

EXTRACTING THE FACTS:

AN INVESTOR GUIDE TO DISCLOSING RISKS FROM HYDRAULIC FRACTURING OPERATIONS



ABOUT THIS GUIDE

This document was inspired by energy companies' requests, in dialogues with investors, for enhanced guidance on disclosure of risk management practices. Investor dialogues were coordinated by members of the Investor Environmental Health Network (IEHN) and the Interfaith Center on Corporate Responsibility (ICCR) including Green Century Capital Management and Boston Common Asset Management.

An eighteen-month investor dialogue convened by Boston Common Asset Management and Apache Corporation provided a venue for extended conversations on risks, management practices and disclosure and review by industry experts of draft practices and indicators.

While Richard Liroff, Executive Director of IEHN, is principal author of this document, it reflects input from both IEHN and ICCR staff and members currently engaging the energy industry.

This is Version 1.0, in anticipation of future updates to accommodate technological innovations and regulatory changes. We welcome your comments and suggestions. Please send them to Richard Liroff at rliroff@iehn.org.



ABOUT ICCR

About ICCR: Currently celebrating its 40th year, ICCR is the pioneer coalition of active shareholders who view the management of their investments as a catalyst for change. Its 300 member organizations with over \$100 billion in assets have an enduring record of corporate engagement that has demonstrated influence on policies promoting justice and sustainability in the world.



ABOUT IEHN

The Investor Environmental Health Network is a collaborative partnership of investment managers and advisors concerned about the impact of corporate practices on environmental health, including the public health risks associated with corporate toxic chemical policies. IEHN member assets under management total over \$30 billion.

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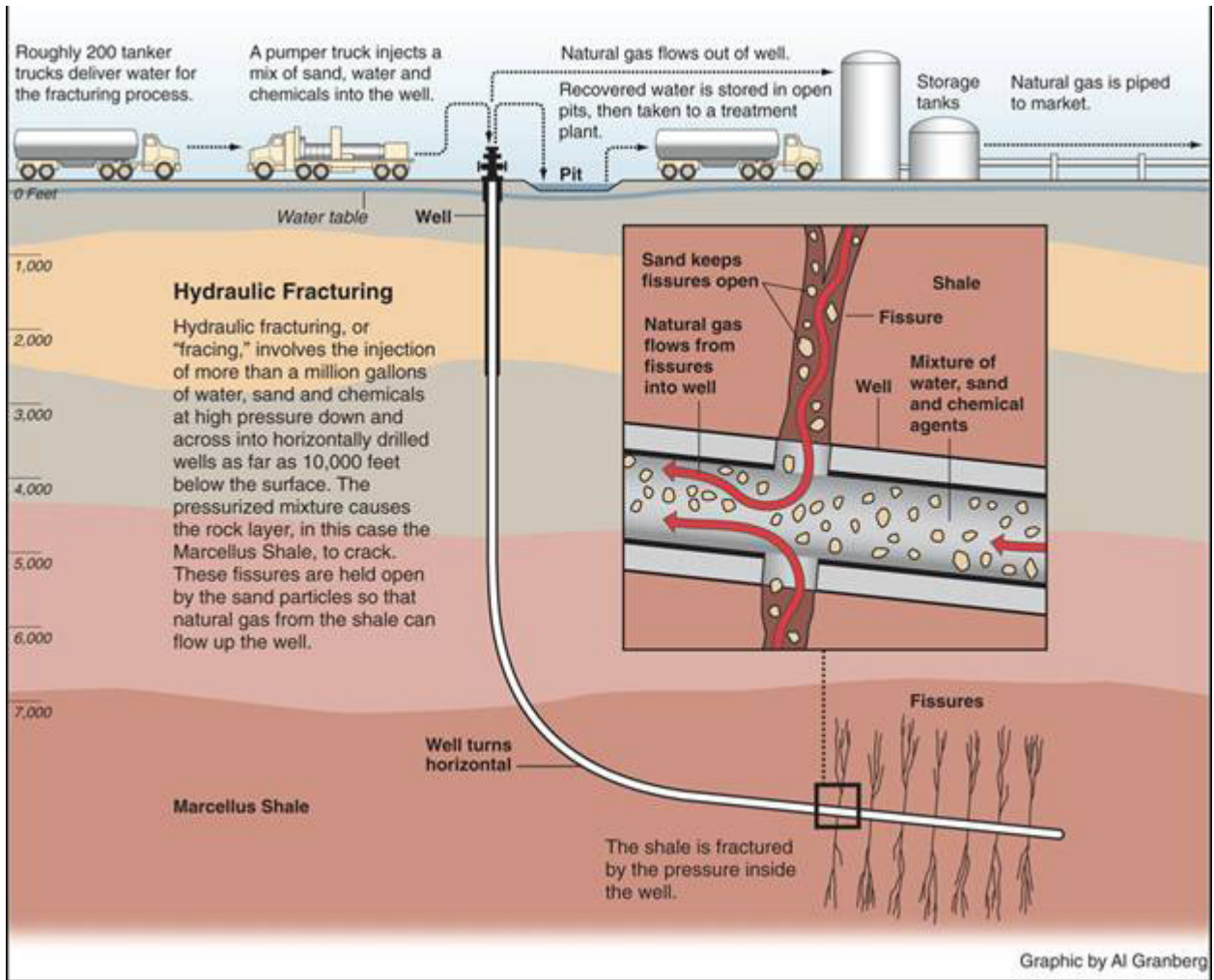
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An overview of the hydraulic fracturing process.

EXECUTIVE SUMMARY

Natural gas production from shale formations in the United States has grown dramatically since the early 2000s, amidst expanding controversy over the horizontal drilling and hydraulic fracturing used to access the gas. The supplies of newly accessible gas are an energy “game changer”, and companies are now assessing shales on nearly every continent.

Many governments and communities around the world are looking to learn from the U.S. experience before deciding whether and how to permit exploitation of their shale resources. In the U.S. there have been numerous incidents of poorly constructed wells, equipment failures, degraded local and regional air quality, water contamination, strained community relations, and related government enforcement actions and private lawsuits. Moratoria or bans have been enacted in New York State, the Delaware River basin, and by local governments in several U.S. states. Outside the U.S., France has banned fracturing and the Province of Quebec, Canada and South Africa, among other jurisdictions, have enacted moratoria.

Bans and moratoria are denials of companies’ social license to operate—denials of public consent—arising from concerns about environmental and social risks. Bans and moratoria impose a wide range of costs on companies, ranging from the costs of delays to complete loss of access to valuable resources where sunk costs must be written off. Companies must be publicly transparent about managing their environmental footprint and social impacts, and engage with key community stakeholders to earn and maintain their social license to operate. Transparency requires full disclosure of steps being taken to minimize risks, acknowledgement of challenges and failures, and clearly defined steps to continually improve operations.

Investors in particular require specific, detailed information about how companies manage natural gas operations’ risks and rewards. It is necessary for investors to have assurance that company managers are reducing business risks by addressing operational hazards and are capturing the genuine, measurable business rewards flowing from environmental management practices that have the potential to lower costs, increase profits and enhance community acceptance. Investors require relevant, reliable, and comparable information about companies’ natural gas operations to make investment judgments based on a robust assessment of companies’ environmental, social, and governance policies, practices and performance.

It is necessary for investors to have assurance that company managers are reducing business risks by addressing operational hazards and are capturing the genuine, measurable business rewards flowing from environmental management practices that have the potential to lower costs, increase profits and enhance community acceptance.

Corporate Core Management Goals (CMGs), Best Management Practices (BMPs) and Key Performance Indicators (KPIs) for natural gas operations can:

1. drive operational efficiencies (reduced costs yield increased margins and profitability);
2. provide insurance in case of accident or natural disaster (lowered toxicities and volumes of chemicals reduce risks from chemical spills);
3. reduce air emissions and fresh water withdrawals that trigger violations of environmental standards (regulators consequently may ban and limit operations); and
4. protect and enhance companies' social license to operate by increasing the odds of positive community response to the best-managed, most transparent companies addressing community needs and concerns.



Investors supporting this document recommend that companies adopt the following 12 core management goals (CMGs) for natural gas operations, implement best management practices (BMPs) to achieve them, and report on key performance indicators (KPIs) to communicate outcomes. Some BMPs also function as KPIs.

Twelve core management goals for natural gas operations include:

1. **Manage risks transparently and at Board level:** Ensure environmental, health, safety, and social risks are core elements of corporate risk management strategy.
2. **Reduce surface footprint:** Minimize surface disruption from natural gas exploration and production activities.
3. **Assure well integrity:** Achieve zero incidence for accidental leaks of hazardous gases and fluids from well sites.
4. **Reduce and disclose all toxic chemicals:** Comprehensively disclose and virtually eliminate toxic chemicals used in fracturing operations.
5. **Protect water quality by rigorous monitoring:** Identify baseline conditions in neighboring water bodies and drinking water sources and routinely monitor quality during natural gas operations.

6. **Minimize fresh water use:** Draw the minimum potable water necessary to conduct fracturing operations, substituting non-potable sources to the fullest extent practicable.
7. **Prevent contamination from waste water:** Store waste waters in secure, closed containers, not in pits open to the atmosphere, and recycle and reuse waste water to the maximum extent practicable.
8. **Minimize and disclose air emissions:** Prevent/minimize emissions of greenhouse gases and toxic chemicals by systematically identifying emission sources of all sizes, implementing operational practices to reduce emissions, and installing emission control equipment; monitor ambient air quality prior to and during operations.
9. **Prevent contamination from solid waste and sludge residuals:** Minimize risks and impacts by deploying closed loop systems for solid waste and sludge residuals from drilling and fracturing operations and fully characterizing and tracking toxic substances.
10. **Assure best in class contractor performance:** Systematically assess contractor performance against the company’s own BMPs and KPIs across the entire range of environmental, health, safety, and social concerns, with the objective of engaging and retaining best-in-class, continually improving contractors.
11. **Secure community consent:** During the site selection process, identify all communities impacted and address major concerns central to community acceptance of company operations; establish community engagement process and third party conflict resolution mechanisms.
12. **Disclose fines, penalties and litigation:** Acknowledge performance issues by disclosing infractions, legal controversies, and lessons learned.

Much of the information sought for KPIs is routinely developed by companies as part of normal business operations, or should be; its absence may reflect gaps in business risk management.

The concept of “comply or explain” provides the foundation for this document. Many practices can be universally implemented while there may be appropriate exceptions to others. Where “one size does not fit all”, variances from the preferred norm should be explained. Some of the CMGs and BMPs are aspirational in certain settings while others can be accomplished relatively quickly and easily. Much of the information sought for KPIs is routinely developed by companies as part of normal business operations, or should be; its absence may reflect gaps in business risk management.

Endnotes to this document elaborate on the BMPs and KPIs and reference related regulatory requirements and reports. **Endnotes in green font cite 17 companies that have adopted related CMGs and BMPs and are reporting outcomes.** The supporting statement provides additional background.

RECOMMENDED CORE MANAGEMENT GOALS (CMGs), BEST MANAGEMENT PRACTICES (BMPs) AND KEY PERFORMANCE INDICATORS (KPIs)¹

GOAL 1: Manage Risks Transparently and at Board Level *Ensure environmental, health, safety, and social risks are core elements of corporate risk management strategy*

Best Practices:

1. The Board of Directors, or an appointed board committee, oversees management of environmental, health, safety, and social impact risks faced by the company, including those associated with natural gas operations in shale.
2. One or more independent board members have specific expertise in managing environmental, health, safety, and social impact risks.
3. Compensation and incentive packages for senior management include specific links to environmental, health, safety and social impact performance results, including natural gas operations in shale.²
4. Policies and procedures ensure that whistleblower complaints involving the company and its contractors are addressed, whistleblowers are protected from retaliation, this system is functioning properly, and the Board of Directors receives regularly-scheduled reports of concerns raised through this system.³
5. Board requires third-party independent monitoring and auditing of environmental, health and safety functions for the company's own operations, including contractors.
6. Senior management encourages public policies that foster BMPs, including BMPs for natural gas operations in shale, via endorsements of laws and regulations that incorporate these BMPs.
7. Company has policy of reporting at least annually its status on hydraulic fracturing indicators and progress on hydraulic fracturing risk management targets via its website and, as appropriate, incorporates related disclosures into its SEC Form 10-K (or SEC Form 20-F for non US companies) or comparable regulatory disclosure documents outside the United States.⁴

GOAL 2: Reduce Surface Footprint

Minimize surface disruption from natural gas exploration and production activities

Best Practice:

In planning operations, company takes an integrated approach to the life cycle of fracturing operations, siting well pads and timing operations to reduce surface impacts (including impacts on both human communities and natural ecosystems) from drilling pads, water sourcing, and waste water management and disposal.

Key Performance Indicator - Company discloses key elements of siting and operational planning designed to minimize surface footprint and reports on environmental outcomes from such systematic planning by appropriate company operating divisions or political jurisdictions.⁵

GOAL 3: Assure Well Integrity

Achieve zero incidence for accidental leaks of hazardous gases and fluids from well sites⁶

Best Practices:

1. Conduct geological characterization of site that includes identifying faults, abandoned mines and wells, confining zones above targeted production shales, and other potential risk factors for potable water contamination.
2. Implement universal well construction integrity policy to virtually eliminate risks from methane and chemical leaks arising from poor construction, surpassing applicable regulatory standards as necessary to achieve the goal of zero leaks.

Key Performance Indicator - Company discloses key elements of policy, identifying specific methods contractors must use to ensure and verify well integrity, in order of preference/feasibility.⁷

3. Pressure test wells prior to fracturing and routinely apply advanced acoustic-testing methods (cement evaluation logs) or their functional equivalent on cemented casing strings.⁸

Key Performance Indicator - Total number and percentage of wells where cement evaluation logs or equivalent tests were performed (by shale play or other reporting area); rationale for non-use where percentage is less than 100.

4. Routinely run cement to surface to assure isolation of well bore from potable groundwater aquifers, unless not technically feasible.⁹

GOAL 4: Reduce and Disclose All Toxic Chemicals

Comprehensively disclose and virtually eliminate toxic chemicals used in fracturing operations

Best Practices:

1. Qualitative or quantitative goals and/or timetables are established for lowering toxicity of chemicals¹⁰ using available toxicity scoring tools.¹¹

Key Performance Indicator - Targets and timetables adopted and disclosed and progress reported.

2. Staff or consultants continually evaluate chemical additive use to reduce toxicity, lower volumes, or eliminate chemical use by substituting alternative technical methods.^{12,13}

Key Performance Indicator - Specific chemicals eliminated; total number and percentage of shale gas wells that used less toxic fracturing fluids for the reporting period; where toxicity scores are used as metrics of progress, report changes in scores.

3. In requests for proposals and other procurements, company asks service providers to provide reduced-toxicity fluids.¹⁴

Key Performance Indicator - Percentages of RFPs and other procurements for fracturing services that include requests for reduced-toxicity options.

4. All chemicals planned for use or used in fracturing operations for individual wells are publicly disclosed, including additives beyond those identified in Material Safety Data Sheets, both prior to fracturing operations and within 30 days of completion of operations.¹⁵



Key Performance Indicator -

Percentage of fractured wells in most recent year(s) for which company publicly disclosed fracturing fluid ingredients (including CAS numbers) to the FracFocus registry or equivalent initiatives, and percentage of such disclosures that included chemicals beyond those identified in Material safety Data Sheets.

GOAL 5: Protect Water Quality by Rigorous Monitoring
Identify baseline conditions in neighboring water bodies and drinking water sources and routinely monitor quality during fracturing and production¹⁶



Best Practice:

1. Conduct pre-drilling water quality testing to determine baseline conditions, including potential risks from biogenic methane close to the surface.¹⁷

Key Performance Indicators -

- a) Report on water quality testing practices across all shale plays, and exceptions to routine testing.¹⁸
- b) Report on compliance, prevention/remediation, or cost issues arising from water quality testing.

Goal 6: Minimize Fresh Water Use
Draw the minimum potable water necessary to conduct fracturing operations, substituting non-potable sources to the fullest extent practicable¹⁹

Best Practices:

1. Using non-potable water sources (e.g. saline aquifers, treated industrial waste waters, flowback waters, or other such sources) is the default management choice for fracturing operations. Exceptions can be made to accommodate local circumstances.²⁰
2. Water sourced for fracturing is reported as part of broader water use reporting under evolving investor disclosure protocols, and is also reported on a jurisdictional (e.g. state) or watershed basis.²¹

Key Performance Indicators -

- a) Quantities of water, sourced by shale play, state, or other appropriate reporting region, including amount/percentage derived by source: surface water/groundwater/potable/nonpotable, recycled/reused flowback water from fracturing and production operations, etc.²²
- b) Average amount of water used per fractured well, per shale play.²³

GOAL 7: Prevent Contamination From Waste Water

Store waste waters in secure closed containers, not in pits open to the atmosphere^{24 25}

Best Practice:

1. Company has a policy of storing wastewater only in covered tanks, or has a program in place for transitioning from storing wastewater in lined pits (where allowed by state regulations) toward covered and appropriately vented tanks.²⁶

Key Performance Indicators - Indicators include percentage of operations where tanks are used to store flowback water (by play/jurisdiction) and where pits are used for this purpose. Company explains reliance on pits and reports any violations or fines associated with waste water storage. Where company is transitioning from pit to tank storage, company reports quantitatively on progress.²⁷

Recycle and reuse waste water to the maximum extent practicable²⁸

Best Practices:

1. Recycling and reuse of waste water is the default management choice. Exceptions can be made to accommodate local circumstances.
2. Quantity of flowback waters is monitored and chemical composition is tested to assess hazards, inform recycling/reuse/disposal decisions and assure compliance with applicable state waste water management standards.²⁹

Key Performance Indicators - Company reports quantitatively on water recycling/reuse volumes and percentages as well as on use of non-freshwater sources.³⁰



GOAL 8. Minimize and Disclose Air Emissions

Prevent/minimize emissions of greenhouse gases and toxic chemicals by systematically identifying emission sources of all sizes, implementing operational practices to reduce emissions, and installing emission control equipment;³¹ monitor ambient air quality prior to and during operations

Best Practices:

1. Monitor, measure and report publicly on air emissions (e.g. greenhouse gases [including methane], volatile organic compounds, BETX and other toxic chemicals) from natural gas operations in shales and results from specific emission reduction measures.^{32, 33}
2. Reduce emissions from well sites by using natural gas or alternative methods in lieu of diesel fuel for powering site operations.³⁴
3. Reduce transportation emissions by substituting pipelines for truck transport, transporting chemicals in dry rather than liquid form, and converting vehicle fleets to natural gas.³⁵
4. Reduce emissions from well sites by using “green completion” practices.³⁶
5. Establish ambient air quality monitoring network, funded by the company or collaboratively with local communities and regulators, to provide routine data on ambient conditions, including tracking of specific chemicals of concern (such as hydrogen sulfide and BETX).

Key Performance Indicators - Consistent with the above BMPs, establish a baseline for emissions of contaminants of concern and routinely report emission reduction strategies and their results.

GOAL 9. Prevent Contamination from Solid Waste and Sludge Residuals

Minimize risks and impacts of solid waste/sludge residuals from drilling and fracturing operations and fully characterizing and tracking toxic substances

Best Practices:

1. Use closed-loop systems for management of drilling residuals.^{37,38}
2. Monitor and track naturally occurring radioactive materials (NORMs) in waste streams from the Marcellus Shale and any other shales where such materials exist.³⁹

Key Performance Indicators - Report publicly on implementation of closed-loop systems and on business, environmental, and public health issues raised by monitored radioactive materials.

3. Dispose of drill cuttings and other solid waste and sludge only in licensed disposal facilities consistent with relevant state and federal regulation.⁴⁰

GOAL 10. Assure Best in Class Contractor Performance

Systematically assess contractor performance against the company's own BMPs and KPIs across the entire range of environmental, health, safety, and social concerns, with the objective of engaging and retaining best-in-class, continually improving contractors

Best Practices:

1. Maintain robust system, including third party auditors, to manage and evaluate the environmental, health and safety (EHS) policies, procedures and performance of contractors involved in natural gas shale operations.
2. Contractor compensation and incentives include EHS performance.
3. Company encourages supplier transparency on EHS impacts.

Key Performance Indicators - Company reports on contractor oversight practices above and their quantitative results.

GOAL 11. Secure Community Consent

During the site selection process, identify all communities impacted and address major concerns central to community acceptance of company operations; establish community engagement process and third party conflict resolution mechanisms

Best Practices:

1. Company seeks to secure community consent by initiating contact with local community leaders and organizations and by establishing and implementing a collaborative plan with key stakeholders to identify and address needs and concerns.⁴¹
2. Company has policy relevant to seeking “Free, Prior and Informed Consent” of host communities for new development and activities, such as reaching advance written agreements with local government officials and community organizations outlining company practices related to specific community concerns (noise, setbacks, road use and damage repair, monitoring and addressing social, environmental and health impacts, etc.). Such agreements may include operating practices above and beyond requirements of state regulations and local zoning codes and land use plans applicable to oil and gas drilling and production operations.^{42 43}
3. Company has a dedicated “hotline” to receive individual complaints arising from company operations and has a response tracking mechanism in place to record complaints and company responses.

Key Performance Indicators - Disclose number and character of complaints received and nature of company responses, including, e.g., amount of potable drinking water supplies provided in response to complaints about contaminated well water.⁴⁴

4. Company supports independent third party conflict resolution mechanism to address concerns and complaints arising from company operations in a community.



Goal 12. Disclose Fines, Penalties and Litigation

Acknowledge performance issues by disclosing infractions, legal controversies, and lessons learned

Best Practices:

For natural gas operations relying on hydraulic fracturing, company discloses:

1. Individual government penalties and aggregate government fines on an annual basis.
2. Notices of violation or equivalent administrative actions alleging serious health threats or environmental damage.⁴⁵
3. Any individual facility shutdown orders, license suspensions or moratoria on licensing.
4. Pending litigation alleging human health or environmental harm, including either amount of claim or company's own worst case estimate.
5. Cases settled (even where actual settlement contents are sealed) in response to private party allegations of environmental damage.



ENDNOTES 1 - 45

- 1 See the supporting statement for definitions and design criteria for goals, practices, and indicators.
- 2 **BG GROUP (U.K) EXAMPLE:** “The importance of our Business Principles is reflected within the performance-related component of our employees’ remuneration. Awards under our Annual Incentive Scheme include a weighting for individual performance in relation to Health, Safety and Environment performance and behaviours.” See: <http://www.bg-group.com/sustainability10/PrinciplesPoliciesAndGovernance/Pages/business-principles.aspx>
- 3 For example, third party surveys of workers may provide clues whether there is a true “safety culture” at the operational level, as compared to the “reporting culture” of checking boxes on a form. See: <http://corporatedisclosurealert.blogspot.com/2010/11/can-shareholders-benchmark-safety.html>
- 4 **SHELL EXAMPLE:** “We will report our performance against these [shale gas] operating principles.” See: http://www-static.shell.com/static/usa/downloads/onshore/onshore_principles.pdf
- 5 **APACHE EXAMPLE:** “The multiwall drilling method allows Apache to drill up to 16 horizontal wells from a single pad, vastly minimizing the surface impact to the surrounding environment [in the Horn River basin in Canada]. As many as 2,000 acres of shale reservoir can be tapped from a single ...drill pad.” See http://www.apachecorp.com/explore/Browse_Archives/View_Article.aspx?Article.ItemID=1586
HESS EXAMPLE: “Prior to drilling, we performed risk based screening to select well pad sites and determine engineering controls to minimize the potential for land disturbance, erosion, and impact on neighbors, communities, potable water sources and sensitive ecosystems. We also consulted with property owners and local emergency responders on well pad and ancillary facilities sites....” See page 61 here: <http://hess.com/reports/sustainability/US/2010/default.pdf>
- 6 State regulations tend to devote considerable attention to specifications for well construction, though regulations vary in their specificity and stringency among the states. The list here is intended to be selective, rather than exhaustive. For a quantitative comparative assessment of risks from natural gas operations in shales, see George E. King (Apache Corporation) “Hydraulic Fracturing 101: What Every Representative, Environmentalist, Regulator, Reporter, Investor, University Researcher, Neighbor and Engineer Should Know About Estimating Frac Risk and Improving Frac Performance in Unconventional Gas and Oil Wells”, SPE 152596 to be presented at the SPE Fracturing Conference, The Woodlands, TX, USA, 6-8 February 2012. Another version of this analysis, “Explaining and Estimating Fracture Risk: Improving Fracture Performance in Unconventional Gas and Oil Wells” is available at George E. King’s website, <http://www.gekengineering.com/> See Downloads section.
CHESAPEAKE EXAMPLE: “We will meet or exceed state law requirements in the design, drilling, completion and testing of wellbores to protect freshwater sources, control well pressures, and avoid migration of gas behind casing strings.”
See: <http://www.chk.com/About/Commitment/Pages/default.aspx>
SHELL EXAMPLE: “We will not operate wells where isolation of our completion and production activities from potable groundwater cannot be achieved.” See: http://www-static.shell.com/static/usa/downloads/onshore/onshore_principles.pdf
- 7 **SOUTHWESTERN ENERGY EXAMPLE:** See “The Steps We Take to Assure Well Integrity” here: <http://www.swn.com/operations/pages/wellintegrity.aspx>

- 8 Drinking water contamination incidents have been associated with cementing failures. Advanced acoustic-testing methods provide substantial assurance of cementing integrity, although superior technologies may emerge. In Arkansas, cement bond logging may be required by regulators when pressure tests raise questions about cementing integrity for intermediate and production casings. See Section (f), Arkansas Rule B-19, “Requirements for Well Completion Utilizing Fracture Stimulation,” available here: http://www.shalegas.energy.gov/resources/060211_arkansas_rule.pdf In Appendix 10 of its August 2011 Revised Draft Supplemental Generic Environmental Impact Statement addressing hydraulic fracturing, New York State has proposed that cement bond logs be conducted for both intermediate and production casing. See paragraphs 35 and 37 here: http://www.dec.ny.gov/docs/materials_minerals_pdf/ogsgeisapp1.pdf
EL PASO EXAMPLE El Paso Corporation states, “in cases where it is desirable to know the location of the top of the cement, the production casing may be tested using acoustic sound testing in addition to pressure-testing.” See El Paso 2011 sustainability report, page 51, http://www.elpaso.com/csr/2010CSR_FULLL.pdf
- 9 The requirement of running cement to the surface is common in state regulatory requirements.
- 10 Particular chemicals of concern to target include biocides and BETX (benzene, ethyl benzene, toluene, and xylene). Particular chemical characteristics to target include chemicals exhibiting persistence, bioaccumulation, carcinogenicity, mutagenicity, reproductive toxicity or endocrine disruption.
- 11 BAKER HUGHES AND HALLIBURTON EXAMPLES: Both companies have developed toxicity scoring systems. For Baker-Hughes, see http://public.bakerhughes.com/ShaleGas/collateral/Quantitative_Ranking_Measures_Oil%20Field_Chemicals_Environmental_Impact.pdf For Halliburton, see <http://www.halliburton.com/aboutus/Default.aspx?pageid=4278>
- 12 APACHE EXAMPLE: Apache has “found that we can often replace non-biodegradable biocides with much less intrusive chemicals.” See: <http://science.house.gov/sites/republicans.science.house.gov/files/documents/hearings/Congressional%20Testimony%20Cal%20Cooper-Apache.pdf>
CHESAPEAKE EXAMPLE: Chesapeake reports it has eliminated 25 percent of the additives used in fracturing fluids in most of its shale plays See <http://www.chk.com/environment/drilling-and-production/pages/green-frac.aspx>
EL PASO EXAMPLE: El Paso used a Halliburton-developed CleanStream ultraviolet light process, instead of 2,400 gallons of a toxic biocide, to kill bacteria during a fracturing job in Louisiana. See: <http://www.lngworldnews.com/usa-el-paso-halliburton-pioneer-first-gas-completion-using-all-current-cleansuite-green-technologies/>
ENCANA EXAMPLE: “In 2010, [Encana] developed a Responsible Products Program. The program assesses the potential health and environmental risks of each ingredient in the products used in our drilling and hydraulic fracturing fluids. Product assessments have been conducted across our drilling and completions operations and we are currently analyzing the initial results.” See: <http://www.encana.com/responsibility/cr2010/environment/>
- 13 New York State proposed regulations governing fracturing would require “appropriate documentation showing that an evaluation of available alternative chemical additive products has been conducted.” There would need to be certification that a permit applicant “will utilize chemical additive products that are efficacious, exhibit reduced aquatic toxicity, or pose less risk to water resources and the environment.” The applicant may alternatively demonstrate that available alternatives are not equally effective or feasible. See 6 NYCRR Part 750-3.4(b)(7) and (b)(8), <http://www.dec.ny.gov/regulations/77383.html>
- 14 HESS EXAMPLE: “During 2010 we met with four service companies providing hydraulic fracturing services in the Marcellus Shale to identify with each the most environmentally preferable frac fluid systems...We ...monitored the development of more environmentally favorable frac fluid additives....” See page 61 here: <http://hess.com/reports/sustainability/US/2010/default.pdf>

- 15 A company can participate in the Groundwater Protection Council/Interstate Oil and Gas Compact Commission (GWPC/IOGCC) disclosure database (www.fracfocus.org), its functional equivalent, and/or provide disclosure on a company website. As of October 2011, 65 companies had agreed to disclose chemicals via FracFocus.org, and 48 companies had reported data for 4,900 wells. See: http://www.energyfromshale.org/sites/default/files/API_Chemical-Disclosure-and-Groundwater-Protection-Priorities.pdf The DOE shale gas advisory panel, in its August 2011 “90 day report” noted that FracFocus.org’s restriction to MSDS disclosures “means that a large universe of chemicals frequently used in hydraulic fracturing treatments goes unreported.” The DOE panel also noted substantial shortcomings in the user-friendliness of version 1.0 of FracFocus.org. See pp. 23-24 here: http://www.shalegas.energy.gov/resources/081111_90_day_report.pdf Fracfocus.org has emphasized disclosures based on MSDS, but in September 2011, the GWPC Board of Directors adopted a resolution noting increasing state enactments requiring disclosures of all chemicals, and signaling that FracFocus would be open to reporting of all chemicals intentionally added for hydraulic fracturing. See: <http://www.gwpc.org/advocacy/documents/resolutions/Resolution%2011-3.pdf> Chemical disclosure legislation introduced in Texas, supported by Southwestern Energy, Talisman Energy, Pioneer Natural Resources, Petrohawk Energy, El Paso, and Apache would have required broad disclosure prior to and following fracturing operations, but it was publicly opposed by Halliburton and FracTech Services and was weakened prior to enactment. For the original bill, see: <http://www.tipro.org/UserFiles/HB3328.pdf> The Texas Railroad Commission, which regulates oil and gas in Texas, has proposed implementing regulations requiring substantial disclosure that it hopes will take effect January 1, 2012. See: <http://www.rrc.state.tx.us/rules/prop-new-3-29-frac-disclosure-Aug29.PDF> Montana regulations adopted in August 2011 require chemical disclosures to regulators 48 hours in advance of a fracturing operation and more detailed disclosure of the chemicals used following completion of the well. See: <http://bogc.dnrc.mt.gov/PDF/FinalFracRules.pdf> For the broadest disclosure regimes, one approach to protecting proprietary information might be reporting all chemicals deliberately added for fracturing purposes, but not linking certain of these chemicals to specific products.
- 16 Monitoring requirements vary state by state, as do company practices; therefore, no specific distance from the wellhead is indicated here. These distances can be reported by companies in the KPI for this CMG.
- 17 There has been extensive public controversy over the impact of gas drilling on local drinking water supplies, including in areas where methane gas is naturally present close to the surface. Pennsylvania does not have drilling standards for private water wells. Pennsylvania law presumes a driller guilty of contaminating water supplies if contamination occurs within 1,000 feet of a well within six months of drilling beginning. Pre-drilling monitoring, while adding cost, can help protect against unjustified claims and associated headline and possibly litigation risk. Some companies already do this routinely, out to 2,500 feet, at least in some plays, and Pennsylvania’s governor proposed in October 2011 to extend the law to cover contamination within 2,500 feet of a well within 12 months. See: page 12 at <http://www.strongerinc.org/documents/PA%20HF%20Review%20Print%20Version.pdf> and <http://www.prnewswire.com/news-releases/governor-corbett-announces-plans-to-implement-key-recommendations-of-marcellus-shale-advisory-commission-130977778.html> Recent pre-drilling monitoring by Chesapeake Energy found methane in 11% of 1,312 water wells it tested in four West Virginia counties. Testing requires landowner cooperation See: http://jlcny.org/site/index.php?option=com_content&view=article&id=736%3Achesapeake-11-percent-of-water-wells-contain-methane-before-drilling&catid=15%3Alatest-news-articles&Itemid=69
ANADARKO EXAMPLE: In Pennsylvania, Anadarko monitors out to 2,500 feet and shares results with land owners. See: <http://www.anadarko.com/SiteCollectionDocuments/Hydraulic%20Fracturing/FracQA.pdf>
CABOT OIL & GAS EXAMPLE: In Pennsylvania, Cabot Oil & Gas, having encountered severe regulatory compliance problems, now monitors out to 2,500 feet. See: http://www.cabotog.com/pdfs/WaterQAclean_final.pdf See Cabot’s website for the broad range of parameters for which tests should be conducted.

HESS EXAMPLE: Hess “conducted [in Pennsylvania] a comprehensive pre-drilling baseline sampling program of potable water wells and some privately owned springs and ponds used for livestock, agriculture or recreational purposes. We extended our sampling radius to 5,000 feet...” See page 61 here: <http://hess.com/reports/sustainability/US/2010/default.pdf>

RANGE RESOURCES EXAMPLE: Range Resources has stated: “Range samples all water sources (e.g., including water wells) within 1,000 feet of our drilling locations before our drilling. We use certified third party environmental laboratories to collect and analyze these samples.” See question 4 here: <http://www.rangeresources.com/Media-Center/Featured-Stories/Range-Answers-Questions-on-Hydraulic-Fracturing-Pr.aspx>

- 18 Exceptions might include, for example, wells substantially isolated (distant from) potable water supplies or areas of special environmental concern. Elements of reporting might include monitoring distances from well site, types of water tested, etc.

- 19 SHELL EXAMPLE: “We design our operations to reduce use of potable water and to use nonpotable water as reasonably practicable.” See: http://www-static.shell.com/static/usa/downloads/onshore/onshore_principles.pdf

- 20 Some U.S. jurisdictions mandate that produced water (naturally occurring, often heavily-saline/high Total Dissolved Solids [TDS] water that comes to the surface following fracturing) must be disposed of by reinjecting into the zone it came from or deep well disposal; these regulations would need to be revised to facilitate recycling and reuse. Note also that recycling processes can raise their own emission and residual disposal issues. Recycling makes the most economic sense when multiple wells are located close to one another; for isolated or widely dispersed wells, the economic case may be less compelling. The “market” already seems to be moving to recycling and reuse, particularly in arid areas and where current deep well injection opportunities are limited or require costly transportation, as in the Marcellus Shale.

APACHE EXAMPLE: Apache/EnCana use subsurface saline water for fracturing in the Horn River Basin of Canada. See <http://www.apachecorp.com/Resources/Upload/Sustainability/environment/resources/water.html>

CHESAPEAKE EXAMPLE: Chesapeake states, “We will effectively plan, manage and reduce where possible the use of freshwater associated with our operations.” See <http://www.chk.com/Environment/Commitment/Pages/information.aspx> Chesapeake Energy has reported substantial savings from recycling in the Marcellus Shale--\$12 million annually in its Eastern Division. See <http://www.chk.com/About/Commitment/Pages/Aqua-Renew.aspx>

RANGE RESOURCES EXAMPLE: Range Resources estimates saving \$200,000/well from recycling in the Marcellus Shale. See <http://www.rangeresources.com/Media-Center/Featured-Stories/Range-Answers-Questions-on-Hydraulic-Fracturing-Pr.aspx>

SELECT ENERGY SERVICES COMPANY EXAMPLE: The Select Energy Services Company offers paper mill effluent to companies fracturing the Haynesville Shale in Louisiana.

See <http://www.upstreamonline.com/live/article272646.ece>

TALISMAN EXAMPLE: Talisman reports: “In 2010, we developed a water management strategy to define best practices for water withdrawal, reuse, disposal and conservation in our North America shale gas operations. This strategy outlines a number of objectives to minimize fresh water use, reduce water disposal and increase the use of alternative water sources.” See <http://cr.talisman-energy.com/2010/environment/>

- 21 For operational reasons, companies need to know how much water they’ll be using for fracturing, where it’s coming from, and how much they might need to pay for it. Note that in July 2011 the Susquehanna River Basin Commission suspended water withdrawals for hydraulic fracturing and other purposes because of low flows in the basin. See http://www.srbc.net/whatsnew/Newsletters/article_55.asp

- 22 Water use reporting continues to evolve. The CDP-Water reporting scheme and the forthcoming GRI oil and gas sector supplement provide detailed guidance on most appropriate approaches to water reporting. WILLIAMS COMPANIES EXAMPLE: Williams Companies, in its 2009 CSR report, stated that over 98% of the fracturing water in its Piceance Basin operations is recycled produced water, 90% of water is recycled in the San Juan and Appalachian Basins, and recycling operations are coming to the Fort Worth Basin. See page 23 here: http://www.williams.com/corporate_responsibility/docs/CSR_2009.pdf
- 23 The average amount of water used for fracturing wells varies by shale play and the amount of water used per well will depend on how many times an individual well is fractured. Some state regulatory authorities require companies to disclose the amount of water they have used for fracturing wells; the proportion of states doing so was not analyzed for this document.
- 24 CHESAPEAKE EXAMPLE: “We will store produced water in enclosed surface water tanks with secondary containment until disposed...” See: <http://www.chk.com/About/Commitment/Pages/default.aspx>
SHELL EXAMPLE: “We have eliminated the use of pit systems for primary containment of produced and drilling fluids in several operating areas. We will remove such pits in remaining operating areas over time.” “We flow back hydraulic fracturing and completion fluids to closed systems or tanks.” See: http://www-static.shell.com/static/usa/downloads/onshore/onshore_principles.pdf
- 25 Berms and emergency response plans are also important elements of containment strategies to reduce risks from wastewater and other toxic chemicals, but are not addressed in this document.
- 26 Open wastewater pits may be sources of emissions to the atmosphere, more so than closed tanks. Even when installed to meet state regulatory standards, pits may be at greater risk of failure than are closed tanks, particularly during severe storm events.
- 27 ENCANA EXAMPLE: “[T]he South Piceance Basin team began an ambitious effort to close approximately 180 historic and active pits containing drill cuttings and completion flowback water. The last drilling and flowback pits were closed in early 2011. We are committed to not constructing any new drilling or flowback pits in this area. In so doing, the South Piceance has been able to address community concerns regarding perceived risks to groundwater and wildlife.” See: <http://www.encana.com/responsibility/cr2010/environment/water/>
- 28 SHELL EXAMPLE: “We recycle fracturing fluid and produced water...to the extent reasonably practicable.” See: http://www-static.shell.com/static/usa/downloads/onshore/onshore_principles.pdf
- 29 Companies need to know the risks associated with the waste waters from their fracturing operations. They should be able to answer the question, “Do you know what’s in your wastewater, where is it going, and can it be processed or disposed of properly at its destination?” Disposal should occur only in licensed disposal facilities. Considerable care should be exercised before permitting waste water to be used for road maintenance. Assessing chemical composition of waste waters is critical if they are being considered for recycling. In the Marcellus, companies’ management of naturally occurring radioactive materials [NORMs] may be of particular concern, and companies’ management of naturally-occurring BETX chemicals may be of concern in multiple shale plays. Pproposed rules in New York State require close tracking of wastes that may be directed to private and public treatment plants and determination that these plants can adequately treat fracturing wastes. See, e.g., Section 750-3.12 et seq here: <http://www.dec.ny.gov/regulations/77383.html> Federal and state regulations govern deep well disposal of wastes.

- 30 There can be sizeable technical challenges in producing meaningful quantified figures over time, because not all injected water returns to the surface, and contaminated naturally-occurring “produced water” that rises to the surface can vary in quantity among shales and individual wells. The April 2011 draft of GRI’s reporting guidelines for the oil & gas sector call for reporting volumes and disposition of produced water from shale formations.
- 31 ANADARKO EXAMPLE: “Anadarko has a GHG Management Plan that includes development of emission reducing activities. Policies include the use of best management practices to enhance energy efficiency and capture methane in addition to implementation of projects that show significant savings economically in addition to the environmental benefits.” See Anadarko Carbon Disclosure Project 2010 report, http://www.anadarko.com/SiteCollectionDocuments/PDF/CDP8%20Response_APC_FINAL.pdf SHELL EXAMPLE: “We develop a plan for each ...well site...to reduce emissions as much as reasonably practicable.” See: http://www-static.shell.com/static/usa/downloads/onshore/onshore_principles.pdf
- 32 SHELL EXAMPLE: “We will work toward testing our facilities for fugitive emissions by visual observation and infrared testing. Where permitted, we will eliminate routine venting; where venting is required by regulation, we will use vapor recovery units or similar equipment as reasonably practicable at the wellhead.” See: http://www-static.shell.com/static/usa/downloads/onshore/onshore_principles.pdf SOUTHWESTERN ENERGY EXAMPLE: Southwestern reports reducing methane emissions by 13.3 billion cubic feet since 2006. See <http://www.swn.com/responsibility/pages/air.aspx> and http://www.swn.com/responsibility/documents/NatGasStar_Summary_Report.pdf
- 33 Securing actual emissions data is critical to addressing the controversy over the extent to which natural gas has a lower climate change footprint than the coal used for energy generation. The DOE shale advisory panel, in its initial “90 day report” recommended that producers “immediately launch projects to design and rapidly implement measurement systems to collect comprehensive methane and other air emissions data.” See page 16 here: http://www.shalegas.energy.gov/resources/081111_90_day_report.pdf The DOE shale advisory panel, in its November 2011 second “90 day report” draft urged “leading companies to adopt a more visible commitment to using quantitative measures as a means of achieving best practice and demonstrating to the public that there is continuous improvement in reducing the environmental impact of shale gas production.” See page 9 here: http://www.shalegas.energy.gov/resources/111011_90_day_report.pdf For proposed EPA regulations that are anticipated to substantially reduce emissions, see <http://www.epa.gov/airquality/oilandgas/pdfs/20110728factsheet.pdf>
- 34 CHESAPEAKE EXAMPLE: “We are converting at least 100 of our drilling rigs and all of our planned hydraulic fracturing equipment to run on LNG. Just converting our rigs and hydraulic fracturing equipment will cut the company’s diesel fuel consumption by approximately 350,000 gallons a day and save the company approximately \$230 million annually.” See: <http://www.chk.com/news/articles/pages/1583997.aspx> SHELL EXAMPLE: “We will work toward using equipment that reduces emissions and/or clean fuels, such as natural gas engines for our rig operations.” “Shell was one of the first to adapt catalyst technology used in diesel cars and power plants to work efficiently on a drilling rig in the harsh Wyoming winters. The catalyst reduces local emissions [at Pinedale] by more than 90 percent.” See: http://www-static.shell.com/static/usa/downloads/onshore/onshore_principles.pdf

- 35 CHESAPEAKE EXAMPLE: “We [are] accelerating the conversion of all 4,500 of Chesapeake’s light duty fleet vehicles to run on CNG and 400 of our heavy duty fleet vehicles to run on LNG, which will reduce our fuel costs by an estimated \$15-20 million per year.” See: <http://www.chk.com/news/articles/pages/1583997.aspx> Reducing truck traffic also reduces road damage.
SHELL EXAMPLE: “We will work toward installing gathering systems and pipelines where reasonably practicable and feasible during the development stage...to eliminate trucking of produced fluids.” See: http://www-static.shell.com/static/usa/downloads/onshore/onshore_principles.pdf
SOUTHWESTERN ENERGY EXAMPLE: “Southwestern Energy designs and builds our own water collection and transfer system to 1) collect rainwater runoff; 2) minimize the need for water from public sources; and 3) reduce the number of water-hauling trucks on the road.” See: http://www.swn.com/responsibility/documents/water_fact_sheet.pdf
- 36 Colorado regulations require green completions, though operators can seek variances from this requirement. See Colorado Rule 805.b here: http://cogcc.state.co.us/RR_Training/presentations/805_Air-Quality.pdf Proposed EPA regulations would require “green completions” of wells to capture more emissions and increase the use of equipment such as “low-bleed” pneumatic valves and vapor recovery units to reduce leaks. For the proposed EPA regulations, see <http://www.epa.gov/airquality/oilandgas/pdfs/20110728factsheet.pdf> In the Bakken Shale of North Dakota, where fracturing is used to extract oil, huge amounts of accompanying natural gas—more than 100 million cubic feet daily—are being flared (burned) because of the lack of pipeline infrastructure, though pipelines and related infrastructure are under development. See: <http://www.nytimes.com/2011/09/27/business/energy-environment/in-north-dakota-wasted-natural-gas-flickers-against-the-sky.html?pagewanted=all> and <http://online.wsj.com/article/SB10001424052970203707504577010463934234498.html>
ANADARKO EXAMPLE: In its 2010 report to the Carbon Disclosure Project, Anadarko reports annual savings of \$15 million from green completions. The company also reports sizeable savings, and methane emission reductions, from other specific reduction technologies. See page 9 in the company’s report, http://www.anadarko.com/SiteCollectionDocuments/PDF/CDP8%20Response_APC_FINAL.pdf: CHESAPEAKE EXAMPLE: Chesapeake Energy notes that “green completions” have been the largest contributor to its own reductions. See <http://www.chk.com/environment/air/Pages/information.aspx>
DEVON EXAMPLE: Devon has stated that “Green completions [are] now the standard in [the north Texas] Barnett Shale”; its green completions have reduced methane emissions by more than 25 billion cubic feet. The company states it uses the same process to complete wells in New Mexico, Wyoming, Oklahoma and south Texas. The company describes the careful corporate planning that enables it to voluntarily undertake these green completions. See: <http://www.dvn.com/CorpResp/initiatives/Pages/GreenCompletions.aspx>
- 37 ANADARKO EXAMPLE: “We are also one of a handful of companies that utilizes a ‘closed loop’ drilling process [in the Marcellus]”. See: <http://www.anadarko.com/SiteCollectionDocuments/Hydraulic%20Fracturing/FracQA.pdf>
EXXONMOBIL EXAMPLE: “All of our drilling rigs in the Marcellus region use closed loop drilling fluid systems. These systems eliminate drilling pits, reducing the overall site footprint.” See: http://www.exxonmobil.com/Corporate/energy_production_hf.aspx
- 38 Some areas have limited options for off-site disposal, so some operators bury dewatered material near operations as allowed by state regulations. Proposed New York State regulations favor closed loop systems for horizontal drilling in the Marcellus Shale. See Section 750-3.11(h) here: <http://www.dec.ny.gov/regulations/77383.html>

- 39 Proposed New York State rules require testing for NORMs. See Section 750-3.11(i) here: <http://www.dec.ny.gov/regulations/77383.html>
- 40 Sludges can be the by-product of wastewater recycling technologies that treat wastewater for reuse or disposal.
- 41 Though it addresses community sustainability issues broadly rather than energy specifically, ICCR's "Social Sustainability Resource Guide: Building Sustainable Communities Through Multi-Party Collaboration" provides a useful discussion of the many steps in collaborative community engagement. See in particular page 21: <http://www.iccr.org/publications/2011SSRG.pdf>
 BG GROUP (U.K.) EXAMPLE: Though focused on "areas with complex social, developmental and economic challenges", BG Group's Social Performance Standard includes impact management (avoiding or minimizing negative impacts of BG activities) and establishing and maintaining effective relationships with local stakeholders. Impact management includes developing a baseline socio-economic assessment and conducting a social impact assessment. In 2010, BG Group-EXCO's joint venture in the Haynesville Shale commissioned an independent social impact assessment of its on-going operations in Holly Field, Desoto Parish, Louisiana. See: <http://www.bg-group.com/sustainability10/ManagementSystems/SocialPerformance/Pages/default.aspx> and <http://www.bg-group.com/sustainability10/Society/Pages/impact-management.aspx>
- 42 APACHE EXAMPLE: Among several examples of stakeholder consultation it cites, Apache notes moving a natural gas facility 25 miles in Australia to accommodate aboriginal desires to safeguard ancient rock art. See: <http://files.apachecorp.com/Sustainability/community/index.html>
 SHELL EXAMPLE: Shell has published several pages of commitments to the Karoo community in South Africa regarding fracturing operations there. These include, for example, setting up an independent advisory committee "to ensure we reduce and mitigate impacts as far as possible"; "provide full compensation to any landowner with evidenced direct negative impact or loss on their land as a result of [Shell] activities; "not compete with the people of the Karoo for their water needs"; "commit to establishing mutually acceptable protocols for ...independent monitoring of ...water quality in existing water wells and surface water"; "conserve and recycle water where ever possible" "not use BTEX in any hydraulic fracturing operations", etc. See: http://www.shell.com/home/content/zaf/aboutshell/shell_businesses/e_and_p/karoo/commitments.html
 TALISMAN EXAMPLE: "Incorporating the broad FPIC principles means we will work with communities, at the earliest stages of development, to gain support for the work we plan to do. While governments have the final say on how resources are developed, this policy demonstrates Talisman's good faith attempt to involve and respect our community neighbours." See <http://cr.talisman-energy.com/2010/communities/> Talisman Energy's "Global Community Relations Policy" expresses its intent to engage in a "timely, honest" way before undertaking significant activities through the life of a project; to build "trust and understanding through an open exchange of information that enables knowledgeable decision-making by Communities"; and to "endeavor to obtain and maintain the support and agreement of Communities...in ways that are respectful and sensitive to local ...consultative processes and to the interests of the Community and Talisman." See: <http://www.talisman-energy.com/upload/editor/File/10417493%20-%20GLOBAL%20COMMUNITY%20RELATIONS%20POLICY%20-%20DECEMBER%209%202010%20-%201%20-%20TLMPRD.pdf>

- 43 Jurisdictional standards for building and public facility setbacks, noise and road usage, and compensation for road damage vary widely. Chapter 8 of New York State’s Revised Draft Supplemental Generic Environmental Impact Statement summarizes the results of a consultant study gathering some of this information. For example, the setback distance between a well-head and a private residence is 600 feet in the City of Fort Worth, Texas, 200 feet in Pennsylvania, and 100 feet in Ohio. Regulations in Colorado, Louisiana and the City of Fort Worth address noise and lighting issues. Requirements include ambient noise determination prior to operations, daytime and nighttime noise level limits, site inspection and possibly sound level measurements in response to complaints, and quiet design mufflers or equivalent equipment within 400 feet of building units. See: http://www.dec.ny.gov/docs/materials_minerals_pdf/rdsgeisch80911.pdf Having natural gas operations too close to a residence may complicate securing FHA financing for a residential mortgage or securing a residential mortgage that can be sold in the secondary mortgage market. See, e.g., <http://www.nytimes.com/2011/10/20/us/rush-to-drill-for-gas-creates-mortgage-conflicts.html?pagewanted=all> See also, “Gas and Oil Leases Impact on Residential Lending”, http://www.tompkins-co.org/tccog/Gas_Drilling/Focus_Groups/Assessment%20Documents/White%20Paper.pdf
- 44 A company “good neighbor” policy could provide water in response to complaints, even while results of testing are awaited and without acknowledgement of responsibility. Supply of water should NOT be made contingent on land owners foregoing the right to pursue legal remedies for contamination or to speak publicly about alleged contamination.
- 45 The company should distinguish among types and magnitude of violations, e.g., the difference between an isolated paperwork omission on the one hand and, on the other, numerous violations of well construction and spill prevention and control standards.
TALISMAN EXAMPLE: Talisman lists and discusses on its corporate website Notices of Violation issued for its operations in Pennsylvania. It notes that Pennsylvania regulators distinguish between administrative violations and operational violations that may have environmental consequences. See http://www.talismanusa.com/how_we_operate/notices-of-violation/how-were-doing.html
CHESAPEAKE EXAMPLE: Chesapeake does not list its numerous violations in Pennsylvania, which for investors would be one measure of Chesapeake’s performance against its “focused programs” for environmental excellence. To see those violations for 2010 and 2011, see the official list on the Pennsylvania Department of Environmental Protection website here: <http://www.dep.state.pa.us/dep/deputate/minres/oilgas/OGInspectionsViolations/OGInspviol.htm> See also “Chesapeake Fined \$1.09 Million in Pennsylvania”, <http://online.wsj.com/article/SB10001424052748703509104576329763790208034.html>

SUPPORTING STATEMENT

HISTORY AND CONTEXT



Natural gas production from shale formations in the United States has grown dramatically since the early 2000s, amidst expanding controversy over the horizontal drilling and hydraulic fracturing used to access the gas. The supplies of newly accessible gas are an energy “game changer”, perceived as offering a lower carbon footprint than coal combustion and providing market advantages to US chemical manufacturers using natural gas as feedstock. Natural gas has also been regarded as a “bridge fuel” away from coal to greater reliance on renewable energy, although some fear that increased use of shale gas, because of current low prices, will stunt market growth of renewables and support for efficiency measures. Increased fracturing to secure oil from shale formations is also viewed as reducing reliance on insecure overseas petroleum sources.⁴⁶

Fracturing and horizontal drilling together make substantial recovery of gas from shales economically possible and have brought drilling and production to localities on a scale previously not experienced.

Global interest in drawing gas from shales has also been growing rapidly, with companies assessing shales on nearly every continent. Many governments and communities from around the world are looking to learn from the U.S. experience before deciding whether and how to permit exploitation of their shale resources.⁴⁷

Since mid-2009, through dialogues and shareholder resolutions, investors have been seeking increased disclosure by companies of the environmental and social risks associated with natural gas operations in shale formations and the policies and procedures they are adopting to reduce or eliminate these risks. Risks are associated with the entire life cycle of operations, although much public discussion, in shorthand terms, focuses on “fracturing” or “fracking”. Fracturing and horizontal drilling together make substantial recovery of gas from shales economically possible and have brought drilling and production to localities on a scale previously not experienced.

The operations include:

- taking steps to minimize surface footprint—disruption of natural ecosystems and damage to human communities;⁴⁸
- transporting millions of gallons of water and thousands of gallons of chemicals to each well site;
- selecting chemical additives for fracturing;
- placing layers of pipes and protective cement in the bore hole to prevent leaks;
- breaking apart (fracturing) sub-surface shale formations by injecting water, sand,⁴⁹ and chemicals under thousands of pounds of pressure;
- storing the water and chemicals that return to the surface during the fracturing process (including naturally occurring toxic chemicals in the formation that also surface during gas production);
- moving and treating waste waters; and
- managing air pollutants.

FINANCIAL REPORTING, REGULATORY, AND TECHNOLOGY DRIVERS

Investors began querying companies about shale gas risks in 2009. Some noteworthy developments since then that underscore the urgency and timeliness of enhanced corporate risk management and disclosure include the following:

Many companies report risk management practices better than state requirements; compliance with existing regulations is just a starting point for risk reduction.⁵³

- **U.S. Securities and Exchange Commission (SEC) Information Requests.** SEC staff have requested increased reporting about natural gas operations in shales. The SEC is seeking “detailed information about oil and gas companies’ hydraulic fracturing operations, including environmental impacts” and is “looking for... whether companies are disclosing risks associated with the practice.”⁵⁰ The list of SEC areas of inquiry reportedly includes:
 - Established steps to ensure that drilling, casing and cementing adhere to known best practices;
 - Real time monitoring of the rate and pressure of the fracturing treatment;
 - Evaluation of the environmental impact of chemical additives; and
 - Efforts to minimize water use or minimizing the impact of disposal on surface waters.⁵¹
- **Increased Regulation.** Individual states, cities and regional jurisdictions have tightened their oil and gas regulations. These emerging regulations address chemical identification and disclosure concerns, water management, well construction, and other issues, though there remain serious questions about the adequacy of state oversight budgets and the efficacy of state enforcement.⁵² State regulators have been moving to catch up with the sizeable growth of natural gas development in shale formations, but state regulation remains uneven. Many companies report risk management practices better than state requirements; compliance with existing regulations is just a starting point for risk reduction.⁵³

... based on available data, the largest known risks from natural gas operations are from surface operations and improperly performed near-surface well construction.

- **Increased Corporate Disclosures.** Individual company disclosures of environmental risks and management practices have increased on websites and in corporate social responsibility reports. These have highlighted a disparate array of corporate risk reduction measures, often anecdotally. But no uniform system of reporting has emerged. Shell Oil Company’s recently published “Onshore Tight/Shale Oil & Gas Operating Principles” speaks to most investor concerns about corporate policies, but these policies need to be supplemented by systematic reporting on implementation.⁵⁴ Chesapeake Energy has published a list of “focus programs” that also responds to many investor concerns, though the company’s numerous regulatory violations and sizeable fines in the Marcellus Shale of Pennsylvania raise questions about how Chesapeake carries out its espoused policies on the ground.⁵⁵
- **Responsive Technological Innovation.** Technological innovations in waste treatment, more benign chemical additives, and analytical software for comparative assessment of chemical toxicity have emerged at a rapid pace. Companies seeking to reduce their risk profile and lower costs now have a broadened array of tools from which to choose.
- **Increased Wastewater Recycling.** Waste water recycling and reuse practices continue to grow in popularity amidst increasing awareness of the economic benefits of such practices and tightened government regulations on off-site disposal in treatment plants.
- **Reduced Air Emissions.** Increasing numbers of companies are voluntarily adopting measures—such as “green completions”—to reduce emissions of airborne contaminants at some of their locations. They are recognizing the economic benefits from such practices and the need to reduce emissions to avoid violations of ambient air quality standards now and in the future.
- **Growing Appreciation for Surface and Well Construction Risks.** Various published analyses have emphasized that, based on available data, the largest known risks from natural gas operations are from surface operations and improperly performed near-surface well construction, not from the literal breaking apart (fracturing) of shale formations thousands of feet below the surface and drinking water aquifers.
- **U.S. Department of Energy (DOE) BMP Recommendations.** An advisory panel on shale gas convened by DOE has urged development and broad adoption of Best Management Practices for managing risks. The panel’s August 2011 report addresses public perceptions, adequacy of existing chemical disclosures, emissions of airborne contaminants, and other issues pertinent to practices and indicators.⁵⁶

The Business Case for Strengthened Goals, Practices and Disclosures

The Proposed Core Management Goals (CMGs), Best Management Practices (BMPs) and Key Performance Indicators (KPIs) are designed to:

1. drive operational efficiencies (reduced costs yield increased margins and profitability);⁵⁷
2. provide insurance in case of accident or natural disaster (lower toxicities and volumes of chemicals reduce risks from chemical spills);⁵⁸
3. reduce air emissions and fresh water withdrawals that trigger violations of environmental standards (regulators consequently may ban and limit operations); and,
4. protect and enhance companies' social license to operate by increasing the odds of positive community response to the best-managed, most transparent companies addressing community needs and concerns.

Gaining Community Consent: The Business Case and Evolving Norms

Two of four “major areas of concern” identified by the August 2011 US DOE shale gas advisory panel pertain to communities: “community disruption during shale gas production” and “cumulative adverse impacts that intensive shale production can have on communities and ecosystems.”

2 Opportunities To Hear About Both Sides of the Fracking Issue in Colorado!

Townhall on Fracking

Thursday, October 20th, 2011
7-8:30 p.m. at the Community College of Aurora
16600 E. Centertech Parkway, Aurora, CO
in the Arts Bldg. (follow signs)

Panel Speakers: Representatives from Colorado Oil and Gas Conservation Commission, Oil and Gas Association, Aurora Water, and Arapahoe County; Walter Wilson (former EPA environmental engineer and whistle blower); Paul Lee (formerly with Dept. of Interior, Bureau of Reclamation, and defender of Colorado water)

Presented by: Senator Morgan Carroll, Representative Sa Hyde, and Representative Rhonda Fields

FRACKING

Wednesday, November 2, 2011
6:30 p.m. at Koebel Public Library
6955 S. Holly Street, Centennial, CO

Representatives from EnCana Oil and Gas Company, Colorado Oil and Gas Conservation Commission, and Colorado Environmental Coalition will present an overview of current practices, industry safety practices, and environmental concerns.

Note: Free & open to the public, but registration is required. Call the Arapahoe Library District 303-542-7279. Forum information 303-750-2639

Presented by:
The League of Women Voters of Arapahoe County
and the Arapahoe Library District

Technical issues, such as proper well construction and water use, are key to addressing those issues, but an additional concern is how and whether energy companies go beyond technical solutions to interact with host communities and states in a manner that is respectful of human rights and secures community consent—a “social license to operate.”

Technical solutions and public engagement need to go hand-in-hand. The failure to address both can result in restrictions on companies' ability to act. For example, in October 2011, France cancelled exploration permits of two energy companies following enactment of a national ban on fracturing.⁵⁹ Local communities in the U.S. have enacted bans or limitations on fracturing, some of which have been challenged in litigation addressing the balance of rights and responsibilities of state and local governments and local landowners.⁶⁰

Jonathan Lash, former President of the World Resources Institute, has summarized the business case for earning community consent this way:

A community ignored or scorned can exact a significant financial price in the present and impose opportunity costs for a company in the future....as a principle and practice, free, prior, informed consent is a key part of legitimacy.... simply ask this question: Is your company better off having the people in the communities where you operate with you or against you?⁶¹

Companies—especially smaller ones with concentrated lease holdings—have incurred sizeable financial penalties from bans and moratoria:

- Shares of Treador Resources dropped 20% after the French government banned the use of fracturing for oil and gas.⁶² In early November 2011, Treador had a market capitalization of just under \$100 million, half its November 2010 value.⁶³
- Shares of Questerre Energy Corporation in Canada, which holds rights to more than one million gross acres in Quebec atop the Utica formation, dropped 25% after the Province of Quebec government placed a moratorium on fracturing in March 2011.⁶⁴ The market capitalization of the company dropped by 75% between June 2010 and June 2011.
- Shares of Junex Inc. and Gastem Inc., “whose fortunes are tied to Quebec’s nascent shale gas industry” closed in June 2011 at 50% off their 52 week highs.⁶⁵
- Norway-based Norse Energy, “once the most active drilling firm in central and southern New York” cut its New York work force in half and launched a “fire sale” of its New York land assets as a result of New York State’s moratorium on fracturing.⁶⁶

By careful assessment and consultation with impacted communities, companies can build broad community support for new projects.⁷² Otherwise they may face community and government opposition or costly delays to new projects or expansions of existing operations.

Larger companies can be significantly impacted as well. In response to well blow-outs and other incidents in neighboring Pennsylvania, New York State regulators have proposed new setback requirements from water supplies and other sensitive areas that are much more stringent than those of Pennsylvania. Shell has calculated that 40% of its acreage in New York State could be off-limits under the proposed rules.⁶⁷

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 upholding the sovereignty of Indigenous Peoples to protect their communal lands and cultures and their right to self-determination; however the same concept also may be applicable to routine domestic development. FPIC is embodied in a number of international agreements and declarations.⁶⁸ Nevertheless, the specific operational meanings of FPIC are still being worked through both globally and on a case-by-case basis. IPIECA, the global oil and gas industry association for environmental and social issues, has published a summary of emerging good practice for dealing with indigenous peoples and World Resources Institute has offered suggestions for implementing the FPIC concept as well.⁶⁹

Talisman Energy’s “Global Community Relations Policy” expresses its intent to engage in a “timely, honest” way before undertaking significant activities through the life of a project; to build “trust and understanding through an open exchange of information that enables knowledgeable decision-making by Communities”; and to “endeavor to obtain and maintain the support and agreement of Communities...in ways that are respectful and sensitive to local ...consultative processes and to the interests of the Community and Talisman.”⁷⁰ Note that the focus of Talisman’s Global Community Relations Policy is its engagements with indigenous and tribal communities.

Even in the United States, with its well-established though fragmented⁷¹ property rights and governance systems outside tribal lands, corporations need to proactively, creatively, and forthrightly develop appropriate engagement processes to secure their social license to operate. By careful assessment and consultation with impacted communities, companies can build broad community support for new projects.⁷² Otherwise they may face community and government opposition or costly delays to new projects or expansions of existing operations.⁷³

Definitions and Design Criteria for Goals, Practices and Indicators

Core Management Goals (CMGs) and Best Management Practices (BMPs) are broad policies and practices adopted and supported at the board and senior executive level within the company.

Key Performance Indicators (KPIs) summarize operational-level outcomes from pursuing CMGs and implementing BMPs. Where specific KPIs are not indicated for BMPs, reporting on the BMPs themselves is sufficient.

CMGs, BMPs, and KPIs should allow:

- investors to more readily compare company policies and performance in reducing and eliminating environmental and related business risks associated with the life cycle of hydraulic fracturing operations; and,
- corporate managers to set performance goals and track progress.

Much of the information sought for KPIs is routinely developed by companies as part of normal business operations, or should be; its absence may reflect gaps in business risk management.

CMGs, BMPs, and KPIs should:

- draw on data that many companies routinely gather for operational reasons, for regulatory reporting, or for reporting according to the Global Reporting Initiative (GRI), Carbon Disclosure Project (CDP) and other reporting mechanisms described immediately below;
- be quantitative where possible;
- be relevant, reliable, comparable and auditable; and,
- embrace the concept of “comply or explain”—allowing for variations in operational settings, but requiring companies to explain why best practices have not been implemented or why key performance indicators are inappropriate for specific activities or locations.

Supplementing Existing Reporting Mechanisms and Guidelines

Corporate reporting on natural gas operations in shales should complement other corporate environmental, social and governance (ESG) reporting mechanisms that have developed over the course of the last decade. The Global Reporting Initiative (GRI) is the most prominent of these. GRI has developed reporting guidelines that apply across multiple sectors and is planning to release a sector supplement for oil and gas in late 2011.⁷⁴ IPIECA, the global oil and gas industry association for environmental and social issues, has developed guidance⁷⁵ on voluntary sustainability reporting for the oil and gas industry; GRI and IPIECA are working to align their reporting efforts.

Many businesses recognize that they need to account for the risks to their operations associated with climate change and water availability and quality. Conversely, there are growing demands for companies to disclose their operations’ impact on climate change and water quantity and quality. Consequently, increasing numbers of companies are reporting publicly on their greenhouse gas emissions, energy management practices, and water use and management practices. Many report emissions via the Carbon Disclosure Project (CDP), which represents 551 institutional investors managing \$71 trillion in assets.⁷⁶ Water reporting has recently begun via CDP’s Water Disclosure Project.⁷⁷

Increased reporting on management of the environmental risks from natural gas operations in shales can be nested within larger disclosure initiatives to avoid unnecessary duplication of data development efforts and to place information within context. Nevertheless natural gas operations in shales deserve discrete reporting because of their ever-increasing public profile.

ENDNOTES 46 - 77

- 46 These CMGs, BMPs and KPIs are based on experience with extracting natural gas from shale, but many likely can be applied to fracturing operations for oil extraction and more broadly to other hydrocarbon production activities. Some of the BMPs for CMG 1 (Manage risks transparently and at Board level) and CMG 10 (Minimize risks from poor contractor performance), for example, were based on questions in a letter by the Investor Network on Climate Risk that Ceres sent in August 2010 to 27 oil and gas companies regarding their deepwater offshore oil safety risk management and spill prevention. See <http://www.ceres.org/incr/news/oil-letters-080510>.
- 47 Contamination incidents in the US have led to moratoria or bans on fracturing both in and beyond the US. See: <http://www.celdf.org/downloads/COMMON%SENSE%20-%20Banning%20Fracking%20at%20the%20Local%20Level.pdf>; <http://www.r-cause.net/bans--moratoria-local-global.html>; <http://online.wsj.com/article/SB100014240529670204612504576608983814069012.html> <http://www.cbc.ca/fp/story/2011/06/30/5031205.html> and <http://www.reuters.com/article/2011/04/21/us-safrica-fracking-idUSTRE73K45620110421>
- 48 For a quantitative comparative assessment of risks from natural gas operations in shales, see George E. King (Apache Corporation) “Hydraulic Fracturing 101: What Every Representative, Environmentalist, Regulator, Reporter, Investor, University Researcher, Neighbor and Engineer Should Know About Estimating Frac Risk and Improving Frac Performance in Unconventional Gas and Oil Wells”, SPE 152596 to be presented at the SPE Fracturing Conference, The Woodlands, TX, USA, 6-8 February 2012. Another version of this analysis, “Explaining and Estimating Fracture Risk: Improving Fracture Performance in Unconventional Gas and Oil Wells” is available at George E. King’s website, <http://www.gekengeering.com/> See Downloads section.
- 49 Sand is commonly used to prop open fractures in shale, but manufactured ceramic “proppants” can also be used.
- 50 “SEC Drills Down on Fracking”, Wall Street Journal, Page B1, August 25, 2011. (longer version available online at <http://online.wsj.com/article/SB10001424053111904009304576528484179638702.html>)
- 51 http://www.martindale.com/natural-resources-law/article_Andrews-Kurth-LLP_1345720.htm
- 52 <http://www.propublica.org/article/state-oil-and-gas-regulators-are-spread-too-thin-to-do-their-jobs-1230> and <http://coloradoindependent.com/53081/state-backlogged-with-gas-contamination-cases-dating-back-years>
- 53 For example, a March 2011 review by STRONGER, a collaborative effort of state regulators and other stakeholders, found that Louisiana’s spill prevention and control plan regulations require development of a Spill Prevention and Control Plan within 180 days after a facility becomes operational and to be fully implemented within one year after the facility begins operation. “Consequently, there is a gap in time between the drilling and hydraulic fracturing of a well and the time that the Spill Prevention and Control Plan is required.” See page 7, “Louisiana Hydraulic Fracturing State Review”, <http://www.stronger-inc.org/documents/Final%20Louisiana%20HF%20Review%203-2011.pdf> For more information on STRONGER and its state regulatory reviews, see <http://www.strongerinc.org/>
- 54 http://www.shell.us/home/content/usa/aboutshell/shell_businesses/onshore/principles/

- 55 <http://www.businessweek.com/ap/financialnews/D9N9C7981.htm> and <http://www.chk.com/About/Commitment/Pages/default.aspx>
- 56 http://www.shalegas.energy.gov/resources/081111_90_day_report.pdf The DOE shale gas advisory panel, in its November 2011 “second 90 day report draft” urged “leading companies to adopt a more visible commitment to using quantitative measures as a means of achieving best practice and demonstrating to the public that there is continuous improvement in reducing the environmental impact of shale gas production.” See page 9 here: http://www.shalegas.energy.gov/resources/111011_90_day_report.pdf Detailed recommendations for best practice have also been provided in the July 2011 report from Pennsylvania of the Governor’s Marcellus Shale Advisory Commission. See: http://www.mde.state.md.us/programs/Land/mining/marcellus/Documents/MSAC_Final_Report.pdf Guidelines have also been issued by the American Petroleum Institute, http://www.api.org/policy/exploration/hydraulicfracturing/upload/Hydraulic_Fracturing_InfoSheet.pdf and by grassroots community activists. http://www.earthworksaction.org/pubs/Drill_Right_Texas_FINAL.pdf The University of Colorado’s Natural Resources Law Center has developed a free-access, searchable website of BMPs for oil and gas development in five western U.S. states, characterizing BMPs as “mitigation measures ... to promote energy development in an environmentally sensitive manner.” <http://www.oilandgasbmps.org/>
- 57 This is often the case with 1. “green completions” that reduce air emissions and create marketable products, and 2. wastewater recycling and reuse that reduces transport emissions and lowers the need for sourcing fresh water.
- 58 Also, pre-drilling water quality testing identifies pre-existing contamination conditions and creates a baseline for assessing the impact of operations.
- 59 <http://online.wsj.com/article/SB10001424052970204612504576608983814069012.html>
- 60 <http://www.celdf.org/downloads/COMMON%20SENSE%20-%20Banning%20Fracking%20at%20the%20Local%20Level.pdf>; <http://www.r-cause.net/bans--moratoria-local--global.html>
- 61 Former WRI President Jonathan Lash, in “Introduction”, World Resources Institute, “Development Without Conflict: The Business Case for Community Consent” (Washington, D.C., 2007). See: http://pdf.wri.org/development_without_conflict_fpic.pdf
- 62 <http://us.mobile.reuters.com/article/environmentNews/idUSTRE79O3WO20111025>
- 63 <http://dealbook.nytimes.com/2010/01/20/big-oil-pursues-toreador-resources/>
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- 65 <http://www.cbc.ca/fp/story/2011/06/30/5031205.html>
- 66 <http://refinerynews.com/norse-energy-fire-sale-of-130k-acres-in-ny/> and <http://www.pressconnects.com/article/20111021/NEWS01/110210398/Norse-Energy-puts-N-Y-land-rights-sale?odyssey=nav|head>
- 67 <http://www.reuters.com/article/2011/10/21/us-newyork-shale-idUSTRE79K4YT20111021>

- 68 These include the International Labour Organization Convention No.169, concerning Indigenous and Tribal Peoples and the United Nations Declaration on the Rights of Indigenous Peoples. See: <http://www.ilo.org/indigenous/Conventions/no169/lang--en/index.htm> and http://www.un.org/esa/socdev/unpfi/documents/DRIPS_en.pdf More detailed discussion is provided in a report by the Foley Hoag law firm prepared for Talisman Energy and accompanying comments from World Resources Institute: http://baseswiki.org/w/images/en/9/9a/FOLEY-HOAG_Informed_Consent_Policy.pdf For the position of the Indigenous Environmental Network on application of FPIC in the United States and Canada, see: http://ecosanity.org/files/images/blogsanity/IEN_FPIC.pdf and http://www.ienearth.org/docs/statement_of_the_indigenous_environmental_network_north_america_agenda_item_3_c_free_prior_and_informed_consent.html
- 69 <http://www.ipieca.org/publication/indigenous-peoples-and-oil-and-gas-industry-context-issues-and-emerging-good-practice>; http://pdf.wri.org/development_without_conflict_fpic.pdf
- 70 <http://www.talisman-energy.com/upload/editor/File/10417493%20-%20GLOBAL%20COMMUNITY%20RELATIONS%20POLICY%20-%20DECEMBER%2009%202010%20-%20201%20-%20TLM-PRD.pdf>
- 71 On governance fragmentation, see Cornell University’s “Zoning and the Marcellus Shale: Levels of Government in New York and Pennsylvania”, http://www.cce.cornell.edu/EnergyClimateChange/NaturalGasDev/Documents/City%20and%20Regional%20Planning%20Student%20Papers/CRP5072_Zoning%20Final%20Report.pdf
- 72 Communities can be deeply split in their consent to proposed activities. As Sister Nora Nash of the Sisters of St. Francis has commented, “Fracking doesn’t just fracture shale—it fractures communities, too.” See page 15 here: <http://www.iccr.org/news/2011AnnualReport.pdf>
- 73 Community consent can also be viewed through the lens of international norms and corporate policies addressing human rights. One primary example is the United Nations’ “Protect, Respect and Remedy’ Framework” proposed by UN Special Representative John Ruggie. In June 2011 the UN Human Rights Council endorsed the “Guiding Principles on Business and Human Rights” drafted by Professor Ruggie after six years of consultation with governments, companies, and nongovernmental organizations. One key conclusion is that nation states have the duty to protect against human rights abuse by third parties, including companies, and that companies have the responsibility to respect human rights and avoid infringing on the rights of others and to address any adverse impacts of company operations. Therefore companies have a separate role from the state and cannot simply maintain they abide by national, state or local laws and regulations when these may be inadequate or unenforced. Numerous companies have adopted human rights policies, including Chevron, ConocoPhillips, and Hess. See http://www.ohchr.org/Documents/Issues/Business/A-HRC-17-31_AEV.pdf; June 20, 2011 Deutsche-Welle interview with Prof. John Ruggie, “States, companies must ensure human rights, UN expert says” <http://www.dw-world.de/dw/article/0,,15173983,00.html>; <http://www.chevron.com/globalissues/humanrights/>; <http://www.conocophillips.com/EN/susdev/policies/humanrightsposition/Pages/index.aspx>; and <http://hess.com/sustainability/environment/Human%20Rights%20Policy.pdf>
- 74 <http://www.globalreporting.org/ReportingFramework/SectorSupplements/OilAndGas/>
- 75 <http://www.ipieca.org/news/20101206/sustainability-reporting-improving-transparency-driving-performance>
- 76 <https://www.cdproject.net/en-US/WhatWeDo/Pages/overview.aspx>
- 77 <https://www.cdproject.net/en-US/Programmes/Pages/cdp-water-disclosure.aspx>



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