

Ottawa and provinces working to establish environmental safeguards for shale gas development

Canada holds large reserves of shale gas locked in shale deposits spread across Western Canada, the Arctic, southwestern Ontario, the St. Lawrence Basin and the Atlantic provinces. As energy companies rush to exploit these as yet largely untapped resources – and governments struggle to put the appropriate regulatory safeguards in place – a number of environmental cautions are being raised. Chief among these is the heavy demand for fresh water such extraction typically requires, coupled with worries about air and water pollution, elevated greenhouse gas emissions, and even increased seismic activity. This special issue of the Willms & Shier newsletter reviews the environmental repercussions of hydraulic fracturing or “fracking” – the technology generally used to liberate shale gas from rock formations – and summarizes the federal and provincial regulatory regimes.

What is shale gas?

Shale gas is natural gas that is trapped within very fine-grained sedimentary rocks. It was formed over millions of years, as layers of mud, silt, plant and animal debris were buried, compacted and solidified. Exposure to high temperatures and pressures on these materials formed shale and mudstone, while the organic material was transformed into oil and gas. The natural gas collects in the micro-pores and fissures in the rock bed and adsorbs to the organic material compacted in the shale.

The unconventional natural gas industry in the United States has adapted hydraulic fracturing technology for freeing and extracting the gas bound in shale stone formations. Boreholes are drilled hundreds or even thousands of metres down and then horizontally for up to 2,500 metres through the gas-containing rock formation to maximize the borehole surface area in contact with the shale. A fluid mixture (usually water, although in some cases, carbon dioxide, nitrogen or propane/butane) is then injected under pressures of up to 15,000 psi to widen existing fractures, and crack new fractures in the rock reservoir, and release the gas. A suspended proppant (usually sand or ceramic beads) is forced into the fractures, keeping them open and creating pathways through which the natural gas can be drawn back up the wellbore.

The composition of the fracking mixture depends on local geography and the structure and properties of the shale reservoir. Fracturing fluids generally comprise 90 percent water, 9.5 per cent sand or other proppants, and 0.5 per cent surfactants, bactericides, gelling agents and other chemical additives. The exact ingredients in a fracturing mix has been considered proprietary information, but the primary industry association has committed to making this information available (see sidebar, page 2).

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This special report is based on a speech prepared by John R. Willms, partner Willms & Shier Environmental Lawyers LLP, with students Luciella Longo and Anton Tabuns, and presented at the Air & Waste Management Association’s Shale Gas Workshop, October 19, 2011. The full text, together with the references, will be posted on the Willms & Shier website at www.willmsshier.com

For more information on the regulation of shale gas development and the required environmental controls, please call John at 416-862-4821 or drop him an e-mail at jwillms@willmsshier.com

Fracking raises environmental concerns

The extraction of shale gas is associated with a number of environmental impacts. Hydraulic fracking can require large amounts of fresh water – between 7 and 19 million litres for a single well – and some wells may have to be fracked a number of times to maintain gas flows. About 100 barrels (some 16,000 litres) of slurry are pumped down the borehole per minute, says Alex Stickler, director of oil and gas technologies for the engineering and consulting firm Hatch, and all this water must be purchased from municipal authorities or withdrawn from surface/groundwater sources, and piped or trucked to the well head. In some locations, such consumption may not be sustainable and/or can conflict with other uses. And between 50 and 250 truckloads of water a day can damage rural roads, annoy neighbours, and generate air and noise pollution.

In some locations, between 10 to 20 per cent of the fracking fluid flows back to the surface; in others, up to 60 percent flows back, says Hatch's Stickler. Unless this material is collected and contained, the additives in fracking mixture, together with dissolved solids, salts, metals and other compounds released from the fractured shale, may contaminate water sources. The majority of the flowback is recovered in a matter of a couple of hours to a couple of weeks, although produced water can continue for several months after gas production begins. These liquids must be collected and stored in on-site impoundments (either ponds or containers). It is then trucked away for treatment and disposal or reuse. The "bottleneck" in fracking is contaminated water storage says Stickler; as a result, the scheduling of back-to-back fracking of multiple wells may not be technically or economically feasible.

The fracturing process may also release significant amounts of methane, a potent greenhouse gas, to the atmosphere. Other volatile organic compounds can escape to the surface and pose a threat to local air quality. The emissions from process equipment, including drills, pumps, compressors and diesel generators can also be problematic. Drill and fracturing operations, which can take several months, generate noise, diesel exhaust and extensive truck traffic.

According to Ken Paulson, chief engineer with the BC Oil & Gas Commission, there are some environmental advantages to unconventional gas drilling and extraction. For example hydrogen sulphide (H₂S) levels are low or non-existent; the productive life of unconventional reserves is generally much longer (more than 20 years, as opposed to

CAPP releases "guiding principles"

On September 8, 2011, the Canadian Association of Petroleum Producers (CAPP) released a series of five "guiding principles for hydraulic fracturing" to guide water management and improve water and fluids reporting practices for shale gas development in Canada. In addition to complying with "all regulations governing hydraulic fracturing operations, water use and protection," Canada's shale gas and tight gas industry commits to the following:

- ◆ We will safeguard the quality and quantity of regional surface and groundwater resources, through sound wellbore construction practices, sourcing fresh water alternatives where appropriate, and recycling water for reuse as much as practical.
- ◆ We will measure and disclose water use with the goal of continuing to reduce our effect on the environment.
- ◆ We will support the development of fracturing fluid additives with the least environmental risks.
- ◆ We will support the disclosure of fracturing fluid additives.
- ◆ We will continue to advance, collaborate on and communicate technologies and best practices that reduce the potential environmental risks of hydraulic fracturing.

5-10 years for a conventional gas well). Because well location over a large reserve of unconventional gas is less important, up to six wells can be clumped on a single pad and access roads can be planned and built along environmentally favourable routes.

However, Matthew Bramley, director of research for the Pembina Institute, says that approximately 100 times as many well pads are required to produce a given amount of shale gas as would be needed for the same amount of conventional natural gas in the Mackenzie Delta. With a well pad and associated infrastructure required every square mile, hundreds or thousands of wells will have to be drilled and accidents will be "inevitable," Bramley says.

The Pembina Institute is also critical of the environmental oversight of shale gas development in much of Canada. Most oil and gas wells are explicitly exempted from provincial environmental assessment processes. In most cases, operators do not have to report on the chemicals they inject underground because these are not covered by the National Pollutant Release Inventory. As with conventional oil and gas extraction, permitting is usually

ECO questions whether the current regulatory regime is sufficient

“While the prospect of a new and plentiful domestic energy resource is appealing, the Environmental Commissioner of Ontario (ECO) notes that associated environmental damage could outweigh the energy benefits of increased natural gas supply. Any future development of Ontario’s shale gas resources must be undertaken with the public assurance that the cumulative effects of such development do not have unintended consequences. Given the close proximity of Ontario’s shale formations to groundwater supplies, such development must be cognizant of the reality that, once groundwater is contaminated, remediation may be prohibitively expensive. The ECO recommends that MNR and MOE review and publicly report on the sufficiency of the regulatory framework to protect water resources and the natural environment from shale gas extraction.”

◆ *Annual Report 2010/2011*
of the Environmental Commissioner of Ontario

administered by a natural resources ministry rather than the environmental ministry.

A recent study conducted by Duke University has confirmed that shale gas drilling has contaminated groundwater supplies in northeastern Pennsylvania and New York with flammable methane. Researchers suspect faulty borehole casings were responsible for the escaping methane. Although the specter of flammable tap water has been discussed anecdotally in the media, this is the first scientific study to confirm the phenomenon and connect it to shale gas extraction. The study, published in the *Proceedings of the National Academy of Sciences*, did not find evidence of contamination of groundwater supplies with fracturing fluids or brines.

In the United States, wastewater is being hauled to and treated at municipal sewage plants, which were not designed to remove many of the contaminants routinely found in it. These sewage plants then discharge the effluent into water bodies that supply drinking water. In June 2011, the US Environmental Protection Agency announced it was undertaking a study of the impact of hydraulic fracturing on drinking water quality in Pennsylvania, Texas, North Dakota, Colorado and Louisiana.

Due to criticism over wastewater disposal, a number of energy companies have started to reuse and recycle their wastewater. Unfortunately, some recycling methods leave behind salts or sludge residues that contain elevated concentrations of radioactive materials and other contaminants. This problem is compounded because some well operators have begun to sell this waste to municipalities for de-icing purposes in winter and dust suppression in summer. When ice melts or rain falls, the waste may run off roads and find its way into the drinking water supply.

Staking a claim in the Canadian shale gas rush

Canada’s reserves of shale gas have attracted the attention of the unconventional natural gas industry. The largest concentration of gas-containing shale lies within the Western Canada Sedimentary Basin (WCSB), extending from northeast British Columbia to southwest Manitoba. Other shale gas reserves are found in the Arctic and in eastern Canada, including southwestern Ontario, Quebec, New Brunswick and Nova Scotia. Although geological testing and mapping is incomplete, Canadian shale gas reserves are estimated at more than 1,100 trillion cubic feet (Tcf), with the majority found in the WCSB. According to the Quebec Oil and Gas Association, up to one-third of these reserves (128 to 343 Tcf) are believed to be marketable using current technology.

Other sources of unconventional natural gas are coal bed methane (where the host rock serves as both the source and the reservoir for the natural gas) and “tight” gas (where the natural gas has migrated into the micro-pores of the host rock). Conventional natural gas reserves are relatively modest when compared to unconventional supplies. They are also harder to find, but they are much easier (and cheaper) to develop, says Dan Cowan, senior market analyst with the Petroleum Resources Branch of Natural Resources Canada (NRCan).

Natural Gas Production in Canada, 2010			
Source	Estimated Reserves	2010 Production	% of Production
Conventional gas	692 Tcf	8.0 Bcf/d	57.5%
Coalbed methane	801 Tcf	0.8 Bcf/d	5.6%
Tight Gas	1,411 Tcf	4.9 Bcf/d	35.2%
Shale Gas	1,111 Tcf	0.2 Bcf/d	1.7%
Total	4,015 Tcf	13.9 Bcf/d	100%

US EPA to draft national standards for shale gas wastewater treatment

On October 20, 2011, the US Environmental Protection Agency (EPA) released a schedule for developing the first comprehensive set of national wastewater discharge standards for natural gas extraction from coalbed and shale formations. In making the announcement, the EPA noted shale gas production has grown to represent almost 15 per cent of total US natural gas production and this share is expected to triple in the coming decades.

While some of the sector's wastewater is currently being reused or re-injected, a significant amount still requires disposal. "As a result, some shale gas wastewater is transported to treatment plants, many of which are not properly equipped to treat this type of wastewater, says the announcement. "EPA will consider standards based on demonstrated, economically achievable technologies, for shale gas wastewater that must be met before going to a treatment facility."

According to the draft schedule, EPA will gather data, consult with industry and other stakeholders, and solicit public comment on a proposed rule for coalbed methane in 2013 and a proposed rule for shale gas in 2014.

According to the Canadian Society of Unconventional Gas (CSUG), "at current consumption rates, including exports to the United States, that's enough gas to supply our needs for the next 100 years or more."

Despite the growing interest in Canada's shale gas reserves, some analysts are predicting trouble ahead for the shale gas industry. Jeff Rubin, former Chief Economist at CIBC World Markets, has noted the abnormally steep depletion rates found with many shale gas reserves and the unprofitable economics of shale gas at current natural gas prices. Rubin asserts that, despite the boom, disappointing cash flows from shale gas are already causing some investors to move away from shale gas.

For the skeptics, the question is not whether the reserves are there, although the rapid depletion rates cited by Mr. Rubin may give some pause for concern, but whether the price of gas will ever rise high enough for it to be economical to extract all of the shale gas remaining in the reserves.

In contrast to the concerns raised by Rubin and others, Ontario Power Generation (OPG) sees shale gas as such

an attractive alternative that the gas may supplant biomass in the province's energy planning. The provincial government has repeatedly stated that Ontario's coal-generating stations will be shut down by 2015 and biomass proponents had hoped that their fuel would be used to fill at least part of the gap left by coal. However, a member of OPG's steering committee on biofuels has stated that the vast reserves of shale gas discovered in Western Canada are cheap enough that biomass cannot compete with it economically.

The regulatory framework to safeguard our water

The rush to stake a claim in the shale gas development across Canada by some of the biggest players in the natural gas industry has left federal and provincial regulators playing catch-up and produced a patchwork of regulations and policies to govern the industry.

Federal Government

The regulation of onshore oil and gas drilling and production falls primarily under provincial jurisdiction. The federal regulatory role is limited to onshore and offshore production in the territories, through the National Energy Board (NEB), and east coast offshore. The NEB also regulates interjurisdictional pipelines and energy trade, while Natural Resources Canada processes NEB decisions for Cabinet approval. In addition, the Geological Survey of Canada, a branch of NRCAN, plays a key role in natural resource characterization through its geo-science and geo-mapping programs.

Ottawa does, however, play a larger role in the protection of Canada's water resources. For example, the *Canadian Environmental Assessment Act* requires a comprehensive environmental assessment for any project on lands under direct federal jurisdiction (such as First Nations reserves) proposing to withdraw 200,000 cubic meters or more of groundwater per year.

The *Canadian Environmental Protection Act* vests responsibility with Environment Canada to ensure our environment is protected. Environment Minister Peter Kent has ordered his department to conduct an in-house study on the impact of hydraulic fracturing. He has also asked the not-for-profit Council of Canadian Academies to conduct an independent assessment "of the state of scientific knowledge on potential environmental impacts from the development of Canada's shale gas resources." The Council is awaiting a formal written request from the Minister before

undertaking the project, which is expected to last 12 to 18 months.

Officials from the Canadian Association of Petroleum Producers (CAPP) reacted positively to the news of the Environment Canada study and stated that they “welcome the opportunity to bring in some science-based knowledge because there has been a lot of unscientific comments and rhetoric out there ... Decisions should be made on the basis of science.”

British Columbia

An estimated 1,000 trillion cubic feet of unconventional gas may be found in the Horn River, Liard and Montney basins in northeastern BC. There are currently 731 producing wells in the Montney Basin and another 109 wells in Horn River Basin.

The industry is regulated under the province's *Oil and Gas Activities Act* and regulations, which cover consultation and notification, drilling and production, and environmental protection and management. Prior to fracturing, proponents must assess groundwater resources in the area, identify all wells within 200 metres of the proposed shallow fracturing operations and notify those well owners. To protect groundwater sources, non-toxic drilling fluids must be used until porous formations within 600 metres of the surface are isolated. Fracturing above 600 metres is subject to increased scrutiny and requires additional engineering support. Records of fluid composition are required, and recovered fluids must be stored on-site in dual containment and monitored pits until disposed of by deep well disposal.

To reduce greenhouse gas emissions, venting is only allowed by exception, and surface casing vents must be controlled and reported. There are also limits on flaring and noise, as well as air monitoring and notification requirements.

The use of surface waters is regulated through either short-term or long-term licenses. The BC Oil & Gas Commission (OGC), which regulates energy projects, is responsible for issuing the short-term water use approvals, while the provincial Ministry of the Environment issues the long-term licenses for surface waters. The short-term water use permits typically have conditions attached to them, such as ceasing water withdrawals when lake levels drop 0.10 meters, as well as daily and cumulative withdrawal limits. Companies involved in shale gas extraction also must keep

accurate records of all water withdrawals and provide this information to the OGC promptly upon request.

In British Columbia, industry is required to maintain a record of components used for hydraulic fracturing activities and, upon request, provide these details to the OGC.

On September 8, 2011, BC Premier Christy Clark announced that the government would establish an on-line, publically-accessible registry that would list the locations of hydraulic fracturing activities, as well as detailed information about the practices and additives used during these activities. The registry is scheduled to become operational in January 2012. In response, the Canadian Association of Petroleum Producers said the industry supported the initiative and will voluntarily disclose details about hydraulic fracturing additives in advance of the registry's official launch.

BC shale gas destined for Asian markets?

About 50 per cent of the current Canadian known reserves of shale gas lie within the Horn River and Montney basins. While among the most economical of shale gas plays to develop, they are also among the furthest from domestic markets. Ken Paulson, chief engineer with the BC Oil & Gas Commission, warns that reduced U.S. demand for Canadian natural gas will likely depress prices over the long term. New infrastructure, including large diameter gas pipelines and large scale liquefaction plants, would be required to move gas to the west coast for sale to Pacific Rim markets.

While provincial approval is still needed, such a scenario has already received the federal go-ahead. On October 13, 2011, the National Energy Board approved an application by KM LNG Operating General Partnership for a licence to export liquefied natural gas (LNG) from Kitimat, BC to markets in the Asia Pacific region. The export licence authorizes KM LNG to export 200 million tonnes of LNG (equivalent to 9,360 Bcf of natural gas) over a 20-year period. The gas will be sourced from producers in the Western Canada Sedimentary Basin and transferred through the Pacific Trail Pipeline, before being liquefied at a terminal to be built in Bish Cove, near the Port of Kitimat.

Alberta and Saskatchewan

Alberta is a potentially significant source of shale gas and is in the early stages of production. The same legislation, rules and policies required for conventional natural gas also apply to shale gas. The Energy Resources Conservation Board (ERCB) regulates the exploration, production, processing, transmission and distribution of natural gas. In addition, regulation of the production, handling and use of the water utilized in the process of extracting natural gas, oil, and bitumen is in the hands of the ERCB. Deep disposal wells are used to return any saline water that is produced during the gas extraction process and would require permission from the ERCB. In contrast, the *Water Act* governs non-saline water produced with gas, and Alberta Environment must authorize diversion or disposal of any non-saline water before wells are drilled. Adjacent property owners, who may be impacted by the development, must be informed of plans to handle the water before authorization by the Alberta Environment is granted.

Alberta Environment requires a permit to use surface water or potable groundwater supplies. Barry Robinson, a staff lawyer with Ecojustice in Calgary stated “companies are not required by Alberta Environment or the ERCB to disclose any chemicals or additives” that they may use in their fracking operations.

In Saskatchewan, the provincial government is providing financial incentives to attract shale gas development. The Saskatchewan Watershed Authority assigns rights to both surface water and groundwater supplies, except in cases where the water is a by-product of oil and gas extraction activities (such as water that flows back up to the surface during the drilling process). Approvals to construct and operate facilities that draw and use water are also the responsibility of the Watershed Authority. Shale gas is governed by the *Oil and Gas Conservation Act* and the Oil and Gas Conservation Regulations. The Saskatchewan Ministry of Energy and Resources provides exploratory permits to companies.

Quebec

In 2010, more than 400 exploration permits and leases were granted for shale gas in the Utica Shale region south of the St. Lawrence River between Montreal and Quebec City. However in the fall of 2010, the provincial government announced a moratorium on exploration and development of shale gas citing the “complex and fragile” nature of the environment and the dependency of coastal communities on tourism and commercial fishing.

In Quebec, the Ministry of Sustainable Development, Environment and Parks (MSDEP) issues water approvals, including permits for surface water and for groundwater. Any proposal to withdraw 75 cubic meters or more of water per day requires a permit. A MSDEP permit is also required to dispose of wastewater and to flare natural gas.

In March of 2012, the much-anticipated inquiry and public hearing report of the Commission of Inquiry into shale gas of the Bureau d’audiences publiques sur l’environnement (BAPE) was released. At that time, MSDEP Minister Pierre Arcand stated that “Shale gas operations should reinforce the security of the energy supply, make the resource available at a fair price and have a leverage effect on economic development.”

“Shale gas [in Alberta] is currently regulated under the same legislation, rules and policies as conventional natural gas. Although shale gas development in Alberta has not been using horizontal multi-stage fracturing, Alberta does have extensive experience with hydraulic fracturing. Approximately 167,000 wells have been hydraulically fractured in Alberta since the technology was introduced more than 50 years ago.”

“Most aspects of the oil and gas industry are regulated in Alberta by the Energy Resources Conservation Board ... Well bores are required to have cemented casings in place that meet stringent requirements and which are also set to depths far below any fresh water aquifers. This ensures there is an impenetrable barrier between the shale gas formation and the well bore so that gas and fluids are unable to use the well bore as a pathway to contaminate groundwater.”

“Alberta has strict requirements in place to manage the safe disposal of produced fluids (fluids that return to the well head as part of the hydraulic fracturing process) and does not allow produced fluids to be sent to municipal waste water treatment systems. Fluids that cannot be treated and recycled must be disposed of in approved disposal wells where the fluids are injected deep underground for permanent disposal. The ERCB has not documented any cases of groundwater being contaminated as a direct result of hydraulic fracturing.”

— from the Alberta Energy website at www.energy.alberta.ca/NaturalGas/944.asp

Among the initiatives listed in the Quebec 2011/2012 Budget were amendments to the current system of rights and licences. The aim of these amendments is to optimize the collective benefits from shale gas exploration and production by introducing a bidding process for exploration licences and by increasing the amount of work required in the territory covered by those licences.

The province also plans to review the overall exploration, drilling and operating rights and licences related to shale gas as part of future amendments to Quebec's oil and gas legislation and regulations. The "polluter pays" principle was considered central to the amendments. Quebec indicated that it intends to create a funding plan to which the industry will be required to contribute. This will ensure that municipalities are fully compensated for any real and quantifiable damages related to shale gas exploration or production in their territory. A lump sum compensation of C\$100,000 may be paid to a municipality over a period of ten years for each shale gas well operated in its territory. One commentator decries this amount of C\$10,000 per year per well as being woefully inadequate and a token gesture. These amendments indicate that Quebec aims to encourage shale gas development, but that sustainable development in the exploration and development of non-renewable resources will remain an important consideration in its decision-making.

In May of 2011, Minister Arcand tabled a number of draft regulations to tackle some of the issues raised by concerned citizens, municipalities, environmental groups and scientists. Amendments to the regulation respecting the application of the *Environmental Quality Act* (EQA) will require proponents to obtain a certificate of authorization under section 22 of the EQA before undertaking operations including drilling work and/or fracturing to explore for natural gas in shale. This regulation would also require public consultation about the proposed activity, and the submission of the report to the MSDEP with the application for a certificate of authorization. A second draft regulation respecting the filing of information on certain drilling and fracturing work on gas or petroleum wells will address certain aspects related to the implementation of the Strategic Environmental Assessment (SEA), allowing the Minister to collect more information on the impacts of the shale gas industry.

New Brunswick

The province's Department of the Environment (DOE) is responsible for assigning water rights. An Environmental

The duty to consult with First Nations

In northeastern BC, the Dene Tha' First Nation has filed a petition with the B.C. Supreme Court challenging the B.C. Ministry of Energy and Mines' decision to sell oil and gas tenures in the "Cordova Basin" in June of 2010. The reason for the lawsuit was explained by Dene Tha' Chief James Ahnassay:

"We are deeply concerned about the lack of adequate information necessary to understand the impacts of shale gas development to the environment and our rights, given that shale gas technologies are new to northeastern B.C., enormous volumes of water are required, serious contamination problems have arisen with shale gas development in the United States, and insufficient studies have been undertaken to identify and address impacts from shale gas technologies."

The Dene Tha' assert that prior to the Ministry of Energy decision to sell the parcels of land, the Dene Tha' was not consulted in a way that was meaningful or addressed their concerns.

Impact Assessment (EIA) is triggered under the province's Clean Environment Act for any proposed water usage of more than 50 cubic meters per day regardless of whether it is surface or groundwater. Under the EIA, the company proposing to make this water usage must undertake public consultation, summarize the public comments and demonstrate how it will address public concerns. Water is also regulated in New Brunswick through Approvals to Construct, that are required where water is pumped underground. These approvals would likely require the user of the water to disclose where they are accessing the water and what chemicals they are introducing into the water prior to the fracking procedure. An EIA would also be triggered in the province for any treatment of wastewater or water produced at any fracking operation.

In certain instances, companies wishing to get around some of the screening by the DOE can purchase water from an existing entity that has a licensed water supply, such as a municipality. This can result in provincial regulators getting skewed results in their analysis of the impacts of shale operations on water resources. This is precisely what has happened in British Columbia. In New Brunswick, Apache Canada has approached the community of Sussex to find out the cost of purchasing water from the municipality.

In 2011, New Brunswick announced forthcoming regulations to require the baseline testing of water prior to seismic exploration and drilling, and the comprehensive compensation of landowners in the event of water contamination. The province has also filed a notice of intent to require the full disclosure of fracking fluid additives.

Ontario

In 2009, the Ontario Geological Survey initiated a three-year geoscience study, including a collection of surface and buried rock samples, to assess the potential for shale gas extraction in the province. While almost all of southwestern and small portions of southeastern Ontario have bedrock formations similar to gas producing shale in Quebec and areas of the US, the Ministry of Natural Resources (MNR) says there is currently no indication that Ontario hosts economic reserves of shale gas. Although several oil and gas companies have leased the rights for shale gas exploration with private landowners, shale gas is not being extracted anywhere in the province and there are no proposals before MNR requesting shale gas drilling or extraction.

The *Oil, Gas and Salt Resources Act* provides MNR with authority over licences or permits relating to the establishment, operation and plugging of a well. When reviewing these permit applications, the MNR decides whether or not drilling may interfere with fresh water aquifers, and whether or not applications are rejected or approved with conditions. Ontario is particularly vulnerable to issues of water contamination since the province's shale formations are shallow and nearer to freshwater aquifers.

International developments

On June 30, 2011, France became the first country to pass a law banning the use of fracking as a technique for extracting natural gas and oil. The French parliament would have to vote for a new law to even allow research using the technique.

Moving in the opposite direction, China has set a production target of one trillion cubic feet per year from shale, tight-gas formations and coal-bed methane, amounting to almost 30% of the nation's 2010 consumption.

Chinese state-owned companies are also investing in North American shale gas, both for profit and to gain the expertise needed to develop their own shale gas resources. China and the U.S. have recently established a formal process, involving experts from industry, government and academia, to share expertise on shale gas development. China has also been active in Canada, with China National Petroleum Corp. negotiating a joint venture with Encana Corp. to develop properties in B.C.'s Montney and Horn River areas.

If any water was required for hydraulic fracturing, the operation would likely require Ministry of Environment (MOE) approval. A Permit to Take Water is also a requirement under the *Ontario Water Resources Act* (OWRA) requiring any person taking more than 50 cubic meters of water per day to obtain a permit from the MOE. The OWRA also regulates any discharges of wastewater. In addition, approvals issued under the *Environmental Protection Act* would apply to air emissions and the production of solid wastes from shale gas operations.

Willms & Shier Environmental Lawyers LLP

4 King Street West, Suite 900, Toronto, Ontario, M5H 1B6
Tel: 416 863 0711 / Fax: 416 863 1938 / Website: www.willmsshier.com

If you would like to receive Willms & Shier's Environmental Law Report, email your name, title and organization to jhardacre@willmsshier.com