CAPP's new guidelines for Canadian shale gas producers: A review of key requirements

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Introduction

In late January 2012, the Canadian Association of Petroleum Producers (CAPP) released six "Hydraulic Fracturing Operating Practices" to guide water management and improve practices for shale gas and tight gas development in Canada.[1] CAPP announced its Operating Practices roughly a month after a group of institutional investors released "*Extracting the Facts: An Investor Guide to Disclosing risks from Hydraulic Fracturing Operations*,"[2] a comprehensive guidance document that provides best practice recommendations to energy companies for reporting on, and reducing risks and impacts from, natural gas operations relying on hydraulic fracturing (hereinafter "IEHN Investor Guide").

The CAPP Operating Practices refer to:

1. Fracturing fluid additive disclosure;
2. Fracturing fluid additive risk assessment and management;
3. Baseline (pre-drilling) groundwater testing;
4. Gas wellbore construction and quality assurance;
5. Water sourcing, measurement and reuse; and
6. Fluid transport, handling, storage and disposal (the term "fluid" encompasses fracturing fluids, naturally occurring water that is produced when gas is extracted, the portion of fracturing fluids that comes back to surface after a well is hydraulically fractured, and fracturing fluid waste).

Each Operating Practice asks CAPP member companies to "meet or exceed" a number of "operational requirements," and establishes "performance measures" to demonstrate conformance with the Practice, as well as "reporting expectations," which in a few cases involve public disclosure of key data.

CAPP developed the Operating Practices to enable and demonstrate conformance by CAPP member companies with the following Guiding Principles for Hydraulic Fracturing, released in September 2011:

1. Safeguard the quality and quantity of regional surface and groundwater resources through sound wellbore construction practices, sourcing freshwater where appropriate, and recycling water use as much as possible;
2. Measure and disclose water use;
3. Support fracturing fluid additives with the least environmental risks;
4. Support disclosure of fracturing fluid additives; and
5. "Continue to advance" best practices that reduce potential environmental risks of hydraulic fracturing.

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[1] CAPP Hydraulic Fracturing Operating Practices (30 Jan. 2012), available on line: http://www.capp.ca/canadaIndustry/naturalGas/ShaleGas/Pages/Default.aspx#operating

[2] Investor Environmental Health Network (IEHN) and Interfaith Center on Corporate Responsibility (ICCR), "Extracting the Facts: An Investor Guide to Disclosing Risks from Hydraulic Fracturing Operations" (December 2011) [IEHN Investor Guide], online: http://iehn.org/documents/frackguidance.pdf

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Will CAPP's Principles and Operating Practices help to mitigate risk?

SHARE believes that CAPP's Hydraulic Fracturing Guiding Principles and Operating Practices are a step in the right direction, as they signal a commitment by CAPP member companies to continuous improvements in performance and, just as important, to public reporting. If fully implemented by companies across their unconventional gas operations, some of the Operating Practices promise to help mitigate environmental risks associated with unconventional gas extraction. Other Practices, however, are not stringent or specific enough to reassure investors that their implementation by companies will effectively reduce risk throughout unconventional gas assets, or lead to actual improvements in corporate performance. Below is a summary of some of the key requirements under each Operating Practice, including a brief discussion of their strengths and weaknesses with respect to how they might contribute to mitigating risk.

1. Fracturing Fluid Additive Disclosure

Under this Operating Practice, companies would publicly disclose, on a well-by-well basis, the common name and unique chemical identification number (i.e., the Chemical Abstract Service (CAS) number) *of each chemical ingredient* of fracturing fluids used or planned for use in their wells *that is listed in Material Safety Data Sheets* provided by fracturing fluids suppliers.

A commitment to public disclosure of CAS numbers is a welcomed development, since chemicals usually have many different common names that make their identification difficult. In contrast, CAS numbers are unique identifiers that give access to toxicological and other information available in the public CAS Registry, a comprehensive and authoritative collection of chemical substance information. However, to limit public disclosure of CAS numbers to ingredients listed in Material Safety Data Sheets (MSDSs) is problematic, because MSDSs focus on worker safety and chemicals that could pose a threat to the environment or the public at large may not be listed in MSDSs.[3]

This issue was recently brought up by a U.S. Department of Energy Subcommittee charged with identifying measures that could be taken to reduce the environmental impact and help assure the safety of shale gas production in the United States. In two reports it released in late 2011, the Subcommittee stressed that "MSDS only report chemicals that have been deemed to be hazardous in an occupational setting ... reporting does not include other chemicals that might be hazardous if human exposure occurs through environmental pathways." The Subcommittee therefore urged that disclosure of fracturing fluid ingredients "should include all chemicals, not just those that appear on Material Safety Data Sheets."[4]

In a similar vein, the IEHN Investor Guide ("*Extracting the Facts: An Investor Guide to Disclosing risks from Hydraulic Fracturing Operations*") asks companies to publicly disclose all chemicals planned for use or used at each well, "including additives beyond those identified in Material Safety Data Sheets."[5]

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[3] In Canada, MSDSs list substances regulated under the Workplace Hazardous Material Information System (WHMIS), which covers the use of hazardous materials in the workplace and parallels the U.S. Occupational Health and Safety (OSHA) Hazard Communication Standard. Ecological information is not specifically required under the Canadian WHMIS. For details, see Canadian Centre for Occupational Health and Safety (CCOHS), "MSDSs - creating" (Comparison of MSDSs headings in WHMIS legislation and other standards (ANSI, GHS), online: http://www.ccohs.ca/oshanswers/legisl/msds_prep.html [Accessed Feb. 10, 2012]; and CCOHS, "The MSDS: A Basic Guide for Users - International Version," online: http://ccinfoweb.ccohs.ca/help/msds/msdsINTGUIDE.html (Revised 1996).

[4] See U.S. Department of Energy, Secretary of Energy Advisory Board, Shale Gas Production Subcommittee, "90-day report" (18 Aug. 2011), pp. 23-24, and "Second Ninety Day Report" (18 Nov. 2011), pp. 5-6 [U.S. DoE SEAB reports]. Both reports can be retrieved from: http://www.shalegas.energy.gov/index.html.

[5] See IEHN Investor Guide, *supra* note 2, Goal 4 (Reduce and Disclose All Toxic Chemicals), para 4.

2. **Fracturing Fluid Additive Assessment and Management**

Key requirements under this Operating Practice include: identification of chemical ingredients in fracturing fluids using MSDSs provided by suppliers; assessment of potential health and environmental risks of each of these ingredients; development of "practices and controls" for specific ingredients to manage the "potential health and environmental risks identified by the risk assessment, as appropriate;" and development of risk management plans as part of well-specific fracturing fluids programs.

CAPP developed the above requirements to enable conformance with two Guiding Principles: to support the development of fracturing fluids with least environmental risk, and to advance best practices that reduce potential environmental risks of hydraulic fracturing. In SHARE's view, the requirements fail to truly operationalize these two principles, casting doubt on whether their implementation will put into action the two principles the Practice purports to develop, or actually reduce fracturing fluid-related risks.

First, the identification of chemical additives companies will assess is based on information contained in MSDSs, which as discussed above focus on occupational exposure and may not list all relevant potentially hazardous ingredients.[6] Second, even if companies identify specific ingredients that pose significant environmental or health risks, the term "controls" in the Operating Practice allows adoption of a wide range of measures to minimize identified risks, from elimination to simple process changes (e.g., changes in concentration).[7] This means companies could continue to use toxic ingredients even if viable, non-toxic or lower-toxicity alternatives exist. Third, while companies are required to adopt risk mitigation plans at each well, the Operating Practice fail to address the equally important issue of an overall, company-wide approach to fracturing fluid safety and risk mitigation. An overall policy could, for instance, provide for progressive reductions of toxic ingredients of fracturing fluids used across a company's unconventional gas operations, and/or a commitment to replace toxic ingredients with safer alternatives whenever possible.

In addition, none of the operational requirements refers to supporting the development of fluids with the least environmental risk, or to implementing best practices with regard to fracturing fluids, for instance by asking companies to set goals and timelines to use and/or progressively increase the use of existing lower-toxicity or non-toxic fracturing fluids across their unconventional gas operations.

The "performance measures" and "reporting expectations" under the Operating Practice are equally underwhelming, as they simply require certain processes associated with the CAPP Operating Practice requirements described above. Companies can demonstrate conformance with these requirements if: a) A "process" is in place to identify and assess chemical characteristics of fracturing fluid ingredients; and b) "practices and procedures" are in place to ensure that risk mitigation plans exist at each well. As for reporting, companies are expected to disclose "their process for developing well-specific risks management plans," rather than the content of the plans themselves, or at the very least a summary of key steps taken at each well to mitigate risk from fracturing fluids.

These measures suggest that investors and other stakeholders will learn whether or not companies have put in place plans for chemical identification and assessment and well-by-well risk mitigation plans, but will be

[6] In our conversations with companies on behalf of shareholder clients, we learned that even though companies have access to MSDSs from their fracturing fluid suppliers, they are not necessarily aware of the full list of chemical ingredients of fracturing fluids used in their wells.

[7] See Canadian Centre for Occupational Health and Safety, "Hazard Control", online: http://www.ccohs.ca/oshanswers/hsprograms/hazard_control.html; and U. Of Arizona, Risk Management Service, "Chemical Safety Information," http://risk.arizona.edu/healthandsafety/chemicalsafetyinfo/index.shtml.

unable to assess whether companies have taken appropriate steps to mitigate risks associated with fracturing fluids throughout their operations. These steps could include, for instance, comprehensive ingredient assessments, clearly defined controls for identified toxics, progressive reduction of toxic ingredients, adoption of targets and timetables to reduce the use of toxics in fracturing fluids, and periodic reporting of performance data. As for well-specific risk management plans, even if companies disclose their content –which would be quite cumbersome, given that most companies drill hundreds of wells every year– it will be very difficult for investors and other stakeholders to have a clear picture of company-wide strategies and practices to mitigate risks associated with fracturing fluids *across* unconventional gas operations.

In contrast to CAPP's specifications under this Operating Practice, the IEHN Investor Guide explicitly asks companies to "comprehensively disclose and virtually eliminate toxic chemicals used in fracturing operations" as a way to mitigate potential risks from fracturing fluids. It also identifies as best practices in this area, among others:

a) The setting of goals and/or timetables to lower toxicity of chemical ingredients of fracturing fluids using available toxicity scores,[8] and the disclosure of those targets and/or timetables, as well as reporting on progress in achieving those goals/targets; and

b) The continuous evaluation of chemical additive use to reduce toxicity, lower volumes or eliminate chemical use through substitution, and periodic reporting of specific chemicals eliminated and of total number and percentage of shale gas wells that used less toxic fluids for the reporting period.

3. Baseline Groundwater Testing

Two requirements under this Operational Practice deserve special attention. The first asks companies to design and carry out baseline (pre-drilling) groundwater testing programs under the direction of a groundwater professional. The second is a set of "domestic water well testing" specifications companies are expected to follow when conducting pre-drilling water tests. These specifications include:

a) Testing of domestic water wells within 250 meters of gas wellheads, or "as required by regulation," with landowner consent;

b) Analyses that enable comparisons with water quality standards and as a minimum test the water for "relevant" constituents identified in the Guidelines for Canadian Drinking Water Quality, and for "free" natural gas (i.e., dry gas, primarily methane);

c) A process to address stakeholder concerns with regard to changes in water well performance, which should include tracking of concerns and documentation of how concerns were addressed; and

d) Testing of "natural springs" within sampling programs, with landowner consent (and presumably also within 250 meters of gas wellheads).

If implemented across their unconventional gas extraction operations, the specifications described above could help mitigate water-related risks, including social license to operate risks and litigation risks. Successful risk mitigation, however, will depend on whether companies adequately address stakeholder concerns and conduct credible and rigorous pre-drilling water tests which either confirm that any post-drilling contamination found in the water is not connected to unconventional gas extraction, or serve to take prompt remedial action if a

[8] A hazard evaluation system applicable to the shale gas industry is described in detail in Andy Jordan et al., "Quantitative Ranking Measures Oil Field Chemicals Environmental Impact," Society of Petroleum Engineers (SEP), 2010. Retrieved from: http://public.bakerhughes.com/ShaleGas/collateral/Quantitative_Ranking_Measures_Oil%20Field_Chemicals_Environmental_Impact.pdf

plausible link between water contamination and shale gas extraction activities is established. Two issues that are not covered under the Operating Practice and would help to further mitigate risk are the use of independent laboratories to conduct all water tests, and a requirement to conduct post-drilling water tests to verify no contamination is taking place or take remedial action, as appropriate. These two measures would confer greater credibility to water tests and reassure landowners that shale gas extraction operations are safe, and that companies are carefully monitoring their water to take corrective actions if contamination is found which can possibly be attributed to shale gas production.

Companies can show conformance with the Operating Practice by "demonstrating that a process is in place to ensure a baseline groundwater testing program is conducted prior to drilling." The problem with this Performance Measure is that having a groundwater testing program in place does not necessarily mean that companies will routinely and consistently conduct pre-drilling water tests *across* their unconventional gas operations, i.e., in *all* wells. For that reason, the IEHN Investor Guide asks companies to "report on water quality testing practices across all shale plays, and exceptions to routine testing."[9] (emphasis added) In addition, it is unfortunate that, even though testing of "natural springs" is discussed in the Operating Practice, the Performance Measure makes no reference to surface water testing, which is also a concern given the potential for surface water contamination from the shale gas extraction process, for instance through spills or seepage of fracturing fluids or wastewater.[10]

The "reporting expectations" under the Operating Practice ask companies to share data collected from baseline groundwater tests with landowners who have the right to use the water "to the extent permitted by privacy legislation and with proper consent" (it is not specified whose consent is required). Since water-related concerns are one of the primary reasons why some landowners oppose shale gas development near their property, best practice would suggest companies should consistently provide water tests results to landowners upon request. In fact, there are examples of companies that use independent laboratories to conduct comprehensive water tests and have copies of test results sent directly to each landowner.[11]

[9] See IEHN Investor Guide, *supra* note 2, Goal 5: Protect Water Quality by Rigorous Monitoring.

[10] See, for instance, "Chesapeake Battles Out-of-Control Marcellus Gas Well," by Mike Lee, Bloomberg (20 Apr. 2011), online: http://www.bloomberg.com/news/2011-04-20/chesapeake-battles-out-of-control-gas-well-spill-in-pennsylvania.html; Frack Fluid Spill in Dimock Contaminates Stream, Killing Fish, by Abrahm Lustgarten, ProPublica (12 Sept. 2009), online: http://www.propublica.org/article/frack-fluid-spill-in-dimock-contaminates-stream-killing-fish-921; and " DEP Fines Atlas Resources for Drilling Wastewater Spill in Washington County," PA Department of Environmental Protection, Press Release (17 Aug. 2010), online: http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=13595&typeid=1.

[11] For instance, in Pennsylvania, Cabot Oil & Gas notifies landowners within 2,500 feet of a proposed well to offer to have the water in their property tested by an independent, state-accredited laboratory at the company's expense. A copy of water test results is sent to each landowner, and tests include water wells, springs, streams and any other water source identified by the landowner. See Cabot Oil and Gas Corp., "Steps Cabot Oil & Gas Corporation is taking to ensure that its operations protect Pennsylvania's water and air resources," online: http://www.cabotog.com/pdfs/WaterQAclean_final.pdf. Similarly, Penn Virginia Corp. reports: "In every state where we operate, we use a certified third party environmental laboratory to collect and analyze water samples from a radius of at least 2,500 feet around the well location so that we can determine if contaminants are present prior to our commencing any activities on the land. We typically share these water testing results with landowners." (Emphasis in original) See Penn Virginia Corporation, "Hydraulic Fracturing," online: http://www.pennvirginia.com/operations/Fracturing/default.aspx.

4. **Wellbore Construction and Quality Assurance**

Under this Operating Practice, companies are required to "meet or exceed" a number of technical requirements regarding the design, installation and quality assurance of the wellbore (drilled hole) to be hydraulically fractured. Key requirements including the following:

- Wellbore design must be conducted "using good engineering practice, in strict conformance with" applicable regulations and under supervision of a "competent individual;"
- Surface casing (i.e., the outer steel pipe that is placed in the drilled hole and acts as a protective barrier between freshwater sources and the wellbore) must be cemented to surface;
- The "final" casing string (the much longer, last metal pipe that is inserted into the wellbore and goes down to the area where the gas will be collected), must be centralized (to ensure cement will completely surround the pipe) and cemented into place, "creating a continuous cement barrier from the surface to the top of the target zone;" [12]
- Companies must verify the quality of these two cementing jobs by running an acoustic, geophysical test known as "cement evaluation logging" or "cement bond logging"[13] (CBL), but only if: the cement that was pumped into the surface casing does not come back all the way up to the surface; or the cement pumped into the final casing string drops below the next casing string. After assessing CBL test results, "appropriate action" must be taken to ensure the "adequacy" of the wellbore's integrity, "consistent with good engineering practice and regulatory requirements;"
- "Where possible," a pressure test should be conducted to confirm the integrity of the wellbore (pressure tests are run to make sure no fluid can escape through the protective casing and cement system during the hydraulic fracturing job). If the integrity of the well is compromised, "a remedial plan must be developed" (and presumably implemented) to restore wellbore integrity; and
- If surface vent casing flow (i.e., a flow of gas and/or liquid out of the surface casing) or gas migration is identified, "the flow must be managed in accordance with jurisdictional regulatory requirements."

The importance of these requirements cannot be overstated, since ensuring proper wellbore construction, including through best casing, cementing and well integrity verification practices, is absolutely essential to protect underground aquifers from potential contamination during unconventional gas extraction operations.

Casing strings serve to isolate fresh water zones and groundwater from the well and the different substances that will flow through it, including fracturing fluids, flowback fluids (a mix of fracturing fluids and saline water that is naturally present in the deep formation, which comes up to surface after the well has been hydraulically fractured), and hydrocarbons (gas, wet gas, etc.). The cementing of each casing, however, is what adds "the most value to the process of groundwater protection," since the proper sealing of annular spaces (the spaces between each casing and the borehole) with cement is what creates a barrier to gas and fluid migration. For

[12] It should be noted that companies sometimes use an "intermediate casing" string to minimize the hazards of subsurface formations that could affect the well, such as abnormal underground pressure zones. These may be cemented in place for added protection. See "Well Completion," Natural Gas.org (developed by the Natural Gas Supplier Association). Retrieved from: http://www.naturalgas.org/naturalgas/well_completion.asp). While the CAPP Operating Practice on wellbore construction does not require companies to use intermediate casing, the requirement that they create a "continuous cement barrier from the surface to the top of the target zone" suggests they would need to cement intermediate casing into place if they were to use it.

[13] By measuring the travel time of sound waves through the casing and cement to the formation, CBL tests show the quality of bonding between the casing and the cement. See Ground Water Protection Council and Interstate Oil and Gas Compact Commission, FracFocus Chemical Disclosure Registry [FracFocus Registry], "Well Construction and Groundwater Protection," online: http://fracfocus.org/hydraulic-fracturing-how-it-works/casing.

that reason, the quality of the cementing job, in particular of surface casing, which is the first protective barrier between the wellbore and groundwater aquifers, is critical to protect groundwater resources and mitigate risk of contamination.[14]

CAPP's requirements around full-length cementing of surface casing, additional cementing to ensure a "continuous cement barrier from the surface to the top of the target zone," and pressure tests constitute best practices that promise to mitigate risk of groundwater contamination. The requirement to run CBLs is also helpful, but the fact that CBLs are only prescribed when problems are evident means that companies may not routinely implement this key test across their unconventional gas operations to reduce to a minimum any risk of potential groundwater contamination.

Recognizing the role that both pressure and CBL tests play in minimizing the risk of accidental gas or fluid leaks from well sites into groundwater aquifers, the IEHN Investor Guide calls on companies to "pressure test wells prior to fracturing and routinely apply advanced acoustic-testing methods (cement evaluation logs) or their functional equivalent on cemented casing strings," and to disclose the "total number and percentage of wells where cement evaluation logs or equivalent tests were performed (by shale play or other reporting area). If the percentage reported is less than 100, companies should explain why the tests were not run in certain cases.[15]

In contrast to the specific operational and disclosure practices required under the IEHN Investor Guide, the CAPP guidelines ask companies to put in place "a process" to ensure that wellbore design and installation will result in the effective isolation of the producing zones from groundwater, and "appropriate" cementing practices and procedures to ensure wellbore integrity prior to hydraulic fracturing operations. The expectation around reporting is that companies will publicly disclose their wellbore construction and quality assurance practices. As with the Operating Practice discussed in section 2, these performance and reporting requirements suggest that investors will likely obtain general information about wellbore construction and well integrity verification practices, but have no access to the specific, play-by-play or region-by-region information that is necessary to assess whether companies are implementing a set of minimum practices across their unconventional gas operations to reduce water contamination risks to a minimum in all wells.

Another potential difficulty with the CAPP Operating Practice is that it relies significantly on regulatory compliance, on the assumption that "hydraulic fracturing processes are strictly regulated by various provincial government agencies."[16] This assumption may be unfounded, however, and several recent reports suggest that regulatory gaps still exist in virtually every Canadian Province where shale gas development is occurring at a commercial or exploratory level, including British Columbia, Quebec, Nova Scotia and New Brunswick.[17] Furthermore, because regulations vary across jurisdictions and may not always be sufficient to mitigate risk,

[14] See FracFocus Registry, *ibid.*
[15] See IEHN Investor Guide, *supra* note 2, "Goal 3: Assure Well Integrity – Achieve zero incidence for accidental leaks of hazardous gases and fluids from well sites," para 3.
[16] CAPP Hydraulic Fracturing Operating Practice: Wellbore Construction and Quality Assurance, "Technical Description," Background section.
[17] See, for instance, "Shale gas in B.C.: Risks to B.C. water's resources," by Karen Campbell and Matt Horne, The Pembina Institute (Sept. 2011); "Fracking rules often lag behind industry's growth," by Jacques Poitras, CBC News (2 Dec. 2011), online: http://www.cbc.ca/news/canada/new-brunswick/story/2011/12/01/nb-shale-gas-regulations-1237.html; "More study needed on Quebec shale-gas drilling: Commission," by Monique Beaudin, Financial Post (8 Mar. 2011), online: http://www.financialpost.com/More+study+needed+Quebec+shale+drilling+commission/4405218/story.html; "Anti-fracking forces gather in N.S.," by Steve Bruce et al., Herald News (15 Jan. 2012), online: http://thechronicleherald.ca/novascotia/52220-anti-fracking-forces-gather-ns; and "Gas industry anxious for fracking regulations," CBC News (1 Feb. 2012), online: http://www.cbc.ca/news/canada/new-brunswick/story/2012/02/01/nb-fracking-regulations-association.html.

investors have emphasized the importance of implementing best practices that go above and beyond applicable regulatory requirements.[18]

5. Water Sourcing, Measurement and Reuse

Under this Operating Practice, companies are required to "meet or exceed" a number of requirements when sourcing, measuring or reusing water. These requirements include the following:

- Evaluate potential sources of water for hydraulic fracturing, including flowback, produced water, saline and non-saline groundwater, wastewater and surface water, to "ensure sustainability" of the water resource while balancing social and economic considerations;
- Demonstrate the sustainability of surface and groundwater quantity by monitoring, "as required," saline groundwater, non-saline groundwater and surface water sources; and
- Collect measurement data for: water sourced, water injected and disposed of, and produced water/flowback generated.

To demonstrate conformance with this Operating Practice, companies must have in place:

a) A "decision-making framework" to ensure all water source options are "assessed and understood;"

b) A system for the collection of monitoring and measurement data related to water quantity and use; and

c) A process for the measurement and reporting of key water management metrics as identified in CAPP's Responsible Canadian Energy™ Program. The program collects data on key performance indicators (including water) from CAPP members and other sources, and publicly discloses these data in aggregated form to illustrate industry's overall performance.[19]

As for reporting, operators are expected to make their "water sourcing, measurement and reuse practices publicly available."

Overall, it is very difficult to predict whether implementation by companies of the requirements and measures described above will serve to mitigate risk with regard to water sourcing or lead to actual improvements in performance, since most requirements call for certain water-related processes and frameworks, without reference to what those frameworks should require or seek to achieve (e.g., progressive reductions of freshwater use, increased use of recycled flowback or treated wastewater, etc.). It is equally difficult to envisage what types of information will become available to investors and other stakeholders regarding companies' water sourcing, measurement and reuse practices, since reporting expectations refer to disclosure of "practices" without specifying the types of data to be disclosed, and CAPP's Responsible Canadian Energy™ Program does not provide company-by-company performance data. As a result, it is possible that operators will not provide relevant quantitative, play-by-play data on water use and sourcing practices, such as average volumes of water used to hydraulically fracture a single well in each of the shale gas plays/regions where they operate, and percentages of water used, by source, in each of those plays/regions.

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[18] See IEHN Investor Guide, *supra* note 2, p. 25.

[19] Current water KPIs under the Program include: freshwater withdrawal; freshwater as a percentage of total water withdrawal; freshwater withdrawal "per barrel of production"; percent water reuse (shale gas, tight gas and tight oil); and water quality. For details see CAPP, Responsible Canadian Energy, Responsible Canadian Energy, "Key Performance Indicators", online: http://www.rce2010.ca/about/key-performance-indicators/; and CAPP, "2010 Responsible Canadian Energy Data," online: http://rce2010.ca/assets/CAPP_AggregateDataGraph.pdf.

Because hydraulically fracturing a single shale gas well can use several million gallons of water and water availability and stresses vary significantly across gas plays/regions, these specific figures are crucial to properly assess risk and benchmark companies. The significance of the risks associated with water needs is discussed in a report by leading investor services provider MSCI, which predicts that "water availability will present material risks to operations for some companies, as the cumulative demand for increased drilling will compete with local needs; the seasonal timing of the water withdrawal and the location of available water will constrain production in some areas; and the regulations governing water withdrawals could drive up operational costs."[20]

The IEHN Investor Guide also acknowledges the significance of water use risks, and encourages companies to minimize potable water used in hydraulic fracturing operations by using non-potable water sources (e.g., saline aquifers, treated industrial waste waters, flowback water) to the fullest extent practicable, and to report water sourced for hydraulic fracturing on a jurisdictional (e.g., state, province) or watershed basis.[21]

6. Fluid Transport, Handling, Storage and Disposal

Under this Operating Practice, companies must meet or exceed a number of requirements when transporting, handling, storing and disposing of fracturing fluids, produced water, flowback and fracturing fluid waste, in order to mitigate risk of a surface release of any of these fluids. While most of the requirements listed call for regulatory compliance, the following two deserve special comment:

- Storage of fracturing fluids, produced water, flowback and fracturing fluid waste must follow "applicable storage regulations," and be stored in a manner that "restricts wildlife in the area from accessing" them; and
- Spent fracturing fluids, produced water, flowback and fracturing fluid waste must be "safely disposed of at approved management facilities, including disposal wells."

Although these and other requirements under the Operating Practice are set to "reduce the potential of the environment being impacted by a surface release of fracturing fluids, produced water, flowback or fracturing fluid waste,"[22] they are by and large redundant, since they ask companies to comply with applicable regulatory (mandatory) requirements. Just as important, the Practice implies that regulations, which often vary from jurisdiction to jurisdiction and thus offer different levels of protection,[23] are sufficient to mitigate risk and minimize environmental impacts, failing to require companies to adopt or move towards recognized best practices with regard to wastewater management, or to demonstrate continuous improvements in corporate performance in this critical area.

According to the U.S. Ground Water Protection Council (GWPC) and the Interstate Oil and Gas Compact Commission (IOGCC), the safe containment of fluids from shale gas extraction "is the most critical element in the prevention of contamination of shallow ground water," since the failure of a tank, pit liner or fluid carrying pipeline can result in an accidental release of contaminated materials directly into surface water or shallow

[20] MSCI ESG Research, "Shale Gas and Hydraulic Fracturing in the US: Opportunity or Underestimated Risk?," by Dana Sasarean et al., (Oct. 2011), p. 6, online: http://www.msci.com/resources/pdfs/Unconventional%20Oil%20%20Gas_Article_October%202011.pdf.
[21] See IEHN Investor Guide, *supra* note 2, Goal 6: Minimize Fresh Water Use.
[22] See CAPP Hydraulic Fracturing Operating Practice: Fluid Transport, Handling, Storage and Disposal, Background section.
[23] See Ground Water Protection Council (GWPC), "State Oil and Natural Gas Regulations Designed to Protect Water Resources" (May 2009), p. 28-29, online: http://www.gwpc.org/e-library/documents/general/State%20Oil%20and%20Gas%20Regulations%20Designed%20to%20Protect%20Water%20Resources.pdf.

groundwater. "Environmental clean-up of these accidentally released materials can be a costly and time consuming process. Therefore, prevention of releases is vitally important."[24]

After a well has been hydraulically fractured, companies must deal with large volumes of fluid that flow back to the surface. These "flowback" fluids are a mix of fracturing fluids that were injected into the well (only a portion of fracturing fluids comes back to surface), which can contain toxic chemicals, and naturally-occurring water that was stored in the formation and is released during the gas extraction process, known as "produced" water. Produced water is usually very salty and corrosive, and may be contaminated with naturally occurring radioactive materials and other toxins (e.g., benzene and toluene), so it can present significant additional risks to the environment and/or human health.[25] While flowback water comes up to surface within days/weeks of the fracturing treatment, lower volumes of produced water usually continue to flow through the life of the well.[26]

To store flowback water and other fluids, companies may rely on lined open pits, which are excavated holes in the ground, or above-ground containment systems such as steel tanks, which need to be maintained to prevent leakages. Tanks help prevent evaporation of fluids into the atmosphere, and can be surrounded by secondary containment dikes to hold any fluids that may escape from them, thereby offering another layer of protection. Companies can also use closed-loop fluid handling systems that avoid the use of pits and keep fluids within a series of pipes and tanks throughout the entire fluid storage process. Since fluids are never placed into contact with the ground, closed-loop systems minimize the likelihood of groundwater contamination and therefore further mitigate risk.[27]

Given that different storage methods present different degrees of risk,[28] the CAPP Operating Practice would have been much stronger if it had required companies to use steel tanks or closed-loop systems whenever possible, or to transition to these systems to mitigate risk of contamination. The IEHN Investor Guide follows this approach and asks companies to have in place "a policy of storing wastewater only in covered tanks," or a program for "transitioning from storing wastewater in lined pits (where allowed by state regulations) toward covered and appropriately vented tanks," so as to prevent contamination from wastewater. Accordingly, companies are expected to disclose the percentage of operations where tanks are used to store flowback water (by play/jurisdiction), and areas where pits are used for that purpose, with an explanation for reliance on pits. In addition, the IEHN Investor Guide asks companies to report on any violations or fines associated with wastewater storage, and to report quantitatively on progress if they are transitioning from pit to tank storage systems.

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[24] See FracFocus Registry, *supra* note 13, "Fracturing Fluid Management- Fluid Storage: 'Pits'," online: http://fracfocus.org/hydraulic-fracturing-how-it-works/drilling-risks-safeguards.

[25] According to an investigation conducted by the New York Times in 2011, flowback water with high radioactivity levels is sometimes hauled to sewage plants not designed to treat it, and then discharged into rivers that supply drinking water. See "Regulation Lax as Gas Wells' Tainted Water Hits Rivers," by Ian Urbina, The New York Times (26 Feb. 2011), online: http://www.nytimes.com/2011/02/27/us/27gas.html?_r=1&pagewanted=all.

[26] See Lisa Sumi, Earthworks, "Environmental Concerns and Regulatory Initiatives Related to Hydraulic Fracturing in Shale Gas Formations: Potential Implications for North American Gas Supply," a report prepared for the Council of Canadians (21 Sept. 2010), p. 7, online: http://canadians.org/energy/documents/fracking/report-fracturing-1010.pdf.

[27] See FracFocus Registry, *supra* note 13; "Fracking Under Pressure: The Environmental and Social Impacts and Risks of Shale Gas Development," by Dayna Linley, Sustainalytics (Aug. 2011), p. 15, online: http://www.sustainalytics.com/sites/default/files/unconventional-fossil-fuel-shalegas_final.pdf; and GWPC, "State Oil and Natural Gas Regulations Designed to Protect Water Resources," *supra* note 23, pp. 28-29.

[28] In the state of New York, a new bill has been proposed to prohibit the use of on-site reserve pits for flowback water, and require flowback water to be contained within steel tanks to decrease the risk of incidental releases into New York's water resources. See NY State Senate, "S6345-2011: Prohibits the on-site storage of flowback water," Sponsor: Sen. Krueger / Committee: Environmental Conservation Law: Amd. S23-0305 (In Senate Jan. 31, 2012). Retrieved from: http://open.nysenate.gov/legislation/bill/S6345-2011.

Companies can demonstrate conformance with the CAPP Operating Practice by having in place "practices and procedures" to: a) identify, evaluate and mitigate potential risks associated with fluid transport, handling, storage and disposal; and b) "respond quickly and effectively" to an accidental surface release of fluids, including remediation of the spill site. As for reporting, operators are expected to make their "fluid transport, handling, storage and disposal practices publicly available." Since the disclosure requirement does not go into specifics, it remains to be seen whether investors will obtain the detailed information they need to determine if companies are appropriately mitigating risk across their unconventional gas operations with respect to wastewater management, such as specific storage, treatment and final disposal methods used throughout their operations, or at each unconventional gas play/jurisdiction, if practices vary from play to play.

Another key issue that is not addressed in the CAPP Operating Practice is the testing of flowback and produced water to inform management decisions (e.g., to determine whether flowback and/or produced water can be treated for reuse in the hydraulic fracturing process or for other purposes) and ensure safe treatment/disposal.

In its two 2011 reports, the U.S. Department of Energy Subcommittee on shale gas tasked with identifying measures to help assure the safety of shale gas production in the United States emphasized the importance of adopting a life cycle approach to water management, based on "consistent measurement and public disclosure of the flow and composition of water at every stage of the shale gas production process," to protect water quality and mitigate risk. Specifically, the Subcommittee recommended that shale gas companies (and regulators) measure and publicly disclose the composition of water stocks and flow throughout the development process, including of flowback and produced water collected in water ponds and collection tanks, as a way to reduce the environmental footprint and water-related risks of shale gas production.[29]

In the same way, the IEHN Investor Guide calls for monitoring of the quantity of flowback water and the testing of this water so as to assess chemical composition hazards (e.g., radioactivity), inform recycling/reuse/disposal decisions, and assure compliance with applicable wastewater management standards.[30] While the issue of flowback measurement is addressed in the CAPP Operating Practice on "Water Sourcing, Measurement and Reuse" (see section 5 above), companies are not explicitly required to publicly report on flowback water volumes at each unconventional gas play or region where they have operations, while the Operating Practice on Fluid Transport, Handling, Storage and Disposal focuses solely on the issue of final disposal of fluids at an approved site or via underground injection.

Conclusion

CAPP's release of Hydraulic Fracturing Guiding Principles and Operating Practices marks a positive development in Canada's shale gas industry, since it evidences a commitment by CAPP member companies to implement practices that mitigate environmental and other potential risks associated with shale gas production, and to publicly report on their risk mitigation efforts. It is not evident, however, that implementation of most Practices will lead to actual improvements in performance, or generate the detailed disclosure of performance data that investors and other stakeholders need to assess whether companies are effectively mitigating risk <u>across</u> their unconventional gas operations, or implementing best practices in all key plays (or otherwise explain why different practices are followed in certain locations).[31]

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[29] See U.S. DoE SEAB reports, *supra* note 4, p. 22 (Aug. 2011 report) and 16 (Nov. 2011 report).

[30] See IEHN Investor Guide, *supra* note 2, Goal 7: Prevent Contamination from Waste Water.

[31] The IEHN Investor Guide recognizes that while some preferred practices can be universally implemented, others may not. Where "one size does not fit all," the Guide asks companies to explain variances to the preferred practice. This approach enables investors to better understand how companies mitigate risk across their unconventional gas operations. See IEHN Investor Guide, *supra* note 2, p. 5 (Executive Summary).

Some of the Operating Practices, in particular those associated with pre-drilling water testing and wellbore construction and integrity verification, promise to help mitigate environmental risks associated with unconventional gas extraction, provided that companies implement them consistently across their shale and tight gas operations. Other Practices, however, in particular those regarding water use, management of risks associated with fracturing fluids and management of wastewater (flowback and produced water), are not stringent or specific enough to reassure investors that their implementation will actually serve to mitigate risk, or bring about public disclosure of relevant, comparable and comprehensive information with which to measure performance and benchmark companies in order to make more sound investment decisions (e.g., invest in lower-risk companies, or engage with companies whose performance or risk management strategies and practices appear to be lagging behind their peers).

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