF 2013* note 54 and associated text.

27. See, for example, Texas Railroad Commission, “Railroad Commission Today Adopts Amendments to Oil & Gas Well Construction Rules”, May 24, 2013, <http://www.rrc.state.tx.us/news/052413/>.

28. <http://www.pennvirginia.com/operations/Fracturing/>

29. Noble Energy 2012 Sustainability Report, page 28.

30. See *DTF 2013* note 55 and associated text. See also WPX’s February 27, 2014 10-K Report to the U.S. Securities and Exchange Commission, pages 21-24, <http://www.wpxenergy.com/investors/sec-filings.aspx>.

Recommendations:

- *Implement Integrity Safeguards Beyond Regulation:* Companies should demonstrate to investors that they are voluntarily implementing strict well integrity safeguards, even in the absence of regulation.
- *Conduct More Detailed Site Assessment:* Companies should further increase disclosure by reporting the steps they take to identify nearby oil and gas wells that could be a conduit of groundwater contamination from the companies' fracturing operations, repair or avoid such wells, and verify the location of aquifers.³¹ This disclosure will provide investors with assurance that companies are operating to the highest standards to minimize contamination risks even where state regulations do not adequately address these issues.

GROUNDWATER MONITORING PRE- AND POST-DRILLING: Water contamination from hydraulic fracturing operations remains a hot-button issue that has not been well addressed by industry. To protect water resources, reduce public fears, and address problems when they occur, companies must increase groundwater monitoring both pre-and post-drilling. Pre-drill testing is critical for providing a baseline of water quality data against which claims of water contamination can be measured.³² Post-drill testing and monitoring is important for continued evaluation of water quality to ensure timely action should any problem arise.

Question: The scorecard asks whether companies conduct monitoring of ground water prior to and following well drilling and hydraulic fracturing.

Scores & notable practices: On a play-by-play basis, 9 of the companies surveyed report that they conduct some type of pre-drill monitoring, while only 3—Hess, Penn Virginia, and Shell—report that they conduct post-drill monitoring in all plays.³³ Companies most commonly report pre-drilling monitoring practices in Pennsylvania, likely because state law encourages such practice.³⁴ Pre-drilling monitoring by a company can be perceived by the community as a demonstration of good will and responsibility, promoting community acceptance. Notable practices include:

- *CONSOL Energy* states that for its Pittsburgh International Airport gas field it tests “all drinking water sources within 2,500 feet of the wellbore prior to drilling, along with resampling post completions to ensure no drinking water impact from our activities.”³⁵

31. Regulators in both Alberta and Colorado have taken action to reduce environmental risks associated with fractures from a new well intersecting existing wells. See, for example, “As ‘frack hits’ grew in Alberta, regulators stepped in”, EnergyWire, January 7, 2014, <http://www.eenews.net/stories/1059992459>, and Colorado Oil & Gas Commission, “DJ Basin Horizontal Offset Policy – June 20, 2013 Rev December 17, 2013”, http://cogcc.state.co.us/RR_Docs_new/Policies/DJ_Basin_Horizontal_Offset_Policy_20131217.pdf. Colorado’s commission has proposed a statewide “wellbore collision prevention” program. See http://cogcc.state.co.us/RR_Docs_New/Enforcement_and_Penalty/StakeholderComments/1412-RM-02_COGA_Stakeholder_Comments_8-22-14.pdf, Section 317(r) for more information.

32. In April 2014, Alaska joined the growing number of states requiring pre-drilling water quality monitoring. The state requires pre-drilling monitoring within a half mile of the well bore and may also require post-drilling monitoring within a half mile of the well bore. See “State commission finalizes tough new rules on fracking”, Alaska Journal of Commerce, April 11, 2014, <http://www.alaskajournal.com/Alaska-Journal-of-Commerce/April-Issue-2-2014/State-commission-finalizes-tough-new-rules-on-fracking/>. The rules are published here: <http://doa.alaska.gov/ogc/hear/Combined%20regulations.pdf>. Nevada is also adopting pre- and post-drilling monitoring rules. See http://minerals.nv.gov/uploadedFiles/mineralsnvgov/content/home/features/HYDRAULIC_FRACTURING_UPDATE_INFO.pdf and <http://www.leg.state.nv.us/register/2014Register/R011-14RP3.pdf> for more information.

33. Uniquely among the companies analyzed in 2013, Ultra was active in just one play and was scored based on reporting on that single play. Ultra has since expanded to another play, and so on some “play-by-play” reporting indicators in this 2014 report, Ultra is not awarded points as it was in 2013.

34. For details of the law, which places the burden on a company to prove it did not cause contamination rather than placing a burden on a landowner to demonstrate the company’s responsibility, see *DTF 2013* note 32 and associated text.

35. CONSOL Energy 2013 Corporate Responsibility Report, page 18, http://www.consolenergy.com/media/24348/2013_consol_energy_corporate_responsibility_report.pdf.

- *Newfield Exploration* reports that “in the Central Basin of Utah, we have initiated a voluntary baseline water quality program, including pre- and post-drilling water analysis. The program was designed to identify, assess, and document the water quality of underground wells and surface water features that exist within close proximity to planned oil and gas drilling operations.”³⁶

Recommendation:

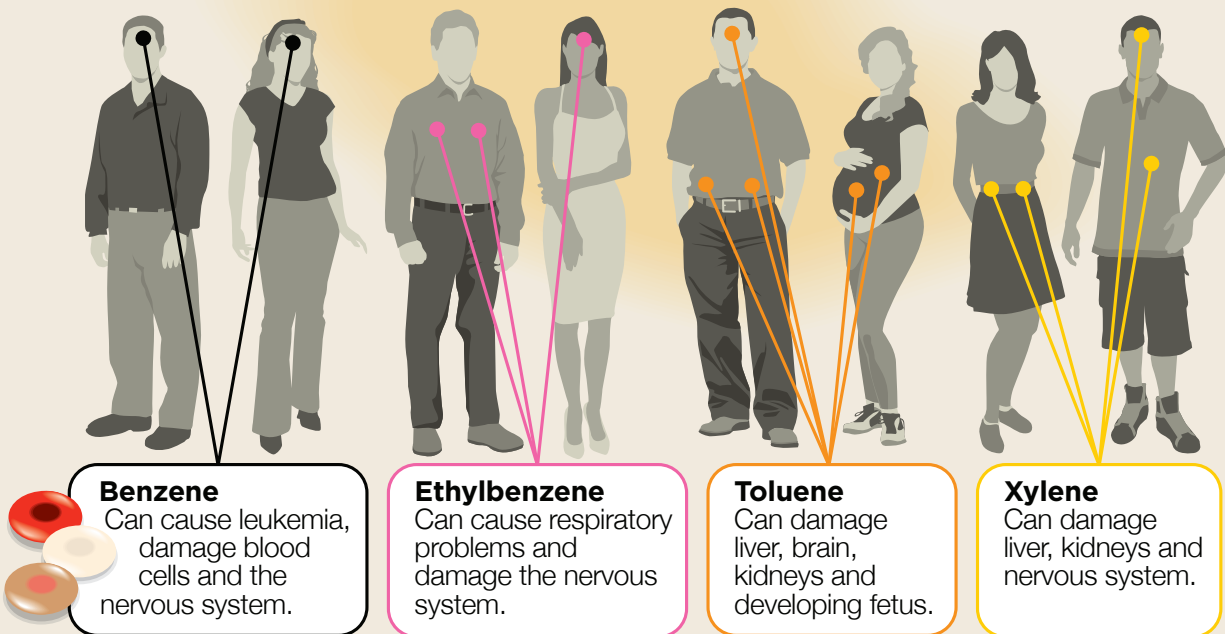
- *Companies should voluntarily implement pre- and post-drilling monitoring programs.*

Waste Pit Emissions – The Big Unknown

The open-air waste pits used in oil and gas production contain chemicals known to affect human health. But because air emissions from pits are rarely monitored, it's impossible to know if they release chemicals in quantities large enough to cause problems for nearby residents. The four chemicals shown below are some of the most studied compounds. Not shown are dozens of others, including cyclohexane and trimethylbenzene, that can also be dangerous.



POTENTIAL HEALTH IMPACTS OF FOUR AIRBORNE CHEMICALS



All four chemicals irritate the eyes, nose, throat and skin to varying degrees. Headaches, dizziness, lightheadedness, nausea and vomiting are also universal reactions to these chemicals.

SOURCES: National Institute for Occupational Safety and Health (NIOSH); Agency for Toxic Substances and Disease Registry (ATSDR); California's Office of Environmental Health Hazard Assessment (OEHHA); health experts Celeste Monforton and Wilma Subra

IMAGE: Paul Horn / Inside Climate News

WATER USE & RECYCLING: The high volume of water used during hydraulic fracturing operations can pose substantial risks to companies operating in water-constrained regions -- from impeding operations, to increasing costs where water must be purchased, to creating competition (actual or perceived) for limited water resources. A recent study illustrated that most hydraulic fracturing operations in the U.S. occur in areas experiencing high local water competition and in many regions experiencing groundwater depletion.³⁷ Since hydraulic fracturing operations

36. Newfield Exploration 2013 Corporate Responsibility Report, page 30, <http://www.newfield.com/assets/pdf/CRReport.pdf>.

37. Monika Freyman, *Hydraulic Fracturing & Water Stress: Water Demand by the Numbers*, (Ceres, 2014), <http://www.ceres.org/shalemaps>.

rely heavily on limited water resources, those companies that are more efficient in their water use are likely to lower their costs and improve their margins, thereby enjoying significant competitive advantages over their peers. Consequently, investors and other stakeholders are pressing companies to increase recycling efforts and source non-potable water to reduce stress on local freshwater sources. In addition, investors are seeking disclosure of data on the efficiency of water use to better compare the relative performance of companies in this area.³⁸

Sourcing of non-potable water, such as treated industrial and municipal wastewater, for hydraulic fracturing operations is an important way companies can minimize impacts on fresh water. Use of brackish—salty or briny—ground water is also often used as an alternative to fresh water, although in the future such water may increasingly become a source for drinking water.

Increased recycling and reuse of waste water in fracturing operations, especially on-site and within a relatively small geographic area, can reduce companies' need for fresh water; reduce greenhouse gas ("GHG") emissions from transportation of waste water; decrease the need for deep well injection of wastes (which has raised seismicity and possible groundwater contamination concerns);³⁹ reduce waste disposal costs; and allay community concerns. The increasingly efficient use of water by some oil and gas companies and the development of new business models can be a competitive advantage and a critical indicator of company performance, particularly for those operating in areas subject to water scarcity.

Industry decisions about wastewater recycling and reuse will be influenced by such factors as the amount and quality of flowback water,⁴⁰ the cost of treatment options, and the availability of nearby deep well disposal facilities.⁴¹



IMAGE: WV Host Farms Program
Drill site, Harrison County, West Virginia

38. Considerable research is underway on methods to minimize freshwater use, reflecting industry concern about water availability and the business opportunities associated with innovative alternatives. For selected examples, see *DTF 2013* note 43.

39. As noted in *DTF 2013* note 46, in a 2012 report, the U.S. National Research Council concluded that hydraulic fracturing itself poses a low risk of earthquakes, but that the risks are higher for waste injection wells. States have begun to meet with seismology experts from industry and academia on best methods to address seismicity risks from fracturing and from disposal of fracturing wastes. Ohio's Department of Natural Resources announced stronger permitting conditions for fracturing proposed near fault lines, and Oklahoma and Texas are tightening monitoring rules for deep well injection sites. See "Drilling states explore earthquake issue", *Houston Chronicle Fuel Fix*, June 11, 2014, <http://fuelfix.com/blog/2014/06/11/drilling-states-explore-earthquake-issue/>; "Residents put pressure on fracking firms as quakes plague region", *Houston Chronicle Fuel Fix*, June 26, 2014, <http://fuelfix.com/blog/2014/06/26/residents-put-pressure-on-fracking-firms-as-quakes-plague-region/>; "Quake reaction: Railroad Commission looks at new rules for injection wells", *Dallas Business Journal*, <http://www.bizjournals.com/dallas/news/2014/08/13/quake-reaction-railroad-commission-looks-at-new.html>; and "Study links Oklahoma earthquake swarm with fracking operations", *Los Angeles Times*, July 3, 2014, <http://www.latimes.com/science/sciencenow/la-sci-sn-oklahoma-earthquakes-fracking-science-20140703-story.html>. On possible groundwater contamination concerns, see "EPA program to protect underground sources from injection of fluids associated with oil and gas production needs improvement", U.S. Government Accountability Office, June 2014, <http://www.gao.gov/products/GAO-14-555>. The GAO notes that federal and state officials have reported few incidents of actual contamination to date.

40. "Flowback water" is the water that flows back to the surface immediately after a well is fractured and includes both injected materials and water already present in the formation. "Produced water" refers to the water in the formation that subsequently flows back in smaller quantities over the life of the well. See http://www.afdc.energy.gov/uploads/publication/anl_hydraulic_fracturing.pdf, pages vii-viii.

41. Plays vary in the average salinity of waters and the proportions of injected fluids that return to the surface. See "Know your water: Evaluating characteristics of source, flowback and produced water for effective treatment", *Shale Play Water Management*, November-December 2013, pages 16-21, <http://www.shaleplaywatermanagement.com/2013-Nov-Dec-Shale-Play-Water-Management.html>. See also Avner Vengosh, et al., "A Critical Review of the Risks to Water Resources from Unconventional Shale Gas Development and Hydraulic Fracturing in the United States", *Environmental Science and Technology* 48, no. 15 (2014), pages 8334-8348, <http://pubs.acs.org/doi/abs/10.1021/es405118y>.

Certain tradeoffs can also occur where recycling and reuse increase truck traffic or surface storage, there is the potential for increased traffic hazards, road damage, and surface leakage.⁴²

Question: The scorecard asks whether companies disclose the percentage of flowback waste water managed and reused; the aggregate quantity of water used; the sources of water used in operations (e.g., ground and surface water); and the intensity of water use (i.e. the amount of water used to produce a unit of energy). The scorecard also asks whether companies have a policy to use non-potable water whenever technically possible.

Scores & notable practices: Critical information about water consumption and management on the regional level is grossly under-disclosed across the industry. While many companies operating in Pennsylvania's Marcellus Shale region report recycling rates, recycling is not systematically reported in other regions.⁴³ Of the 30 companies reviewed, only BHP Billiton and Hess report aggregate water use per play and only EQT and Hess report the percentage of flowback water managed and reused per play. Promisingly, 18 companies do disclose policies that indicate an intent to favor the use of non-potable water sources. It appears that such policies are a growing norm within the industry, even if not always fully disclosed. BHP Billiton reports quantitatively on the percentage of water sourced from various water types for each shale play. A number of other companies report at different levels, such as by state or by company operating region. Two (2) companies—BHP Billiton and Chesapeake—disclose water intensity (the volume of water used by the company in order to produce one unit of energy) on a play-by-play basis. Notable disclosures in these areas include the following:

■ *Reducing Freshwater Use*

- *Apache*, in the drought-stricken Barnhart area of Texas' Permian Basin where it is drilling into the Wolfcamp Shale, uses no fresh water from the local aquifer. Rather, it uses flowback and produced water from previously-drilled wells together with brackish water from this region that has been deemed not suitable for human consumption or agriculture. The company drilled about 75 wells into the Santa Rosa aquifer in 2013 as the source of its brackish water. The company's recycling saves money since the cost of water disposal ranges from \$2.00 to \$2.50 per barrel, while the cost of recycling is approximately \$0.29 per barrel.⁴⁴
- *ConocoPhillips* has found that by increasing the quantities of sand, or "proppant," used in its Eagle Ford fracturing operations in Texas, along with other innovations, it has managed to reduce its water use per well by approximately 45%.⁴⁵
- *Devon* is placing covers on ponds it uses to store water for fracturing in the Permian Basin. The polyurethane covers save the company more than \$1 million annually in water purchases; the covers pay for themselves in two to six months.⁴⁶

42. Companies' use of pipelines in lieu of trucks to transport fluids can minimize road hazard concerns. A recent piping innovation, "lay-flat hose", can be swiftly laid by companies to achieve fewer potentially leaky connections compared to the use of conventional round pipes. See "Lay-flat hose: The economical answer for fluid transfer", Shale Play Water Management, May-June 2014, pages 10-13, <http://www.shaleplaywatermanagement.com/2014-May-June.html>.

43. Companies that already implement data management systems for aggregate internal and external reporting on water use and disposal have a head start and should configure these systems to report data on a disaggregated, play-by-play basis.

44. See "Fresh ideas for re-using water in Permian, Central Regions", http://www.apachecorp.com/News/Articles/View_Article.aspx?Article.ItemID=3893, and "Apache fracs Wolfcamp wells without fresh water in dry Barnhart project area", Unconventional Oil and Gas Review, February 11, 2014, <http://www.ogj.com/articles/uogr/print/volume-2/issue-1/wolfcamp/apache-fracs-wolfcamp-wells-without-fresh-water-in-dry-barnhart-project-area.html>.

45. <http://www.conocophillips.com/sustainable-development/common-questions/can-hydraulic-fracturing-be-done-responsibly/Pages/preserving-and-conserving-water.aspx>. The baseline year for this statistic is not provided.

46. <http://www.devonenergy.com/featured-stories/storage-pond-covers>. The covers reduce evaporative losses.

- *Intensity of Water Use*
 - *Noble Energy* released a report in 2012, authored by Colorado State University researchers and Noble staff, on the intensity of its water use in the Denver Julesberg basin of Colorado during 2010 and 2011, including assessments of both vertical and horizontal wells.⁴⁷
 - As noted in *DTF 2013, Chesapeake*, the second largest natural gas producer in the U.S., has uniquely reported water use intensity on a play-by-play basis.⁴⁸
- *Play-by-Play Water Use*
 - *Occidental* provides key metrics on water use for many of its regional operations (e.g. South Texas, North Dakota, and Colorado) in easy-to-use charts, including amount of potable municipal fresh water and other fresh water used; percentage of total use from each source; amount of non-freshwater used; amount of produced water generated and recycled; and direct discharge to surface waters.⁴⁹
 - *Apache* provides key metrics on water use for its regional operations, detailing municipal, surface and ground water sourcing, potable and non-potable water sourcing, and total water withdrawals.⁵⁰
- *Reuse & Recycling*
 - *Devon* has constructed a 21 million gallon collection and reuse basin to service its 36 multi-well sites in western Oklahoma's Cana Woodford shale play. The company is installing pipelines connecting the well sites and the collection basin across a 40-square-mile area. Each site can then receive water from the basin and return water to it without relying on trucks and their associated diesel emissions and road wear.⁵¹
 - As noted in *DTF 2013, CONSOL Energy* is using treated acid mine drainage water for its fracturing operations and has been willing to sell it to other companies.⁵²
 - As highlighted in *DTF 2013, Encana* is using treated industrial effluent for fracturing in the Haynesville Shale, while *Apache* and *Encana* are using subsurface saline water for fracturing in Canada's Horn River Basin.⁵³

TREATMENT AND DISPOSAL OF WASTE WATER AND SURFACE WATER PROTECTION: Water contamination can occur not only from chemicals deliberately added to fracturing fluids, but also from the naturally occurring contaminants in waters that are brought to the surface from shale formations as wells are completed, including flowback and produced waters. The wastes generated from drilling operations can also contain toxic chemicals, posing local water, air, and soil contamination risks, and need to be disposed of responsibly. Substantially larger amounts of drilling wastes are being generated as the horizontal lengths of wells grow longer, on the order of half a mile to one mile or more, and as companies drill more wells from single drill pads.

47. Noble 2012 Corporate Sustainability Report, page 26, http://www.nobleenergyinc.com/2012sr/pdf/FULL-REPORT/NBL051_2012SR.pdf. More detailed results can be found in Stephen Goodwin, et al., "Life cycle analysis of water use and intensity of oil and gas recovery in Wattenberg field, Colorado", Oil and Gas Journal, May 7, 2012, pages 48-59, <http://cewc.colostate.edu/wp-content/uploads/2012/05/OGJ-May-2012-Lifecycle-Analysis-of-Water-.pdf>.

48. See *DTF 2013* note 45 and associated text.

49. See <http://www.oxy.com/SocialResponsibility/Environmental-Stewardship/Pages/Colorado.aspx>; <http://www.oxy.com/SocialResponsibility/Environmental-Stewardship/Pages/Produced-Water-Management.aspx> and <http://www.oxy.com/SocialResponsibility/Environmental-Stewardship/Pages/Water-Management.aspx>.

50. Apache 2014 Sustainability Report, http://www.apachecorp.com/Sustainability/Environment/Water/Apache_global_water_usage/index.aspx.

51. Devon Energy 2011-2012 Corporate Responsibility Report, page 25, http://www.devonenergy.com/documents/DVN-2012CSR-5-29_2014.pdf.

52. See *DTF 2013* notes 49 and 52 and associated text.

53. See *DTF 2013* notes 50 and 51 and associated text.

Expert analysis has identified the use of open pits for storing flowback and produced water waste materials as one of the highest risk pathways for surface water contamination,⁵⁴ and one which increases the surface footprint of hydraulic fracturing operations. Closed, above-ground storage tanks, while not entirely risk-free, can lower risks to surface and ground water by preventing or mitigating leaks and overflows from open pits. Their use can also lower the surface footprint of wastewater management operations.⁵⁵ Closed tanks fitted with suitable vapor controls also mitigate risks to air quality by preventing toxic chemical vapors escaping into the atmosphere, as occurs with open storage pits.⁵⁶ The use of “closed loop” systems for the management and storage of drilling residuals is another means of reducing contamination risks.



IMAGE: Earthworks

Damaged lined waste pit

Question: The scorecard asks whether companies report a policy to store flowback water in closed tanks for their wells in each shale play, and also whether companies use closed loop systems for the management of drilling residuals for each shale play.

Scores & notable practices: Of the companies surveyed, only 5 report that they use closed tanks for wastewater storage for all plays and only 6 report routinely using closed loop management of drilling wastes across their plays. Notable practices include the following:

- *Use of Closed Loop Systems*
 - As highlighted in *DTF 2013*, *Anadarko* uses closed loop management systems in its Marcellus and Wattenberg operations, *CONSOL* uses closed loop systems in its Marcellus operations, and *Encana* uses closed loop systems in the Denver-Julesburg Basin in eastern Colorado.⁵⁷
 - As noted in *DTF 2013*, *EQT* created a waste treatment facility in West Virginia that has capacity to treat not only *EQT*'s waste water, but waste water from other sources.

IDENTIFYING & MANAGING NORMS: Naturally occurring radioactive materials (“NORMs”) have drawn considerable attention in the Marcellus Shale region, spurred by reports of increasing numbers of radioactivity warning alarms sounding at dump sites.⁵⁸ Radioactive materials have also become a serious concern in the Bakken formation of North Dakota because of illegal dumping of “filter socks” used in waste disposal that are contaminated with radioactive material.⁵⁹ Reporting on practices and results for NORMs management can address community concerns arising from a growing number of media reports about radioactivity associated with hydraulic fracturing operations.

54. Alan Krupnick, Hal Gordon, and Sheila Olmstead, “Pathways to Dialogue: What the Experts Say About the Environmental Risks of Shale Gas Development: Overview of Key Findings”, (Resources for the Future; 2013), page 19, http://www.rff.org/Documents/RFF-Rpt-PathwaystoDialogue_FullReport.pdf.

55. Closed tanks are not entirely risk-free because they can leak or mistakes can be made in their management. See *DTF 2013* note 41.

56. “Small study may have big answers on health risks of fracking’s open waste ponds”, InsideClimate News, October 10, 2014, <http://insideclimatenews.org/news/20141010/small-study-may-have-big-answers-health-risks-frackings-open-waste-ponds>.

57. See *DTF 2013* notes 57-60 and associated text.

58. “Radioactive debris triggers worries at dump sites”, Pittsburgh Tribune-Review, May 11, 2013 <http://triblive.com/business/headlines/3945499-74/gas-radiation-radioactivity#axzz38UXNXe2Z>.

59. See “North Dakota wrestles with radioactive oilfield waste”, High Country News, July 14, 2014, <http://www.hcn.org/articles/north-dakota-wrestles-with-radioactive-oilfield-waste>, and “Continental Resources hired contractor that stockpiled waste”, Oil Patch Dispatch, February 27, 2014, <http://oilpatchdispatch.areavoices.com/2014/02/27/continental-resources-hired-contractor-that-stockpiled-waste/>.

Question: The scorecard asks whether companies report practices for identifying and managing the hazards from naturally occurring radioactive materials.

Scores & notable practices: The number of companies reporting on their management of NORMs increased significantly, from 1 in *DTF 2013* to 6 in *DTF 2014*. Disclosures range from single-sentence to multi-paragraph descriptions. Notable examples include:

- *EQT* provides the most detailed explanation among all companies of how it manages radioactive materials. It works to minimize the waste, analyzes it, and, based on the results of the analysis, determines the type of landfill in which it should be disposed.⁶⁰
- *BHP Billiton* offers an extensive discussion of its NORMs management, noting how it monitors equipment and waste and makes disposal choices based on the monitoring results.⁶¹
- *Apache*, like *EQT* and *BHP Billiton*, discusses how it monitors NORMs and responds to risks they may pose.⁶²

Additional water management recommendations

- **Increase multi-company collaboration on freshwater use reduction.** While companies may be seeking a competitive edge in their prudent management of water risk, companies also are beginning to recognize the value of collaboration in water management. For example:
 - *Shell* and the City of Dawson Creek, British Columbia, collaborated on construction of a wastewater treatment plant whose effluent can be used by *Shell* and other companies in their fracturing operations. This collaboration reduces *Shell*'s use of fresh water, provides revenue to Dawson Creek, and, because the water is piped 30 miles to *Shell*'s operations, it is expected to reduce truck traffic on local roads by nearly 2 million miles during the life of the gas development project.⁶³
- **Provide information on potential water constraints on long-term drilling and completion plans, particularly in areas with elevated water risk.** In a 2014 report on water risk, *Ceres* recommended that companies provide information on the percentage of their revenues, operations, and future growth estimates that come from regions exposed to water risks. Because of the widely-recognized sharp decline in production during the first year of a fractured oil or gas well's operation, companies must continually drill new wells to maintain production levels. However their ability to do so in the future may be constrained by the amount and quality of water available. The magnitude of the limitations will be a function of a number of factors that can be heavily influenced by technological innovation, such as rising efficiencies in water use, increased use of non-potable waters, and use of fracturing techniques that reduce reliance on water.⁶⁴

60. *EQT* 2014 Social Responsibility Report, page 18.

61. *BHP Billiton*, "Case Study: Responsibly managing hydraulic fracturing", http://www.bhpbilliton.com/home/society/reports/Documents/2014/140912_ResponsiblyManagingHydraulicFracturingCaseStudy.pdf.

62. *Apache* 2014 Sustainability Report, http://www.apachecorp.com/Sustainability/Environment/Emissions/Managing_NORM/index.aspx.

63. <http://www.shell.ca/en/aboutshell/media-centre/news-and-media-releases/2012/0907dawson-creek.html>.

64. See Yuanlei Yang, et al., "Analysis of U.S. Hydraulic Fracturing Design Trends", *Society of Petroleum Engineers* (2013), <https://www.onepetro.org/presentation/SPE-163875-PT>. GASFRAC has been promoting its waterless gelled propane fracturing system. See www.gasfrac.com for more information.

3. AIR EMISSIONS

Issue

Air contaminants are emitted during multiple stages of oil and gas development. Studies have linked air emissions from oil and gas operations to declining air quality and associated public health risks.⁶⁵ Play-by-play reporting on management of air emissions—particularly volatile organic compounds (VOCs⁶⁶) and nitrogen oxides (NOx)—is relevant for investors in assessing local impacts, including the special demands that may be placed on companies operating in or near regions that violate, or may be at risk of violating, human health-based air quality standards, such as areas of Colorado, California, Texas, and Utah.⁶⁷

Greenhouse gas (“GHG”) emissions are another important air pollution issue receiving increased attention from investors and other stakeholders. Natural gas burns more cleanly than coal and with negligible emissions of sulfur dioxide and mercury, but these benefits can be offset, or partially offset, by leakage of methane in the natural gas production, transmission, and distribution life cycle. Leakage rates matter because methane is a tremendously potent greenhouse gas, having a “global warming potential” 86 times that of carbon dioxide over a 20-year time frame, according to the latest report by the Intergovernmental Panel on Climate Change.⁶⁸

65. See *DTF 2013* note 61.

66. VOCs help create ground-level ozone, which can contribute to severe respiratory and immune system problems. Benzene, toluene, ethyl benzene, and xylenes are VOCs that are naturally present in many hydrocarbon deposits and are separately regulated under the CAA. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1817691/>.

67. See *DTF 2013* notes 61 and 62. See also “Harmful air pollutants build up near oil and gas fields”, *Chemical and Engineering News*, March 25, 2014, <http://cen.acs.org/articles/92/web/2014/03/Harmful-Air-Pollutants-Build-Near.html>. The Eagle Ford Shale play’s impact on San Antonio’s air is being watched closely but is somewhat uncertain. See “What’s behind surging ozone pollution in Texas? Study to weigh role of fracking in health hazard”, *Inside Climate News*, October 23, 2013, <http://insideclimatenews.org/news/20131023/whats-behind-surging-ozone-pollution-texas-study-weigh-role-fracking-health-hazard>, and “Take a deep breath, Texas; fix air quality”, *My San Antonio Express-News*, May 14, 2014, <http://www.mysanantonio.com/opinion/editorials/article/Take-a-deep-breath-Texas-fix-air-quality-5481747.php>. Regarding the Uintah Basin in Utah, see “Questions arise about the role of methane in Uintah Basin air quality”, April 3, 2014, <http://kuer.org/post/questions-arise-about-role-methane-uintah-basin-air-quality>, and Utah Department of Environmental Quality, “Summary of findings from the Uintah Basin ozone study: preliminary update from 2013 field study”, http://www.deq.utah.gov/locations/U/uintahbasin/docs/2013/09Sep/SummaryFindings_UBSO2013_23Sep2013.pdf.

68. Methane is 28-34 times more potent over a 100-year time frame. See “Climate Change 2013: The Physical Science Basis, Intergovernmental Panel on Climate Change, page 714, http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf. Measurement of methane leakage from oil and gas production operations is critical to establishing whether increased production and use of natural gas provides a net climate benefit. As *Chemical and Engineering News* stated in a July 2014 overview of competing views, “Whether natural gas is a savior or destroyer of climate depends on how much is leaking into the atmosphere.” See “Methane’s role in climate change”, *Chemical and Engineering News* 92, no. 27, pages 10-15, July 7, 2014, <http://cen.acs.org/articles/92/i27/Methanes-Role-Climate-Change.html?h=1898752047>. See also Steven Hamburg, “Another major methane study shows action is needed now to reduce emissions”, February 13, 2014, <http://www.edf.org/blog/2014/02/13/another-major-methane-study-shows-action-needed-now-reduce-emissions>. The leakage rate of methane in the life cycle of natural gas use has been hotly debated, based largely on competing assumptions and measurement methodologies. For instance, one study may assume high natural gas leakage rates for long distance pipelines, while another may assume much lower leakage rates. More recently, studies based on actual measurements have come to competing conclusions due to differences in measurement design and scope. “Top down” studies using air samples from aircraft and towers suggest higher levels of leakage while “bottom up” measurements from facilities on the ground indicate lower overall levels but also signal “hotspots” of emissions from individual facilities. Both types of studies are improvements over pre-existing engineering estimates, but as carried out thus far, still need further improvement. The recent “bottom up” studies, most notably those conducted by a collaboration comprising the University of Texas, the Environmental Defense Fund (EDF), and industry, are limited in scope. The collaboration has faced criticism, including that the modest number of sites studied is not representative of most sites and that the number of wells tested at those sites were too limited. Concerns have also been raised that the results could have been biased because the project depended on industry cooperation. EDF provides extensive details on project methods and limitations, which are useful for weighing these critiques, in “FAQ about the University of Texas methane study”, <http://www.edf.org/climate/methane-studies/UT-study-faq>. “Top down” studies are important contributors of measured data, but it can be difficult to divide measurements among multiple contributing sources, such as landfills, wetlands, agriculture, natural methane seepage, and the several components of the oil and gas production and distribution life cycle. Much more consistent and comprehensive monitoring of well sites is necessary to measure and address actual leakage. Currently, regulators primarily use generic emission inventories to assess the impacts of natural gas operations. These “rely on limited, incomplete, and sometimes outdated emission factors and activity data, based on few measurements...[S]ubstantial additional measurements of air emissions from the natural gas life cycle are essential to understanding the impacts and benefits of this resource”. See Christopher W. Moore, et al., “Air Impacts of Increased Natural Gas Acquisition, Processing and Use: A Critical Review”, *Environmental Science and Technology* 48, no. 15, pages 8349-8359 (2014), <http://pubs.acs.org/doi/abs/10.1021/es4053472>.

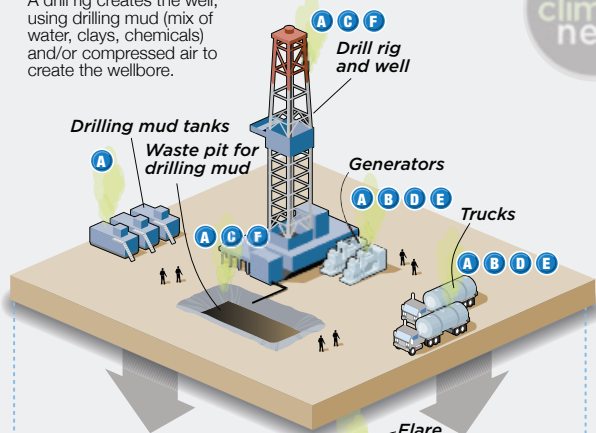
Air Emissions from Oil and Gas Development in the Eagle Ford

There are more than 7,000 oil and gas wells in the Eagle Ford Shale, and Texas regulators have approved another 5,500. Most of them, like the one shown here, are oil wells that also produce condensate and natural gas. Developing these resources releases various air pollutants, some of which are shown in this simplified diagram.



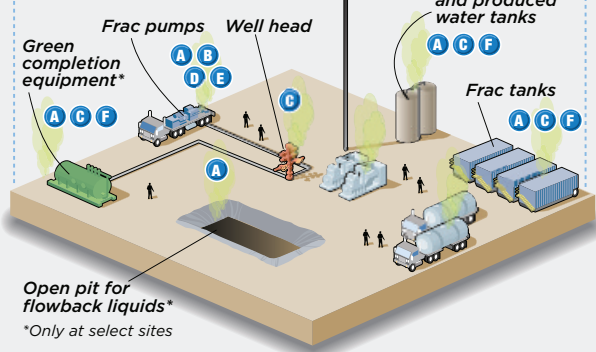
1 Drilling stage

A drill rig creates the well, using drilling mud (mix of water, clays, chemicals) and/or compressed air to create the wellbore.



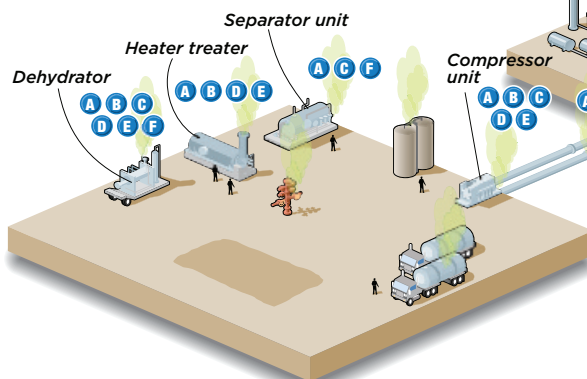
2 Hydraulic fracturing and well completion

Water, proppants and chemicals are pumped into the well to fracture the rock and release the oil and gas.



3 Production

The well begins to produce large amounts of oil and gas. The recovered oil is shipped to refineries; gas and condensates are separated and processed.



Emission Sources

The pollutants come from a number of sources, including the diesel- or natural gas-fueled equipment, the oil and gas itself, and leaks from storage devices. The emissions' actual and relative amounts vary widely based on operator practices and local geology. The emissions occur regularly in some cases, but are intermittent in others.

CHEMICAL	WHAT IT IS	WHAT IT DOES
A VOCs	Volatile organic compounds including benzene, formaldehyde	There are dozens of VOCs that make people sick. Some can cause cancer. VOCs react with NOx to form ozone, a respiratory irritant and greenhouse gas.
B PM	Particulate matter	Affects the heart and lungs.
C CH ₄	Methane	Main component of natural gas. Much more powerful than CO ₂ as a greenhouse gas.
D CO ₂	Carbon dioxide	Major greenhouse gas.
E NOx	Nitrogen oxides	Reacts with VOCs to create ozone.
F H ₂ S	Hydrogen sulfide	Toxic gas found in some gas fields. Causes illness and death at certain concentrations.

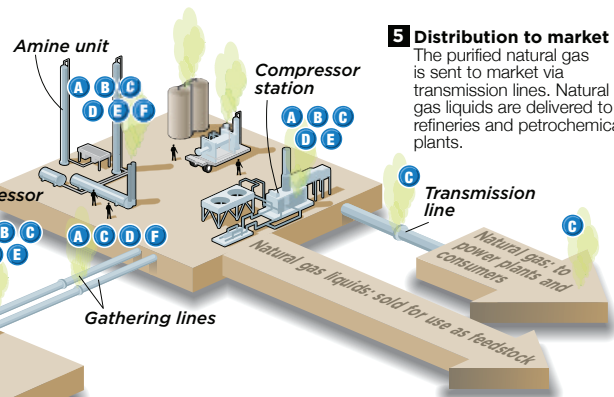
Fugitive emissions: pipelines, valves, pneumatic devices etc. leak methane, VOCs, H₂S and CO₂ throughout the entire process.

4 Dehydration, treatment and processing

Water, condensate, H₂S and other impurities are taken out of the raw natural gas. This can occur on or near the well pad or at a centralized processing facility. Additional equipment used to purify and process natural gas liquids is not shown here.

5 Distribution to market

The purified natural gas is sent to market via transmission lines. Natural gas liquids are delivered to refineries and petrochemical plants.



NOTES: the equipment and processes can vary with operator and facility. This diagram shows what the process could look like in a field with high levels of H₂S (common in the Eagle Ford Shale). Some sources, such as trucks, appear in multiple stages but their emissions are only shown once. For clarity, most pipelines are omitted, and only one well is depicted although well pads often have many wells. Not to scale.

SOURCES: EPA and Schlumberger publications; experts consulted for various aspects of the diagram include Ramón Alvarez (EDF), Richard Haut and Jay Olaguer (HARC), Alisa Rich (UNT), Jim Tarr (Stone Lions Env. Corp), engineers from industry and Cardno Entrix.

Research by LISA SONG / InsideClimate News Graphic by PAUL HORN / InsideClimate News

IMAGE: Paul Horn / Inside Climate News

State governments have begun to tighten regulations to reduce fugitive emissions of both methane and VOCs. For example, in 2014 Colorado adopted new rules requiring companies to routinely check equipment for leaks and fix any leaks detected.⁶⁹ Wyoming and Ohio have taken similar action.⁷⁰ Since 2013, Pennsylvania has required operators of gas compression and processing facilities to conduct quarterly leak assessments using Forward Looking Infrared (FLIR) cameras and to repair any detected leak no later than 15 days after detection.⁷¹ In April 2014, EPA released for peer review five technical white papers identifying potentially significant sources of methane and VOC emissions in the oil and gas sector, and methods for lowering them. These papers, which include assessments of compressors, pneumatic devices, and well completions, may be the forerunner of future EPA regulations.⁷²



IMAGE: WV Host Farms Program

Well site flare, Doddridge County, West Virginia

Well completions can be a sizeable source of both greenhouse gas and VOC emissions. When a well is completed and being made ready for production, the gases initially emerging from the well can be vented straight to the atmosphere, directed to and burned in a flare, or cleaned for sale purposes and routed quickly to a pipeline. Venting, which releases methane and other pollutants directly to the atmosphere, is the least desirable of these options, while quick routing to a pipeline is the most desirable. Flaring releases GHGs in the form of carbon dioxide emissions. “Green” or “reduced emission” completions are the terms generally applied to systems that capture much of the methane and other gases produced during well completions.⁷³ The captured gases can be directed to pipelines and sold, or flared, depending on equipment and applicable regulations. The payback period for the cost of such completions is relatively short when revenues are realized from sale of the gas. Regulations in Colorado and Wyoming have required green completions at gas wells for several years. More recent EPA regulations will require green completions nationwide at new gas wells starting in January 2015.⁷⁴

Flaring, though preferable to venting, has nevertheless been controversial, especially in North Dakota’s Bakken formation, where companies have been drilling for oil and burning off the associated gas because of the absence of gas collection pipelines and processing plants. In the Bakken, approximately 30% of gas is flared, as compared to roughly 1% in Texas, and the flaring is so widespread that it is visible from space. Only in 2014 did the State of North Dakota take action to address this problem; in June 2014, the state declared that permits for new wells will

69. See “Colorado’s tough new air rules for oil and gas: Inside story of how industry, enviros joined forces”, Denver Business Journal, March 3, 2014, http://www.bizjournals.com/denver/blog/earth_to_power/2014/03/colorados-new-strict-air-quality.html?page=all, and “Colorado first state to clamp down on fracking methane pollution”, Bloomberg, February 23, 2014, <http://www.bloomberg.com/news/2014-02-24/colorado-first-state-to-clamp-down-on-fracking-methane-pollution.html>. The rules were developed based on a proposal from three energy companies—Anadarko, Noble, and Encana—and the Environmental Defense Fund, but have been criticized by other energy companies concerned with compliance costs.

70. In late 2013, Wyoming adopted rules for the Upper Green River Basin, where energy production has led to unhealthy ozone pollution, that will require companies to scan their well sites on a quarterly basis with infrared cameras and make timely repairs. In 2014, Ohio adopted a policy that will require operators to find and fix leaks at new unconventional oil and gas wells on a quarterly basis. See Matt Watson, “Leading states tackling fugitive emission problems head-on”, Environmental Defense Fund, April 10, 2014, http://blogs.edf.org/energyexchange/2014/04/10/leading-states-tackling-fugitive-emissions-problem-head-on/?_ga=1.43197793.59674418.1403097462#sthash.OB4V606X.dpuf.

71. Pennsylvania Department of Environmental Protection Air Quality Program, “General Operating Permit BAQ-GPA/GP-5”, http://www.dep.state.pa.us/dep/deputate/airwaste/airwaste/aq/permits/gp/GP-5_2-25-2013.pdf.

72. <http://www.epa.gov/airquality/oilandgas/whitepapers.html>.

73. <http://www.epa.gov/airquality/oilandgas/index.html>.

74. The EPA regulations do not apply to oil wells or “hybrid wells” producing a mix of hydrocarbons. See <http://www.gpo.gov/fdsys/pkg/FR-2012-08-16/pdf/2012-16806.pdf>.

only be issued if permit seekers submit “gas capture plans” to capture the associated natural gas. State regulators further declared that, as of September 30, 2014, oil producers that fail to meet state targets for capping and reducing flaring will be faced with state-mandated oil production limits. The state’s goal is lowering flaring to 23% of produced gas by 2015 and 10% by 2020. Flaring has led to litigation by those who have leased mineral rights to oil and gas companies; the plaintiffs contend they have been denied royalties they should be earning on the flared gas.⁷⁵

Technical experts generally agree that, in addition to green completions, a sizeable number of cost-effective emission reduction measures are currently available to substantially reduce methane and other emissions. The *DTF 2014* scorecard therefore adds additional questions about these issues.⁷⁶

AIR EMISSIONS											
COMPANY	% green completions [^]	Low emission engines pad ops. [^]	% low emission vehicle conversion	NOX and VOCs reporting [^]	Pipelines replace trucks	NOX and VOCs reductions [^]	Methane leakage	Low-bleed controllers	Leak detection cameras	Leak inspection frequency	TOTAL
Encana	✓		✓	✓			✓	✓	✓		6
Andarko	✓		✓	✓				✓	✓		5
Apache	✓		✓	✓			✓	✓			5
EQT	✓		✓	✓			✓				4
Noble Energy		✓	✓	✓				✓			4
Range Resources			✓	✓			✓	✓			4
Ultra Petroleum*	✓			✓				✓	✓		4
BHP Billiton	✓			✓				✓			3
Chevron				✓				✓	✓		3
Devon	✓			✓			✓				3
EOG	✓			✓				✓			3
Chesapeake			✓					✓			2
ConocoPhillips				✓				✓			2
Exco Resources		✓		✓							2
Occidental Petroleum				✓				✓			2
Shell				✓				✓			2
Southwestern Energy				✓				✓			2
Talisman	✓			✓							2
Whiting Oil & Gas	✓							✓			2
BP								✓			1
CONSOL		✓									1
ExxonMobil				✓							1
Hess Energy				✓							1
WPX				✓							1

Companies that did not receive points for any indicator in this category are not included in this chart. They are Cabot, Carrizo, Continental Resources, Newfield Resources, Penn Virginia, and QEP.

[^] = Question requests disclosure by play.

75. See “North Dakota flaring crackdown may slow oil field growth”, Reuters, June 5, 2014, <http://www.reuters.com/article/2014/06/05/bakken-flaring-idUSL1N00K2AI20140605>; “North Dakota regulator sets new gas-flaring rules”, Wall Street Journal, July 1, 2014, <http://online.wsj.com/articles/north-dakota-regulator-sets-tough-gas-flaring-rules-1404257684>; “Dispute flares over burned-off gas”, Wall Street Journal, August 3, 2014, <http://online.wsj.com/articles/dispute-flares-over-burned-off-natural-gas-1407108281>; and “Executing the Gas Capture Plan”, The Bakken Magazine, August 2014, <http://www.thebakken.com/articles/763/executing-the-gas-capture-plan>. See also “How a sudden flood of oil money has transformed North Dakota”, Inside Climate News, July 21, 2014, <http://insideclimatenews.org/news/20140721/how-sudden-flood-oil-money-has-transformed-north-dakota>.

76. *DTF 2013* suggested increased reporting on use of low-bleed valves and on maintenance practices but did not include these as scorecard indicators. *DTF 2014* includes them.

Questions

The scorecard asks for play-specific information about the percentage of wells for which a company uses green completions; use of natural gas, or other reduced-emission methods to power well pad operations; emissions of NOx and VOCs from well drilling and completion activities; and reductions in NOx and VOC emissions from emission reduction efforts. The scorecard also asks, on a non-play-specific basis, for the percentage of vehicle fleets converted to lower emission fuels; methane leakage rates from drilling, completion, and production operations; the percentage or number of high-bleed valves replaced with lower emission valves; the technologies used to monitor operations for fugitive emissions; the frequency of monitoring for fugitive emissions; and the use of pipelines instead of trucks to move water.⁷⁷

Scores and discussion

Sixteen (16) companies—just over half of our sample—indicated they use Forward Looking Infrared (“FLIR”) cameras to detect emissions, but only 4 report on the frequency of their use. Just 10 companies report percentages of green completions and 7 report the percentage of their vehicle fleets being converted to natural gas-powered engines. Numerous companies are introducing dual-fueled drilling rigs to their operations, a practice Apache helped pioneer in 2012,⁷⁸ but only 3 companies—CONSOL, Exco, and Noble—report use of these rigs and other low-emission drilling and completion equipment on a play-by-play basis. Only 2 companies—Devon and Encana—report the percentages of high-bleed controllers they replace, and no company reports on a play-by-play basis its VOC and NOx emissions and reductions. Only 3 companies—Apache, EQT, and Range—report their methane leakage rates.

Changes in scores from DTF 2013

The most noteworthy positive changes in indicator reporting for this section include green completion percentages (from 3 to 10 companies), pipeline use in lieu of trucks (from 15 to 20, including 2 newly-scored companies), and vehicle fleet conversion (from 4 to 7).

Recommendations and notable practices

Pressure on companies to minimize air emissions throughout their oil and gas production life cycle is growing and is likely to be sustained in the years ahead. One potentially important driver of reduced emissions may be litigation by neighboring landowners alleging health harms from airborne contaminants. In a closely watched Texas case, a judge upheld a \$3 million damage award against a company for creating a private nuisance that affected a family's health, including inducing breathing trouble, nausea, nosebleeds, and rashes.⁷⁹ The decision is currently being appealed. In contrast, another Texas judge recently dismissed a similar lawsuit filed against two additional companies by landowners alleging a nuisance due to company emissions of benzene and other toxic chemicals impinging on use of their homes and property.⁸⁰ The common denominator of both cases—health harms related to oil and gas air emissions—is frequently alleged by people affected by oil and gas development around the country.

77. *DTF 2014* replaces a question from *DTF 2013* inquiring whether companies are reporting on their websites methane emissions from their drilling and completion activities. This question was deleted in favor of a technology-specific question on valves and maintenance practices that provides more information about companies' methane leakage management strategies.

78. http://www.apachecorp.com/News/Articles/View_Article.aspx?Article.ItemID=2957.

79. See “Texas fracking verdict puts industry on notice about toxic air emissions”, The Center for Public Integrity, May 28, 2014, <http://www.publicintegrity.org/2014/05/28/14812/texas-fracking-verdict-puts-industry-notice-about-toxic-air-emissions>; “Fracking companies fight Texas families’ pollution suits, fearing precedent”, InsideClimate News, August 13, 2014, <http://insideclimatenews.org/news/20140813/fracking-companies-fight-texas-families-pollution-suits-fearing-precedent>; and “Jury awards Texas family nearly \$3 million in fracking case”, Los Angeles Times, April 24, 2014, <http://www.latimes.com/nation/la-na-fracking-lawsuit-20140424-story.html#axzz2zocxGFhJ>.

80. “Judge throws out Texas family’s fracking pollution case”, InsideClimate News, August 15, 2014, <http://insideclimatenews.org/news/20140815/judge-throws-out-texas-familys-fracking-pollution-case>.

- **Reduce air emissions from drilling, well completion, and related production infrastructure.**

- *Vehicle Fuel Conversions*

- *Range Resources* reports that 184 vehicles—the majority of its field vehicle fleet—are now fueled by compressed natural gas (CNG). Range was the largest CNG corporate fleet purchaser in 2012 for both Chrysler and General Motors.⁸¹
- *Apache* has converted 50% of its 1200 vehicles to CNG, with a goal of converting 80%, and has opened 18 CNG fueling stations to serve its fleet. Six of the stations are open to the public.⁸²

- *Dual-Fuel Rigs*

- *Cabot*, whose wells produce gas that is 97% methane and less than 3% heavier hydrocarbons, uses methane to fuel its drilling rig generators. Cabot draws the gas either from a local pipeline or from mobile trailers of compressed gas. The gas can displace 30-40% of Cabot's diesel consumption. Cabot reports savings totaling \$144,000 by replacing diesel with natural gas at four wells; the company drilled 19 wells using natural gas in 2013.⁸³
- *Hess* converted half of its 14 drilling rigs in the Bakken from diesel to bi-fuel use (diesel or natural gas) in 2013, with attendant emission reductions and cost savings.⁸⁴ The company is also using a fleet of mobile units to capture-for-sale natural gas liquids that otherwise would be flared.⁸⁵

- *Flaring Reduction*

- *Continental Resources*, the Bakken's largest oil producer, discloses that in North Dakota's Bakken formation, it flared less than 11% of produced natural gas volume in 2013 compared to 15% in 2012 and 19% in 2011, despite increasing production. Continental notes that, in comparison, the entire industry flared approximately 30% of produced natural gas volume in the state as of late 2013.⁸⁶
- *Hess*, another of the largest oil producers in the Bakken, has set a goal of reducing flaring in the Bakken to 10% of produced natural gas volume by 2017 from more than 25% in 2013.⁸⁷ To accomplish this, the company is investing more than \$1.5 billion to build gas gathering systems, expand its gas processing plant, and explore ways to capture gas at the wellhead for use in operations.

- *Disclosing Leakage Rates and Enhancing Leak Detection*

- *Range Resources* declares that total methane emissions from all of its operations were 0.17% (less than 1%) of the company's annual production for 2012, based on EPA prescribed measurement protocols. The company further reports total GHG emissions (methane and carbon dioxide) declined 31% between 2011 and 2012. The company notes that providing percentages, rather than reporting on total emissions, "clearly [demonstrates] for stakeholders which companies are being the most effective in minimizing emissions based on the same relative measurement." The company lists 17 different approaches it uses, including forward-looking infrared "FLIR" cameras and low-bleed valves, to minimize emissions.⁸⁸

81. Range Resources Corporate Responsibility Report, page 13, http://rangeresponsibility.com/pdf/Range_Resources_CR_Report.pdf.

82. http://www.apachecorp.com/Sustainability/Environment/Energy/Fueling_efforts_to_promote_natural_gas/index.aspx.

83. <http://www.cabotog.com/social-responsibility/natural-gas-usage/>.

84. Hess projects payback periods of 1 to 3 years for these investments. See Hess 2014 CDP Air Report, Section CC3.3b, <http://www.hess.com/docs/default-source/sustainability/investor-information-request>.

85. Hess 2013 Corporate Sustainability Report, pages 39-40, <http://www.hess.com/docs/default-source/sustainability/hess-corporation-2013-csr.pdf?sfvrsn=2>.

86. Continental's disclosures were in response to a shareholder resolution requesting the company develop quantitative goals to reduce flaring. For the shareholder resolution from Mercy Investments, see <http://www.ceres.org/investor-network/resolutions/continental-resources-flaring-2013>. For Continental's 10-K disclosures, see page 22, <http://nocache-phx.corporate-ir.net/phoenix.zhtml?c=197380&p=irol-SECText&TEXT=aHR0cDovL2FwaS50ZW5rd2l6YXJkLmNvbS9maWxpbnmcueG1sP2lwYWdlPTk0MjQ4MjlmRFNFUT0wJINFUT0wJINRREVTQz1TRUNUSU9OX0VOVEISRZzdWJzaWQ9NTc%3d>.

87. Hess 2014 CDP Air Report, Section CC3.1b, <http://www.hess.com/docs/default-source/sustainability/investor-information-request>.

88. <http://rangeresponsibility.com/environment-health-and-safety/emission-reduction-and-elimination/>.

- *EQT* reports that its methane emissions were 0.19% of its total production, using EPA measurement protocols.⁸⁹
 - *Apache, Hess, Noble, Southwestern, BG Group*, and the Environmental Defense Fund launched a “Methane Detectors Challenge” in April 2014 aimed at identifying and bringing to market new, relatively low-cost, cutting-edge technologies useful for detecting and reducing methane emissions.⁹⁰
 - As reported in *DTF 2013*, *Noble* expanded its program of using infrared cameras to detect and correct maintenance problems in 2012. The company reports surveying 600 sites, identifying approximately 1,000 maintenance opportunities, saving more than 40 million cubic feet of natural gas, and reducing GHG emissions by more than 500 metric tons.⁹¹
- *Substituting Water Pipelines for Trucks*: Reduced reliance on trucks results in less noise, lower greenhouse gas emissions, reduced transportation costs, and reduced risk of vehicle accidents.
- *Hess* has begun to use flat steel hoses instead of trucks to transport water. Laid in 600 foot sections over several miles, these are now used at 20% of *Hess*’s wells. When piloting this project, *Hess* eliminated the need for 5,000 truckloads. The company has set a 2014 goal to use hoses for 25% of its water needs in the Bakken.⁹² Other companies employing “lay flat pipes” include *Apache* and *Chesapeake*.
 - *Anadarko* uses “Stim Centers”— centralized facilities where equipment and horsepower for hydraulic fracturing operations are sited. From these central facilities, the company pipes frac fluid via pipes to adjoining pads, “reduc[ing] truck traffic and associated emissions and the resources required to continuously set up, break down, and move operations from one well pad to another.” These facilities maximize the number of well pads served while providing “adequate distance” from homes and other occupied buildings.⁹³
 - *Occidental*’s Barilla Draw water distribution project, serving its operations in Texas’ Wolfcamp Shale, will include over 50 miles of pipeline and 25 water ponds, networked together, to allow *Oxy* to distribute water to its well locations. The project is expected to result in a 4% capital cost savings per well, through reduction of water handling costs by more than 75%, and “it will become the standard water handling template for future horizontal well developments.”⁹⁴
 - *DTF 2013* included examples of additional emission reduction accomplishments and innovations from companies, including green completions, engine conversions, use of solar power, and replacement of high-bleed valves.⁹⁵

89. *EQT* 2014 Corporate Social Responsibility Report, page 20. The figures are for *EQT*’s “upstream” operations, i.e. exploration, drilling, completion, and production operations.

90. *Shell* joined the initiative in June 2014. The project has issued a request for proposals of technologies that will be evaluated. See <http://www.edf.org/energy/natural-gas-policy/methane-detectors-challenge>. Methane detection and reduction is a rich area of competitive innovation, from Fortune 500 companies to startups. See, for example, “12 companies to pitch oil and gas execs at Colorado cleantech challenge”, *Denver Business Journal*, September 12, 2014, http://www.bizjournals.com/denver/blog/earth_to_power/2014/09/12-companies-to-pitch-oil-and-gas-execs-at.html?page=all; “Applying creativity to a byproduct of oil drilling”, *New York Times*, December 17, 2013, http://www.nytimes.com/2013/12/18/business/energy-environment/applying-creativity-to-a-byproduct-of-oil-drilling-in-north-dakota.html?pagewanted=all&_r=0; and “Pioneer Energy takes aim at unwanted ‘flared’ natural gas in oil fields”, *Denver Business Journal*, July 29, 2014, http://www.bizjournals.com/denver/blog/earth_to_power/2014/07/pioneer-energy-takes-aim-at-unwanted-flared.html?page=all.

91. *Noble* 2012 Sustainability Report, page 33, http://www.nobleenergyinc.com/2012sr/pdf/FULL-REPORT/NBL051_2012SR.pdf.

92. *Hess* 2013 Corporate Sustainability Report, page 40, <http://www.hess.com/docs/default-source/sustainability/hess-corporation-2013-csr.pdf?sfvrsn=2>. The long lengths of pipe, as compared to the much shorter lengths of round pipe that are conventionally used, mean that the number of connections between pipes can be reduced, thereby reducing the risk of leaks at connection points.

93. <http://www.anadarko.com/Operations/Pages/HydraulicFracturing.aspx>.

94. Edited transcript: *OXY-Q1 2014 Occidental Petroleum Corporation Earnings Conference Call*, May 5, 2014, page 7, <http://www.greeleytribune.com/news/business/11049853-113/drilling-anadarko-center-stim>.

95. See *DTF 2013* notes 67-72 and associated text.

- **Increase play-by-play or more localized reporting:** Air pollution, and its health effects, remains a top-level concern of local communities and regulators. As such, it must be a high priority for companies. Companies that already have systems in place to report aggregate emissions of regional significance (e.g. VOCs and NOx) should use these systems to report data on a disaggregated, play-by-play basis, so that problems with local air quality are identified and addressed and improvements are made public. Where monitoring and reporting are not being conducted locally, companies should make it a priority to do so, even when not required by regulation, in order to reduce health impacts, avoid lawsuits, and improve community relations.

4. COMMUNITY IMPACTS

Popular Perception of Risks from Hydraulic Fracturing Operations



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Issue

As the shale energy industry has boomed and expanded across the nation, operations have increasingly overlapped with local communities. Many communities have expressed concerns about the adverse impacts of this industrial activity, including fear of potential harm to air and water quality and human health, as well as disruptions to community life through increased traffic congestion, road damage, impacts on community facilities and services, or shortages of affordable housing.⁹⁶ Added to these daily problems, communities and employees face the potential of catastrophic impacts to safety, health, and the environment.⁹⁷ The industry's failure to adequately respond to these

96. Other impacts include "boom town" effects such as increased crime, drug use, prostitution, and human trafficking, issues which are difficult for companies to address alone, but are very real to those living in the communities.

97. Selected high profile incidents include, for example, a Chevron well pad explosion and fire that lasted more than a week, during the early days of which Chevron blocked state regulators from the site ("Chevron blocked access to DEP after fatal well fire in southwest Pa.", NPR, <http://stateimpact.npr.org/pennsylvania/2014/04/09/chevron-blocked-access-to-dep-after-fatal-well-fire-in-southwest-pa/> and "Report faults Chevron in deadly gas well fire" <http://news.yahoo.com/report-faults-chevron-deadly-gas-well-fire-194345927.html>). Other examples include a Whiting Oil & Gas well blowout in North Dakota where the escaping fluids were contained in a protective berm ("ND official: Whiting well leaking 200 barrels a day in ND," <http://bakken.com/news/id/78256/nd-official-whiting-well-leaking-200-barrels-day-nd/>) and a spill of one million gallons of briny water from a ruptured pipeline in North Dakota ("Cleanup area nearly 2 miles down ravine after ND saltwater spill; separated pipe suspected", US News & World Report, July 10, 2014, <http://www.usnews.com/news/us/articles/2014/07/10/cleanup-of-nd-pipeline-spill-could-last-weeks>). Leaks from Range Resources' waste water impoundments in Pennsylvania that reportedly were constructed incorrectly, have led to lawsuits and violation notices from the state based on stream and groundwater contamination. In September 2014, Range agreed to pay a \$4.15 million fine for its actions. See "State: Fracking waste tainted groundwater, soil at three Washington County sites", Pittsburgh Post-Gazette, August 6, 2014, <http://www.post-gazette.com/local/washington/2014/08/06/Pa-finds-tainted-water-soil-at-three-Washington-County-shale-sites/stories/201408050198#ixzz3A6SeShbq>, and "Range Resources to pay \$4.15M penalty", Pittsburgh Post-Gazette, September 18, 2014, <http://www.post-gazette.com/local/2014/09/18/DEP-orders-Range-Resources-to-pay-4-million-fine/stories/201409180293>. Despite industry assurances to the public about the safety of operations, a 2013 Resources for the Future public opinion survey in Pennsylvania and Texas found that in both locations industry messaging about hydraulic fracturing increased public opposition to and concern around risks of fracturing as often as it reduced them. See Alan J. Krupnick, et al., "The natural gas revolution: critical questions for a sustainable energy future", Resources for the Future, 2014, page 23, <http://www.rff.org/RFF/Documents/RFF-Rpt-NaturalGasRevolution.pdf>.

concerns has prompted backlash and opposition culminating in bans and moratoria on hydraulic fracturing by over 100 local governments across the U.S. and leading community activists to frame hydraulic fracturing as a human rights issue.⁹⁸ Recognizing that the industry faces a real threat to its social license to operate, investors have increasingly pressed companies to disclose systematic policies and practices for effectively identifying and responding to community concerns.

In several states, community concerns have led local and state governments to compete in a tug of war over the extent to which local governments can exert control over hydraulic fracturing operations.⁹⁹ Communities in Pennsylvania and New York secured court decisions in 2013 and 2014 affirming that local governments have authority to limit hydraulic fracturing operations.¹⁰⁰ In 2014, Coloradans engaged in an extended debate over local authority, leading to judicial decisions overturning three local efforts to limit fracturing operations and the creation of a gubernatorial panel whose mandate is to create policies that reduce conflicts between communities and companies.¹⁰¹ In Texas, where cities such as Dallas and Fort Worth exercise considerable “home rule” authority, local impacts such as road damage, noise, traffic, and odors are addressed by local governments, not the Texas Railroad Commission, which otherwise regulates oil and gas operations in the state.¹⁰²

Internationally, the principle of earning community approval has been labeled Free, Prior, and Informed Consent (“FPIC”). The primary focus of this human rights principle has been to uphold the sovereignty of Indigenous Peoples

98. See “Santa Cruz becomes first California county to ban fracking”, <http://rt.com/usa/160316-santa-cruz-ban-fracking/>. Voters in some localities in Texas, Ohio, and California voted to ban or put new restrictions on hydraulic fracturing for oil and natural gas, though other ballot measures in those states failed. See “Mixed results for local anti-fracking measures”, The Hill, November 5, 2014, <http://thehill.com/policy/energy-environment/223072-mixed-results-for-local-anti-fracking-measures>. For more details on bans, moratoria, and variations among state regulations, see sources cited in *DTF 2013* note 6.

99. Hannah J. Wiseman, one of the foremost academic legal authorities on state fracturing regulation, concluded in 2014 that “Gaps remain in the substance of regulations...and many states appear to lack adequate support or policies for training industry in compliance matters, monitoring activity at sites, prioritizing certain types of regulatory violations that pose the highest risks, enforcing laws, and ensuring that the public is aware of inspections and enforcement and can therefore monitor state activity”. See Hannah J. Wiseman, “The Capacity of States to Govern Shale Gas Development Risks”, *Environmental Science and Technology* 48, no. 15 (2014), pages 8376-8387, <http://pubs.acs.org/doi/abs/10.1021/es4052582>. State regulators claim they are making progress through the Groundwater Protection Council (GWPC), which has published an overview of regulations in 27 states accounting for 98% of U.S. oil and gas production. The report tracks improvements since a similar overview published in 2009 and projects continued tightening in the future. GWPC “believes that regulation of oil and gas field activities is managed best at the state level where regional and local conditions and best applied practices are understood, and where regulations can be tailored to fit those conditions.” See “State Oil & Gas Regulations Designed to Protect Water Resources”, Groundwater Protection Council, 2014, <http://www.gwpc.org/state-oil-gas-regulations-designed-protect-water-resources-2014-edition>.

100. In 2012, Pennsylvania’s state government enacted “Act 13” to severely limit local controls over hydraulic fracturing operations. In December 2013, in response to a lawsuit filed by local governments, Pennsylvania’s Supreme Court ruled that major provisions of Act 13 violated Pennsylvania’s Constitution, which declares that Pennsylvanians have a right to clean air and pure water and that the state government, as trustee of Pennsylvania’s resources, has an obligation to “conserve and maintain them for the benefit of all the people”. See “Pennsylvania Supreme Court declares portions of shale-drilling law unconstitutional”, <http://www.post-gazette.com/local/2013/12/19/Pennsylvania-Supreme-Court-declares-portions-of-shale-drilling-law-unconstitutional/stories/201312190254>, and “Environmental rights: 5 facts about the Pennsylvania constitution”, http://www.pennlive.com/midstate/index.ssf/2014/04/environmental_rights_5_shockin.html. In New York State, the New York Court of Appeals, the state’s highest court, in a challenge to local bans brought by an energy company and a local landowner, affirmed the right of local governments to impose these restrictions. See <http://www.usatoday.com/story/news/nation/2014/06/30/fracking-new-york-court-ruling/11765711/>.

101. See “Judge overturns Lafayette fracking ban”, Bizwest, August 27, 2014, http://bizwest.com/judge-overturns-lafayette-fracking-ban/?utm_source=internal&utm_campaign=employee. To address the ongoing controversy, in August 2014, Governor John Hickenlooper agreed to work with anti-fracturing advocate Rep. Jared Polis (D-CO) to establish an 18-member panel to write new proposals to reduce conflicts between oil and gas companies and local communities. In exchange, state-level anti-fracturing ballot initiatives were withdrawn as was a state challenge to a local ordinance. See, for example, “Colorado compromise aims to head off fracking showdown at ballot box”, Houston Chronicle Fuel Fix, August 4, 2012, <http://fuelfix.com/blog/2014/08/04/colorado-compromise-aims-to-head-off-fracking-showdown-at-ballot-box/>.

102. See Charles Davis, “Substate federalism and fracking policies: does state regulatory authority trump local land use autonomy?”, *Environmental Science and Technology* 48, no. 15 (2014), pages 8397-8403, <http://pubs.acs.org/doi/abs/10.1021/es405095y>. In Colorado, where local governments have much less regulatory control over fracturing operations than local governments in Texas, some local communities have negotiated memoranda of understanding (MOUs) with oil and gas companies requiring additional protective practices to supplement state requirements. See, for example, “Erie’s oil and gas agreements could serve as statewide model”, Boulder Daily Camera, September 6, 2012, http://www.dailycamera.com/ci_21486096/eries-oil-and-gas-agreements-could-serve-statewide.

to protect their communal lands and cultures and their right to self-determination; the same concept may also apply to domestic oil and gas development.¹⁰³

In both the U.S. and Canada, impacts of shale development have been an issue involving Indigenous Peoples. In North Dakota, the 180,000 barrels of daily oil production from the 1,000 wells on the Ft. Berthold Indian Reservation in the Bakken would place the reservation among the top 10 state producers of oil if the reservation were a state. While this production has provided an economic boost to the resident Mandan, Hidatsa, and Arikara tribes, it has also brought with it a host of problems, including pipeline spills, illegal waste dumping, and rising crime.¹⁰⁴ In contrast, the Council of Yukon First Nations in Canada has vowed not to allow fracturing operations on its lands.¹⁰⁵ In June 2014, the Supreme Court of Canada ruled that the federal and provincial governments must consult and accommodate Indigenous Peoples on projects proposed on their lands.¹⁰⁶



IMAGE: WV Host Farms Program

Heavy truck traffic, Wetzels County, West Virginia

Companies, whether operating inside or outside the U.S., and whether in a system with strong or weak laws, must proactively, creatively, and forthrightly develop appropriate engagement processes. Recognizing that the industry faces a material threat to its social license to operate, and that the health and welfare of human lives and the environment are in the balance, investors have increasingly pressed companies to disclose systematic policies and practices to effectively identify and respond to key community concerns.¹⁰⁷

Through careful assessment of community risks and consultation with impacted communities, companies can build broad community support for new projects. Otherwise, they may face community and government opposition, and associated costly delays, to new projects or expansions of existing operations. Play-by-play disclosure of community concerns and corporate responses to those concerns is particularly imperative because of the place-based nature of these issues.

103. Although FPIC is embodied in a number of international agreements and declarations, its specific operational meanings are still being worked through both globally and on a case-by-case basis. With regard to hydraulic fracturing in New York State, see Environment and Human Rights Advisory, “A Human Rights Assessment of Hydraulic Fracturing for Natural Gas”, 2011, http://www.earthworksaction.org/files/publications/EHRA_Human-rights-fracking-FINAL.pdf. For a similar analysis of the U.K., where advocates suggest a moratorium on hydraulic fracturing until a human rights impact assessment is conducted, see Anna Grear, et al., “A Human Rights Assessment of Hydraulic Fracturing and Other Unconventional Gas Development in the United Kingdom”, 2014, <http://www.sas.ac.uk/sites/default/files/files/UK%20HRIA%20w%20appdx-hi%20res.pdf>.

104. See “North Dakota tribes’ oil output rivals US states”, Houston Chronicle Fuel Fix, April 23, 2014, <http://fuelfix.com/blog/2014/04/23/north-dakota-tribes-oil-output-rivals-us-states/>; “Dark side of the boom”, Washington Post, September 28, 2014, <http://www.washingtonpost.com/sf/national/2014/09/28/dark-side-of-the-boom/>; and “Tribe warns that children might play with illegally dumped filter socks”, Bismarck Tribune, March 5, 2013, http://bismarcktribune.com/bakken/tribe-warns-that-children-might-play-with-illegally-dumped-filter/article_1937f2a2-85ce-11e2-8878-001a4bcf887a.html.

105. Ed Struzik, “A new frontier for fracking: drilling near the Arctic Circle”, Yale Environment 360, August 18, 2014, http://e360.yale.edu/feature/a_new_frontier_for_fracking_drilling_near_the_arctic_circle/2794/.

106. The court ruled that “governments and others seeking to use the land must obtain the consent of the aboriginal title holders”, although if consent is not granted, the government could justify moving forward if a project has a compelling purpose and is consistent with the government’s fiduciary duty to indigenous peoples. See “Canada must consult with aboriginal groups on land use: court”, Bloomberg BNA, June 27, 2014, <http://www.bloomberg.com/news/2014-06-27/canada-must-consult-with-aboriginal-groups-on-land-use-court.html>.

107. In its 2013 report, “Indigenous Rights Risk Report for the Extractive Industry (U.S.)”, First Peoples Worldwide commented, “Events over the last decade have proven that companies that fail to respect Indigenous Peoples’ rights and do not forge positive, trust-based relationships with Indigenous communities increase their risk of protests, negative press, work stoppages, shut-downs, and law suits—all of which have a negative and material impact on profits and share price.” See <http://www.firstpeoples.org/images/uploads/R1KReport2.pdf>, page 3.

Questions

The scorecard asks whether a company describes or discloses major identified community impact concerns and company responses to those concerns on a play-by-play basis; internal processes for aggregating local concern statistics and for reporting local concern statistics upward within the company; and clearly stated policies to adjust activity schedules to prevent or reduce traffic congestion and to reimburse state and local authorities for road damage caused by its operations.

COMMUNITY IMPACTS						
COMPANY	Disclose community impact concerns, company response [^]	Aggregate statistics for local concerns	Upward reporting of local concern statistics	Traffic congestion policies	Road damage payment policies	TOTAL
BHP Billiton		✓	✓	✓	✓	4
EQT	✓	✓	✓	✓		4
EOG		✓	✓	✓		3
BP		✓		✓		2
Chesapeake		✓	✓			2
Encana		✓		✓		2
ExxonMobil		✓		✓		2
Cabot				✓		1
ConocoPhillips		✓				1
Hess Energy				✓		1
Newfield Resources				✓		1
Noble Energy				✓		1
Shell				✓		1

Companies that did not receive points for any indicator in this category are not included in this chart. They are Anadarko, Apache, Carrizo, Chevron, CONSOL, Continental Resources, Devon, Exco Resources, Occidental Petroleum, Penn Virginia, QEP, Range Resources, Southwestern Energy, Talisman, Ultra Petroleum, Whiting Oil & Gas, and WPX.

[^] = Question requests disclosure by play.

Scores and discussion

Overall there are fewer companies earning points in this topical area than in the scorecard's other four topical areas. Eleven (11) companies have policies to adjust or reduce traffic congestion as a result of operations, but only BHP Billiton clearly states a policy to reimburse state and local authorities for road damage caused by its operations. Eight (8) companies disclose their internal processes for aggregating local concern statistics, but only EQT provides detailed statistics describing those concerns. Only 4 companies identify how these concerns are reported upwards within the company.

Many companies provide general discussions of the processes they have in place for engaging local communities and some provide case studies of how they have done this. But without systematic play-by-play reporting on whether and how companies are managing specific community concerns, investors do not have adequate data to evaluate the risks of potential moratoria and other disruptions to operations.

Changes in scores from DTF 2013

Disclosure increased on two indicators: corporate efforts to address traffic congestion (from 3 to 11 companies) and corporate aggregation of local concerns (from 4 to 8).

Recommendations and notable practices

- **Publish general policies, guidelines, and decision criteria for addressing local impacts and key performance indicators.** One consequence of the industry's minimal reporting on how it addresses community concerns is that companies' individual reputations and the reputation of the industry as a whole are currently defined principally by high-profile complaints about community harms. Companies should state what measures they routinely take, beyond actions required by applicable regulations, to address community impacts.¹⁰⁸ Such measures could include, for example, policies regarding payments to local governments for extra fire, police, emergency response, healthcare personnel, and equipment; road repair and traffic management, with recognition that legal requirements for such actions may vary from state to state; abatement of light, noise, and other nuisances that impact residential zones and community facilities; or mechanisms to address local concerns about air and water quality and affordable housing.¹⁰⁹ Decision criteria could include a list of circumstances under which measures are taken or payments are made. In addition, companies should establish measureable metrics to address and incorporate stakeholder concerns into their management practices, including concerns from community residents, NGOs, and businesses.
 - *Traffic and Roads*
 - *Noble Energy* reports that, before starting its Marcellus Shale region operations, it learned communities were concerned about traffic and environmental impacts from operations. Consequently, Noble developed a Road Use Commitment, which includes restricting heavy equipment and truck traffic during school and peak traffic hours, using staging areas to reduce the number of trucks on the road, and adopting a “we break it, we fix it” approach to property damage.¹¹⁰
 - *EOG Resources* reports that it “proactively addresses community concerns regarding traffic congestion and wear and tear to local roads occurring in the normal course of oil and gas operations, specifically by truck traffic. EOG instructs trucks supporting its operations to avoid roads near schools during school zone times (i.e. during the beginning and ending of the school day) and to use predetermined travel routes designed to keep trucks off of more populated and heavily traveled roads”.¹¹¹
 - *EQT* has developed a “school zone curfew program” for its trucks.¹¹²
 - *Chesapeake Energy* promoted development of a model road maintenance agreement to be used by highway authorities and oil and gas companies in Ohio.¹¹³ The model agreement addresses issues such as pre-drilling assessments of road conditions, road use and repairs, and posting of performance bonds by companies.¹¹⁴

108. In July 2014, the American Petroleum Institute published “Community Engagement Guidelines”, outlining steps companies can take to engage local communities. See http://www.api.org/~media/Files/Policy/Exploration/100-3_e1.pdf. Publishing specific community concerns and actions the company has taken is highlighted as important in the IPIECA/API/OGA “Oil and Gas Industry Guidance on Voluntary Sustainability Reporting”, 2010, page 87, Indicator SE1, http://www.api.org/environment-health-and-safety/~media/files/ehs/environmental_performance/voluntary_sustainability_reporting_guidance_2010.pdf. The guidance recognizes a growing call for companies to provide “data on the types of concerns raised via engagement or grievance mechanisms, and how concerns have been addressed.”

109. For a good overview of the stunning, multi-faceted impact of Bakken oil development on Williston, North Dakota, see “Welcome to Williston, North Dakota: America’s new gold rush city”, *The Guardian*, July 28, 2014, <http://www.theguardian.com/cities/2014/jul/28/-sp-welcome-williston-north-dakota-america-new-gold-rush-city>. A Duke University study of several major shale plays concludes that, for the most part, shale development has had a positive impact on local public finances. These funds can be used to address increased demand for community services and other impacts. See Duke Shale Public Finance Project, <http://energy.duke.edu/shalepublicfinance>, and <http://www.coloradomesa.edu/energy/symposium/documents/2014presentations/7-Energy-Environment-2014-Daniel-Raime-Fiscal-Impacts.pdf>.

110. Noble 2012 Sustainability Report, page 14, http://www.nobleenergyinc.com/2012sr/pdf/FULL-REPORT/NBL051_2012SR.pdf.

111. <http://www.eogresources.com/responsibility/hydraulicfracing.html>.

112. EQT 2014 Social Responsibility Report, page 11.

113. Chesapeake 2011 Corporate Responsibility Report, page 34, <http://www.chk.com/Media/Publications/Corporate-Responsibility-Report/Documents/pdf/2011CorporateResponsibilityReport.pdf>.

114. For the text of the model agreement, see http://www.ceao.org/aws/CEAO/pt/sd/news_article/88051/_PARENT/layout_details/false. For a specific example, an agreement between Jefferson County, Ohio, and Chesapeake, see <http://www.ovrdc.org/Links/ROADWAY%20USE%20AND%20MAINTENANCE%20AGREEMENTS%207-7-11.pdf>.

■ *Tracking Concerns and Responses*

- EQT launched an “issues tracking and resolution” process in 2013. Of the 113 issues reported to the database by the company’s network of designated community advisors, 54% related to construction traffic or road conditions, 20% to possible property damage, and the remaining 27% to a variety of additional issues. EQT also operates a related water tracking program, which tracks complaints and other data. Company staff now report quarterly to senior corporate management on “the number of complaints received per 100 wells spud [wells where drilling has begun].”¹¹⁵
 - BHP Billiton reports that “[c]ommunity concerns and complaints are acknowledged, documented, investigated, and resolved, and reported back to the complainant in each of our shale play operations. The process further informs stakeholders that a complaints and grievances process exists and the method for submitting a complaint. The process is easily accessible to all members of the community, including vulnerable and disadvantaged groups. Additionally, we track all community complaints in our global database system, allowing local concerns to be aggregated and reported upward via weekly reports to petroleum leadership within our Company, including the President.”¹¹⁶
 - Chesapeake Energy describes its process for tracking and responding to community concerns expressed via its 24/7 toll-free telephone number posted at wells and other facilities. Twice every month the company provides summaries of concerns and coordinated responses to senior management.¹¹⁷
- *Integrated Program — Proactively Anticipating Community Concerns*
- CONSOL Energy discusses its use of multiple leading practices for its drilling project on 9,200 acres at Pittsburgh International Airport, which starts with 45 wells on 6 pads. CONSOL states that it “takes its social license to operate very seriously” and will be using state-of-the-art technologies and practices, including, for example, testing of all drinking water sources within 2,500 feet prior to drilling, along with resampling following drilling; closed loop systems for managing drill wastes; low-emitting engine technology for drilling and completions equipment; electric-powered drilling rigs; green completions with no flaring; and recycling of all flowback water.¹¹⁸



IMAGE: Tim Ruggiero, Earthworks

Not your typical neighbor

Other companies would be well-served by making presentations similar to CONSOL’s, subject to a critically important proviso: such narratives are most valuable where they are presented as illustrating overarching company policies applied in all communities (allowing for variations among communities), rather than as exceptional or unique programs.

115. EQT 2014 Social Responsibility Report, pages 28-29.

116. BHP Billiton, “Case Study: Responsibly managing hydraulic fracturing”, http://www.bhpbilliton.com/home/society/reports/Documents/2014/140912_ResponsiblyManagingHydraulicFracturingCaseStudy.pdf.

117. Chesapeake 2011 Corporate Responsibility Report, page 34, <http://www.chk.com/Media/Publications/Corporate-Responsibility-Report/Documents/pdf/2011CorporateResponsibilityReport.pdf>. The company does not indicate, however, how it tracks community concerns expressed in other venues.

118. CONSOL 2013 Corporate Responsibility Report, page 18. This approach combines many of the best current practices highlighted in the air and water management sections of this scorecard.

Companies' reports on their efforts to address road issues are a reminder that these are among the most visible yet readily addressable community nuisances associated with hydraulic fracturing operations. What remains much less clear, however, are the measures companies are taking to address other impacts that can also be quite significant. These include, for example, minimizing noise and light pollution; reducing air pollution emissions; and addressing water quality concerns. Beyond or as part of addressing these issues, companies and governments together must develop collaborative mechanisms to monitor impacts on human health as well as cumulative regional impacts of shale energy development.¹¹⁹ Overall, the industry is failing to demonstrate that it has robust systems in place to identify and effectively respond to community concerns about the potential impacts of hydraulic fracturing operations.

5. MANAGEMENT AND ACCOUNTABILITY

Issue

Investors require information demonstrating that company managers have direct responsibility for reducing operational hazards that lead to key business risks. Policies and systems for reducing risk should include metrics to track impacts; incentives for good performance on health, environment, and safety metrics; and independent third-party assessments of practices and performances.¹²⁰

Contractor hiring and oversight is another critically important management and accountability issue. In the oil and gas industry, exploration and production companies own, lease, and hold drilling permits, but much of the drilling and well construction work is conducted by contractors. At the end of the day, though, it is the oil and gas company or operator that is publicly held responsible, including being assessed fines for regulatory transgressions.

Fines and notices of violation ("NOVs") are also an important accountability tool as they indicate quality of operational management, revealing patterns of problems and offering insight into company improvement processes.

Questions

The scorecard asks whether companies report policies to provide compensation and incentive packages for senior management linked to health, safety, and environment ("HSE") and social impact performance and results; employ third-party independent auditing of HSE functions for operations; rely on third-party databases for information to evaluate potential contractors before hire; disclose the number of NOVs¹²¹ or equivalent administrative actions, and number and amount of fines, related to operations; and report reductions, if any, in the number of NOVs received year over year.

Scores and discussion

Eighteen (18) of the 30 companies studied tie executive compensation to health, environment, and safety

119. On cumulative impacts, see, for example, Jeffrey S. Evans and Joseph E. Kiesecker, "Shale gas, wind and water: assessing the potential cumulative impacts of energy development on ecosystem services within the Marcellus play", PLOS One, February 19, 2014, <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0089210>. For a review of research into health effects, see John L. Adgate, et al., "Potential public health hazards, exposures and health effects from unconventional natural gas development", *Environmental Science and Technology* 48, no. 15 (2014), pages 8307-8320, <http://pubs.acs.org/doi/abs/10.1021/es404621d>.

120. Major U.S. investment banks have been overlaying their traditional financial analyses of energy companies with extra environmental, social, and governance (ESG) questions regarding hydraulic fracturing operations. For example, JPMorgan Chase developed a detailed risk assessment framework covering well integrity, water, air, community impact and regulatory compliance issues. See JPMorgan Chase & Co. 2012 Corporate Social Responsibility Report, page 53, http://www.jpmorganchase.com/corporate/Corporate-Responsibility/document/JPMC_Full_CR_Report_2013.pdf. Goldman Sachs's enhanced due diligence process looks at many of these same issues, "in addition to normal course EHS related questions, regulatory and legal compliance, and governance requirements". See <http://www.goldmansachs.com/citizenship/environmental-stewardship-and-sustainability/environmental-markets/business-selection-and-environmental-advisory.html>. Citigroup follows suit. See http://www.citigroup.com/citi/environment/data/1160848_Sector_Brief_Shale_Oil_and_Gas.pdf. Major pension fund advisor Mercer Investments views ESG issues as an extra layer of due diligence, part of a "responsible investment" approach with the goal of maximizing risk-adjusted returns. Mercer reports that "a significant number of studies support the belief that the quality of a company's governance practices positively correlates with market-based outperformance and a strong link between poor corporate governance and underperforming companies". Governance practices cited by Mercer include accounting and audit quality, compensation, and transparency. See <http://www.mercer.com/insights/view/2014/the-evolution-of-responsible-investment.html#>.

121. NOVs per number of wells completed or in operation would provide one means by which investors could compare companies.

performance. While not specific to hydraulic fracturing operations, these compensation systems can be an important indicator of the priority companies assign to HSE issues. These linkages are displayed in companies' proxy statements, where executive compensation is disclosed to shareholders as part of "say on pay" reviews.

Thirteen (13) companies report that they use third-party information or databases prior to hiring contractors. But only 6 disclose on their public website that they use third-party auditors to monitor HSE functions for their operations.¹²² Other than Whiting Petroleum, no company surveyed reports on its website, on a play-by-play basis, NOVs or fines beyond the disclosure required in 10-K reporting.¹²³ Additionally, no company reports a reduction in NOVs at the play-level.

MANAGEMENT & ACCOUNTABILITY						
COMPANY	Senior management pay tied to HES	3rd party audit for HES	3rd party information prior to hiring contractors	NOVs and fines[^]	NOV trends[^]	TOTAL
Encana	✓	✓	✓			3
Hess Energy	✓	✓	✓			3
Noble Energy	✓	✓	✓			3
Apache	✓		✓			2
BHP Billiton	✓		✓			2
Cabot		✓	✓			2
CONSOL	✓		✓			2
EQT	✓		✓			2
Exco Resources		✓	✓			2
Newfield Resources	✓		✓			2
Occidental Petroleum	✓		✓			2
Penn Virginia		✓	✓			2
Anadarko	✓					1
BP	✓					1
Chesapeake	✓					1
Chevron	✓					1
Conoco Phillips	✓					1
Devon	✓					1
ExxonMobil	✓					1
Range Resources			✓			1
Shell	✓					1
Talisman	✓					1
Whiting Oil & Gas				✓		1

Companies that did not receive points for any indicator in this category are not included in this chart. They are Carrizo, Continental Resources, EOG, QEP, Southwestern Energy, Ultra Petroleum, and WPX.
[^] = Question requests disclosure by play.

Changes in Scores from DTF 2013

The total number of companies reporting use of third-party databases for hiring contractors increased from eight to 13.

122. The companies usually cite ISNetworld as the commercial third-party database they use for assessing contractors.

123. In its 10-K report to the U.S. Securities and Exchange Commission for fiscal year 2013, Whiting Petroleum Corporation discusses specific incidents in North Dakota, but states that otherwise it is not "aware of any environmental incident, citations or suits related to hydraulic fracturing operations involving oil and gas properties that we operate...." See page 43 of the 2013 report, available here: <http://www.whiting.com/investor-relations/annual-reports/>.

Recommendations and notable practices

In order to mitigate risks, investors would like to see companies:

- **Increase due diligence on HSE issues in hiring and evaluating contractors.** For most oil and gas companies, a significant portion of their public persona is in the hands of contractors, whose personnel substantially outnumber company employees at job sites. Many companies report higher injury rates for contractors than for company employees. Further, amidst the exponential growth of domestic shale development, experienced, expert personnel are in short supply. Companies should use independent third parties that specialize in collecting and verifying health and safety data from contractors and suppliers to assure they are hiring contractors who adhere to the highest standards. Some companies report that they carefully assess the contractors they hire, without reference to third-party assistance; however, without further disclosure, investors have no way of knowing the robustness of such reviews. Auditing of contractors on HSE practices can also help assure that drill sites create conditions that protect workers, the local community, and a company's social license to operate.
- **Promote independent third-party auditing of company environmental management practices.** Independent third-party auditors routinely assess corporate financial statements. The concept of extending independent validation to assess data underlying corporate social responsibility reports is increasingly recognized as a best practice. One example is from offshore oil and gas development in U.S. waters: Beginning June 4, 2015, the U.S. federal government will require third-party auditing of offshore operations; the Center for Offshore Safety, an industry group organized following the 2010 Macondo well blow-out in the Gulf of Mexico, has approved three independent auditing firms to conduct the analyses.¹²⁴

In a novel experiment to develop third-party certification standards for oil and gas operations, several companies, foundations, and environmental groups established the Center for Sustainable Shale Development ("CSSD") in Pittsburgh, Pennsylvania in mid-2013.¹²⁵ The Center has developed 15 performance standards for conducting energy operations in the Appalachian Basin (which includes the Marcellus Shale), recruited an independent auditing firm, and developed a process for conducting and reporting on the auditing process. The Center has skeptics in both industry and the environmental community, with industry skeptics perceiving the performance standards as potentially leading to strengthened regulations. Meanwhile, environmental community skeptics have been critical of the process by which the Center was established as well as of the voluntary nature and scope of the standards.¹²⁶ The CSSD standards include many of the issues addressed in this scorecard, such as water recycling, closed-loop drilling, groundwater monitoring, and wastewater disposal.

- *Chevron* announced in early September 2014 that it had become the first company to be certified under the CSSD protocols. *Chevron* is one of CSSD's four founding companies—the others are CONSOL, EQT and Shell. The published certification includes numerous scorecard indicators, but only for the Marcellus and not for *Chevron*'s other plays. Practices addressed in the certification include waste water recycling; closed loop systems for drilling fluid and flowback water; pre- and post-drilling water quality monitoring; no use of diesel fuel in fracturing fluid; reduced-emission (i.e. green) completions; use of low-bleed or zero-bleed pneumatic controllers; and annual use of FLIR cameras to detect leaks.¹²⁷ Ironically, the audit comes at a time when *Chevron* is investing most heavily in its Texas plays, having reported to FracFocus that it completed approximately 375 wells in Texas in 2013 and approximately 180 more through September 2014.¹²⁸ In contrast, it completed approximately 80 wells in Pennsylvania in 2013, and 30 in 2014. The CSSD certification, despite the considerable information it provides about *Chevron*'s practices in the Marcellus, leaves investors in the dark about *Chevron*'s practices and impacts in its Texas operations. Investors have filed four shareholder proposals at *Chevron* since 2011 seeking such enhanced disclosure.

124. See *DTF 2013* note 83.

125. www.sustainableshale.org.

126. See *DTF 2013* note 30 for sources describing the controversy.

127. <https://www.sustainableshale.org/wp-content/uploads/2014/09/Final-CSSD-Audit-Summary17Sept.pdf>.

128. *Chevron* reports developing plays in Texas and New Mexico. See <http://www.chevron.com/documents/pdf/unitedstatesfactsheet.pdf>.

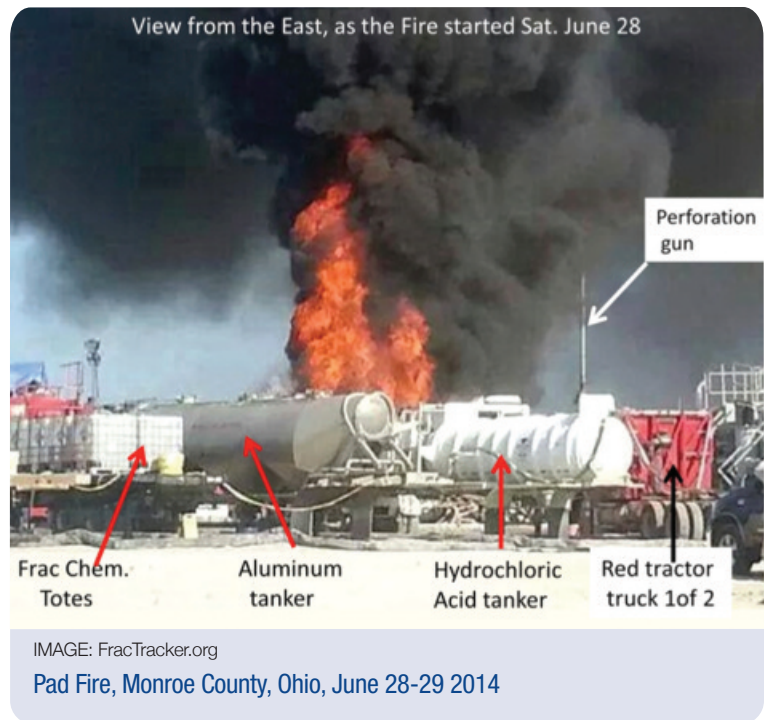
- EQT reported in September 2014 that it is evaluating its current practices and expects to apply for CSSD certification on standards related to air and climate later in 2014. The company is reviewing its current practices related to the water and waste certification standards but has not determined when it will apply for certification.¹²⁹
- CONSOL has reported its intention to pursue “full certification for conformance to all fifteen of the CSSD performance standards” in 2014.¹³⁰

- **Quantitatively report on NOVs, fines, and reductions in NOVs.**

Companies should disclose the amount of non-de minimis fines issued and the total number of non-monetary sanctions for violation of environmental laws and regulations.¹³¹ Play-by-play reporting on NOVs provides investors with information on how effective corporate management policies and practices are in avoiding problems that

lead to enforcement actions. Corporate self-reporting also fills a significant transparency gap stemming from many state government agencies’ failure to report publicly on their enforcement activities.¹³²

- *DTF 2013* reported on Talisman’s useful approach to reporting on its notices of violation in Pennsylvania; the company lists individual violations and company responses to avoid future violations.¹³³
- **Tie executive and management compensation to specific health, environment, and safety performance.** At present, those companies linking compensation to environmental and safety issues usually cite data on worker health and operational spills as factors in compensation and draw upon detailed tracking systems for such decisions. In an age of investor concern about issues such as pollution, water risk, climate change, and community impacts, companies should consider tying executive compensation to an expanded range of measurable criteria.



129. EQT 2014 Social Responsibility Report, page 14.

130. CONSOL 2013 Corporate Responsibility Report, page 18.

131. The Global Reporting Initiative’s (GRI) Oil and Gas Sector Supplement sustainability reporting guidelines call upon companies to provide information on the amount and extent of fines and also the total number of non-monetary sanctions for noncompliance. See GRI Oil and Gas Sector Supplement Guidelines, specifically indicators EN28 and SO8 here: <https://www.globalreporting.org/resourcelibrary/OGSS-G3.1-Complete.pdf>. The U.S. Securities and Exchange Commission requires reporting of fines in excess of \$100,000; however, the imposition of multiple small fines can also signal to investors possible problems with corporate oversight and accountability processes.

132. See *DTF 2013* note 85, noting that Pennsylvania has been the only state agency to publish a readily accessible database on its website that allows users to independently examine NOVs and use them to raise issues with companies. In 2013, Colorado Governor John Hickenlooper issued Executive Order D 2013-004 requiring Colorado’s Oil and Gas Conservation Commission to post all violations and the basis for penalty assessments on its website. The order and the commission’s report are accessible here: http://cogcc.state.co.us/Announcements/Enforcement_Penalty_Policy_Review_Final.pdf.

133. See *DTF 2013* note 86.

- *Apache Corporation* uses 3 safety metrics and 1 environmental metric as part of its calculation of executive compensation. For 2013, the environmental metric was building capacity in North America to recycle and treat 60,000 barrels per day from non-fresh water sources for hydraulic fracturing. The company exceeded this goal with capacity to recycle over 100,000 barrels per day.¹³⁴
- *CONSOL Energy*, as part of its compensation practices, sets targets to lower the incidence of notices of violation. CONSOL's gas division recorded 50% fewer NOV's in 2013 than in 2011, though the division still missed its goal and CONSOL adjusted executive compensation accordingly. CONSOL also incorporates employee and contractor safety goals into its compensation decisions.¹³⁵
- *Newfield Exploration's* Compensation Committee considers safety, environmental, regulatory and compliance (SERC) performance. The company reported that SERC performance fell short of expectations in 2013, resulting in reduced executive compensation.¹³⁶
- As noted in *DTF 2013*, *Devon* devotes 10% of its executive compensation to HSE measures and, uniquely among companies in the sample, an additional 10% of compensation to an indicator called "Maintain Social License to Operate." Also noted in *DTF 2013*, *Anadarko* lists safety as one of 3 core performance goals underlying executive compensation decisions.¹³⁷

CONCLUSION

Generally speaking, this year's scorecard follows the findings of our 2013 scorecard, concluding again that the industry as a whole needs to undertake substantial work to demonstrate adequate management of the impacts associated with hydraulic fracturing operations. Based on the disclosures analyzed in this scorecard, the industry is performing worst in the area of community engagement.

Nonetheless, several companies have improved their scores dramatically. Further, we have seen a general trend of improved disclosure among companies—albeit falling short of the standards laid out in this scorecard—since first raising these issues in 2009 in a series of continuing investor engagements with companies. Especially encouraging are the dramatic increases in disclosure that we have seen from BHP Billiton (which had been among the lowest-scoring companies in the 2013 scorecard), EQT, Hess, and Noble.

It is clear, though, that concerns around the impacts of hydraulic fracturing remain and continue to threaten the industry's social license to operate, and that investors are in a unique position to press companies to improve practices and provide quantitative disclosures on how these risks are being managed. We encourage investors to continue engaging companies on these issues, and for the industry to positively respond to continuing public and investor concerns.

134. Apache 2014 proxy statement, page 45, <http://investor.apachecorp.com/secfiling.cfm?filingID=1193125-14-127066&CIK=6769>.

135. CONSOL Energy 2014 proxy statement, page 41, http://phx.corporate-ir.net/phoenix.zhtml?c=66439&p=irol-sec&control_selectgroup=Proxy%20Filings, and CONSOL Energy 2013 Corporate Responsibility Report, page 27, http://consolenergy.com/media/24348/2013_consol_energy_corporate_responsibility_report.pdf.

136. Newfield Exploration 2014 proxy statement, page 31, <http://phx.corporate-ir.net/phoenix.zhtml?c=63798&p=irol-sec>.

137. See *DTF 2013* notes 88-89 and associated text.



We believe companies implementing best practices in operations and providing thoroughly transparent information will reduce regulatory and reputational risks; enhance their likelihood of securing and maintaining their social license to operate; reduce liabilities associated with poor performance, spills, contamination, and lawsuits; and thereby increase their access to capital.



APPENDIX A: RECOMMENDATION CHART

TOXIC CHEMICALS	<i>Reduce the toxicity of fracturing fluids.</i>	Companies should dedicate staff or consultants to continually evaluate chemical additive use and industry developments and should ask their contractors or chemical suppliers to provide reduced toxicity options in requests for proposals and other procurements.
	<i>Report quantitatively on progress in toxicity reduction.</i>	Companies should publicly report progress in reducing the toxicity of chemicals used in their hydraulic fracturing operations, particularly chemicals used in fracturing fluids.
	<i>Clarify when CBI claims prevent full disclosure of chemicals used.</i>	Where CBI claims prevent the disclosure of certain chemicals, it is incumbent on companies to make that limitation clear. Further, oil and gas companies should be aware of all the chemicals they are using in their wells, executing nondisclosure agreements with their suppliers if absolutely necessary to learn chemical identities.
WATER MANAGEMENT	<i>Implement integrity safeguards beyond regulation.</i>	Companies should demonstrate to investors that they are voluntarily implementing strict well integrity safeguards, even in the absence of regulation.
	<i>Conduct more detailed site assessment.</i>	Companies should further increase disclosure by reporting the steps they take to identify nearby oil and gas wells that could be a conduit of groundwater contamination from the companies' fracturing operations, repair or avoid such wells, and verify the location of aquifers.
	<i>Companies should voluntarily implement pre- and post-drilling monitoring programs.</i>	
	<i>Increase multi-company collaboration on freshwater use reduction.</i>	
	<i>Provide information on potential water constraints on long-term drilling and completion plans, particularly in areas with elevated water risk.</i>	
AIR EMISSIONS	<i>Reduce emissions from drilling, well completion, and related production infrastructure.</i>	Companies should increase the quantitative information they provide on use of cost-effective technologies for emission reductions and on leak detection and repair programs.
	<i>Increase play-by-play or more localized reporting.</i>	Companies that already have systems in place to report aggregate emissions of regional significance (e.g. VOCs and NOx) should use these systems to report data on a disaggregated, play-by-play basis, so that problems with local air quality are identified and addressed and improvements are made public. Where monitoring and reporting are not being conducted locally, companies should make it a priority to do so, even when not required by regulation, in order to reduce health impacts, avoid lawsuits, and improve community relations.
COMMUNITY IMPACTS	<i>Publish general policies, guidelines, and decision criteria for addressing local impacts and key performance indicators.</i>	Companies should state what measures they routinely take, beyond actions required by applicable regulations, to address community impacts.
MANAGEMENT COMMITMENT AND ACCOUNTABILITY	<i>Increase due diligence on health, safety, and environment issues in hiring and evaluating contractors.</i>	Companies should use independent third parties that specialize in collecting and verifying health and safety data from contractors and suppliers to assure they are hiring contractors who adhere to the highest standards.
	<i>Promote independent third-party auditing of company environmental management practices.</i>	
	<i>Quantitatively report on notices of violations, fines, and reductions in numbers of violations.</i>	Companies should disclose the amount of non-de minimis fines issued and the total number of non-monetary sanctions for violation of environmental laws and regulations.
	<i>Tie executive and management compensation to health, environment, and safety performance.</i>	In an age of investor concern about issues such as pollution, water risk, climate change, and community impacts, companies should consider tying executive compensation to a more expanded range of measurable health and environmental criteria.

APPENDIX B: SCORECARD QUESTIONS*

Toxic Chemicals

1. Does the company provide quantitative reporting on progress in reducing the toxicity of hydraulic fracturing fluids?
2. Does the company state a practice to not use diesel in hydraulic fracturing fluids?
3. Does the company state a practice to not use BTEX in hydraulic fracturing fluids?
4. Does the company clearly state on its website that FracFocus reports may exclude chemicals protected by claims of confidential business information?

Water Management: sourcing, well integrity, waste management, and monitoring

1. Does the company report principal practices used to test well integrity beyond pressure testing (e.g., temperature, acoustic, or ultrasonic methods)?
2. For each shale play does the company disclose whether it routinely assesses groundwater quality before it drills?
3. For each shale play does the company disclose whether it routinely assesses groundwater quality after it drills?
4. For each shale play does the company disclose the percentage of flowback water managed and reused for subsequent well completions?
5. For each shale play does the company report the aggregate quantity of water used for operations?
6. For each shale play quantity reported in response to the question immediately above, does the company report the share of water sourced from various types (e.g., x% groundwater, y% surface water, z% flowback water, etc.)
7. Does the company state it has a policy of using non-potable water sources to the fullest extent technically practicable?
8. For each shale play does the company report the intensity of its water use—the amount of water required to produce measurable units of energy (e.g., gallons/million BTU[MMBTU])?
9. For each shale play does the company disclose a policy to store flowback water in closed tanks?
10. For each shale play does the company report whether it routinely uses closed loop systems for management of drilling residuals?
11. Does the company report its practices for identifying and managing the hazards from naturally occurring radioactive materials (NORMs)?

Air Emissions

1. For each shale play does the company report the percentage of wells for which it used green completions?
2. For each shale play does the company report it uses any of the following—natural gas, low emission diesel engines, or other reduced-emission methods—to power well pad operations?
3. Does the company report the percentage of its vehicle fleet converted to lower emission fuels?
4. For each shale play, does the company disclose data or estimates for NO_x and VOCs emitted from well drilling and completions?

5. For each shale play, does the company report reductions in NOx and VOC emissions from emission reduction efforts?
6. Does the company report when pipelines have been used to replace trucks in transporting water used for fracturing operations?
7. Does the company report the percentage leakage rate for methane from its drilling, completion, and production operations?
8. Does the company report the percentage or number of high-bleed controllers replaced with low-emission alternatives?
9. Does the company report the technologies it uses (e.g., infrared cameras) to monitor operations for fugitive emissions?
10. Does the company report with what frequency it conducts monitoring for fugitive emissions?

Community Impacts

1. For each shale play does the company describe major identified community impact concerns and its response?
2. Does the company disclose its internal processes for aggregating local concern statistics?
3. Does the company disclose its internal processes for reporting local concern statistics upward within the company?
4. Does the company disclose a clearly stated policy to adjust activity schedules to prevent or reduce traffic congestion from operations?
5. Does the company have a clearly stated policy to reimburse state and local authorities for road damage caused by its operations?

Management and Accountability

1. Does the company report it provides compensation and incentive packages for senior management linked to HSE and social impact performance and its results?
2. Does the company require third-party independent auditing of HSE functions for its operations?
3. Does the company rely on third-party databases for information to evaluate potential contractors before hire?
4. For each shale play does the company disclose notices of violation numbers (or equivalent administrative actions) and numbers and amounts of fines related to its operations?
5. For each shale play does the company report reductions, if any, in numbers of notices of violations received over the past year?

APPENDIX C: METHODOLOGY

Scorecard Goals

The scorecard has 3 goals: 1) assess the overall state of industry disclosure; 2) identify those issues about which most disclosures are made; and 3) distinguish industry leaders from laggards with regard to disclosure.

Company Selection

The scorecard reports on 30 publicly traded companies producing shale gas and oil in the U.S. Twenty-four (24) of these companies were selected for assessment in the first edition of this scorecard in 2013 and have been carried over to the second edition to permit comparisons of changes in disclosure practices. The 6 additional companies—Carrizo, Continental, Exco, Newfield, Penn Virginia, and Whiting—were added because of their prominent activity in major “plays.” These include the Bakken formation, Eagle Ford, Haynesville, and Woodford-Cana plays.

Geographic Coverage

The scorecard addresses onshore operations in the U.S. and Canada.

Chronological Coverage

The scorecard addresses reporting on specific, identified metrics principally from August 31, 2013 through September 30, 2014, while also accounting for disclosures in prior years.

Indicator Selection

Indicators are both qualitative and quantitative. The goal was to select indicators that would enable clear “yes/no” answers, with minimal interpretation. This second edition of the scorecard contains refinements of the reporting indicators in the air emissions section; as discussed in the text, one question was deleted and four added.

Company Scoring

Each company was scored based solely on documents and information available through its public website, including SEC proxy and annual report filings; climate change and water management reports submitted to the CDP and posted directly on the company website; and sustainability/social responsibility reports. Companies were scored independently by 2 project staff. Companies received a copy of the questions on which they would be scored and an opportunity to provide feedback on the accuracy of the scorecard information and to update their public disclosures. Final scoring was based on staff reviews of corporate disclosures published by September 30, 2014.

The report text cites examples of exemplary disclosures by numerous companies even where particular disclosures did not earn credit on the scorecard. Some low-scoring companies may in fact be broadly implementing best management practices to manage and reduce risks, but absent play-by-play disclosures sought by the scorecard, investors and communities remain unaware of these activities.

Play-by-play Reporting

The scorecard places special emphasis on play-by-play reporting. Play-by-play reporting is critical to understanding corporate risk management because most impacts of concern are regional and local. Atmospheric, geological, demographic, political, and other pertinent characteristics vary immensely among plays. We emphasize plays as the appropriate unit of analysis, but this term is not intended for literal use; rather, it is intended as a proxy for appropriate regional reporting. For example, plays can comprise thousands of square miles and conditions can vary dramatically within plays. Furthermore, shale and other formations accessed by horizontal drilling and hydraulic fracturing can be stacked on top of one another, such as in Pennsylvania and the Permian Basin of West Texas.

Timing of play-by-play reporting is also a core issue. As defined by the American Petroleum Institute, oil and gas projects go through five phases—entry, exploration, development, operations/production, and exit.¹³⁸ The most detailed reporting should be done during the development phase, when environmental and community impacts are likely to be most pronounced, but companies should have appropriate principles and practices in place and be attentive to local concerns in the entry, production, and exit phases.

Where companies are involved in joint ventures or solely as equity partners, reporting responsibility falls on the company actually conducting operations, i.e. the “operator.” We expect play-by-play reporting for individual companies to shift over time because of the extensive merger, acquisition, and divestment activity within the industry and also as companies shift their drilling foci to reflect changes in the absolute and relative prices for oil and gas.

138. “Community Engagement Guidelines”, American Petroleum Institute and ANSI, Bulletin 100-3 (2014), page 4, http://www.api.org/~media/Files/Policy/Exploration/100-3_e1.pdf.

NOTES

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