The Unconventional Promise and Problems of Shale Gas Development in the US and China: A Comparative Study

VLS-China Partnership for Environmental Law

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Introduction

On March 23, 2011, China successfully opened its first shale gas well in the Sichuan basin to the fanfare of its Central government and the international oil and gas industry.[1] The Sichuan well is being lauded as a triumphant first step towards greater energy independence and cleaner air, as the country races to meet nationally-mandated gas use goals. Echoing the sentiment, Ming Sung of the American Clean Air Task Force stated "Shale gas is a game changer for the US and should do the same for China."[2] With its enormous estimated shale gas reserves, oil and gas industry executives portray China as a country on the verge of a shale gas revolution- just like the United States. In November 2009, China and the United States launched the US-China Shale Gas Initiative as part of the larger American Global Shale Gas Initiative.[3] The Initiative's stated goals are to assist China to achieve greater energy security and while meeting its environmental objectives by sharing technical expertise and regulatory capabilities through government-to-government policy engagement.[4]

Although America's shale gas revolution has doubtless exponentially increased American gas supplies, it has not been without its controversies. Shale gas production poses four unique environmental threats: (1) freshwater aquifers can be conaminated by fracturing fluids; (2) surface water is threatened by improperly-dipsosed of flowback; (3) the amounts of water required during the fracturing process can deplete local water supplies; and (4) the cumulative noise, traffic, and surface disruption of fracturing operations can create public

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[1] Jonathan Watts, *"China Takes Step Towards Tapping Shale Gas Potential with First Well,"* THE GUARDIAN, Apr. 21, 2011, http://www.guardian.co.uk/environment/2011/apr/21/china-shale-gas-well.
[2] *Id.*
[3] OFFICE OF THE PRESS SECRETARY, FACT SHEET: US-CHINA SHALE GAS RESOURCE INITIATIVE, THE WHITE HOUSE, (Nov. 17, 2009) http://www.chinafaqs.org/library/doe-fact-sheet-us-china-shale-gas-resources-inititiative.
[4] *Global Shale Gas Initiative*, U.S. DEPARTMENT OF STATE, http://www.state.gov/s/ciea/gsgi/index.htm (last visited, May 1, 2011).

nuisances in populated areas.[5] Although there are dozens of environmental issues, laws, and regulations in both countries associated with unconventional gas production, the most widely publicized are those pertaining to water pollution. As a result, the public and this study both focus on the threats fracturing poses to water supplies, and how they can best be mitigated.

Despite obvious differences, similarities between the two countries beckon, rather than ward off a comparative study. First, natural gas will play a vital role in the future of both countries, where skyrocketing energy demands have come face to face with environmental realities, namely pollution and greenhouse gas emissions. Second, as net energy importers, both countries are actively seeking greater energy security by aggressively developing domestic resources. Third, and most importantly, the two countries' regulatory frameworks are not altogether dissimilar, which allows obvious parallels to be drawn.

The United States' regulatory model can be succinctly described as follows: a system of overarching federal regulations supplemented and enforced through a widely-varied patchwork of state regulations tailored to unique local concerns. Similarly, China's regulatory framework consists of centrally mandated laws enforced at the local and regional level by local branches of the *central* government; as in the United States, the regularity and uniformity of local enforcement is widely varied according to prevailing local interests. An insurgence of transparency initiatives in both countries is playing a central role in the implementation of new regulations and better enforcement of those currently in place.

This study addresses shale gas regulation in both countries through a multi-step process. First, natural gas' importance as a global energy source first examined in light of global, American and Chinese markets. Next, the study examines unconventional gas' place in

[5] STEPHEN R. CONNORS ET AL., THE FUTURE OF NATURAL GAS 15 (2010) *available at*, http://web.mit.edu/mitei/research/studies/naturalgas.html.

those markets. To do so, it examines shale gas' potential in the form of global and national reserves as well as its dangers, by explaining its production. Third, the United State's regulatory structure is compared with its Chinese counterpart, as well as the methods in which those regulations are enforced. Fourth, the study examines the vital role open access to information plays in effectively enforcing water pollution regulations, and explains its relevance to shale gas. Finally, the study closes with suggestions on how China could best protect its water supplies while developing its shale gas reserves.

Natural Gas and Global Energy

As the global community attempts to mitigate CO2 emissions, natural gas will play a major role in global energy supplies. Three factors make gas a particularly appealing choice in the short to medium term: cleanliness, efficiency, and supply.[6] Known as the cleanest fossil fuel, natural gas burns much cleaner and emits fewer GHG emissions than either petroleum or coal.[7] Second, gas generally doesn't need to be refined in the manner that oil does, which lowers its total transaction costs.[8] Third, while there is no universal agreement on the total amount of global natural gas reserves, there is consensus that existing, economically recoverable reserves are substantial. A 2010 MIT study concluded that there are currently proven global reserves of 16,200 trillion cubic feet (Tcf) of economically recoverable natural gas reserves worldwide, which translates to 150 times the entire amount of gas consumed globally in 2009.[9] Of those global reserves, only 11 percent have been developed.[10] For perspective, the United States alone

[6] *Id.* at xi.
[7] U.S. ENERGY INFO. ADMIN., INTERNATIONAL ENERGY OUTLOOK 2010 x (2010), http://www.eia.doe.gov/oiaf/ieo/nat_gas.html.
[8] Connors, *supra* note 4, at 1.
[9] *Id.* at 15.
[10] *Id.* at 7.

is estimated to possess roughly 2,100 Tcf of recoverable gas, which is "92 times the annual amount of gas consumed nationally in 2009."[11] New technologies and rising energy prices have further opened the development potential of vast, previously unrecoverable natural gas reserves.

The Unconventional Potential of Unconventional Gas

Unconventional gas is expected to play a large role in meeting future demand.[12] There are three major types of unconventional gas: tight gas, coalbed methane, and shale gas.[13] Whereas conventional gas is found in easily recoverable permeable, porous formations, unconventional gas is characterized by dense, low permeability formations.[14] A 2011 partial global study produced for the U. S. Energy Information Administration (EIA) concluded there is an estimated 25,300 Tcf of economically recoverable *shale gas* in 32 countries; significantly, the study excluded Russia and the Middle East, which are home to the world's largest conventional gas supplies.[15] The EIA estimates shale gas will represent 7% of global gas supplies by 2030.[16] Increased production in the United States alone has resulted in a global gas "glut" that has lowered international prices. Based on the American experience and tentative estimates of economically recoverable shale reserves across the globe, the sheer volume of natural gas could ostensibly create a viable alternative to the current "cheaper" fossil fuel standards, coal and oil. As the current global leader in unconventional gas development, the United States is an ideal case study on large-scale shale gas development.

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[11] *Id*. at 9.
[12] Jacqueline Lang Weaver, *The Future of the Petroleum Industry in a World of Global Warming, in* THE GLOBAL WARMING READER 457 (William H. Rodgers, Jr. & M. Robinson-Dorn ed., Carolina Academic Press 2009)
[13] GROUNDWATER PROTECTION COUNCIL & ALL CONSULTING, U.S. DEPT. OF ENERGY, MODERN SHALE GAS DEVELOPMENT IN THE UNITED STATES: A PRIMER 14 (Apr. 2009).
[14] Weaver, *supra* note 10.
[15] U.S. ENERGY INFO. ADMIN., WORLD SHALE GAS RESOURCES: AN INITIAL ASSESSMENT OF 14 REGIONS OUTSIDE THE UNITED STATES 6 (Apr. 2011), http://www.eia.gov/analysis/studies/worldshalegas/ [hereinafter EIA Initial Assessment].
[16] *Id*.

The North American natural gas market could be viewed as a mircrocosm of worldwide unconventional gas production. In the United States, conventional oil and gas production peaked in 1971 and 1973. Advents in hydraulic fracturing and horizontal drilling were largely responsible for revitalizing domestic production, which boosted reserves by "over 50 percent in the past decade.[17] Accordingly, shale gas currently accounts for 10 percent of America's domestic gas production.[18] The EIA predicts that shale gas will account for 26 percent of American supplies by 2035.[19] The surge in gas availability has already displaced coal in some parts of the US as the cheapest electrical base fuel.[20]

Natural Gas in China

The Chinese Central Government sees natural gas as a crucial factor in meeting the country's future energy and environmental goals. China is currently both the world's largest producer and consumer of coal,[21] which accounts for between 68-70 percent of its energy supply. The coal industry is directly responsible for thousands of deaths each year in mining accidents, and untold environmental damage. Acid mine drainage, methane and dust emissions, and coal waste wreak havoc on the China's water supplies.[22] It's contributions to air pollution are worse. Burning coal emits vast amounts of sulfur dioxide into the atmosphere, resulting in localized acid rain.[23] Furthermore, the fine particulate matter that lingers in the air and largely contributes the overwhelming smog in China's cities is annually responsible for untold cases of heart and

[17] *Id.* at 41–42.
[18] *Global Shale Gas Initiative*, *supra* note 3.
[19] EIA Initial Assessment, *supra* note 13, at 42.
[20] Yangmin Cite
[21] NRDC, *China Facts: NRDC Strives to Minimize the Toll from Coal in China*, Apr. 2007.
[22] *Id.*
[23] *Id.*

respiratory diseases.[24] Additionally, the amount of CO2 emitted from coal-fired power plants has helped China overtake the United States as the world's leading source of greenhouse gases.[25] The Central government is well aware of the problem, and has announced the goal of lowering its carbon intensity "by 40 to 45 percent of 2005 levels by 2020."[26] In order to do so, the country has embarked on a number of programs to reduce its reliance on coal by setting increased energy efficiency goals and encouraging a shift to alternative energy supplies, especially natural gas.[27]

The Central government is embracing the "cleanest" fossil fuel and its promises of increasing energy security, reducing greenhouse gas emissions, and improving domestic air quality while simultaneously enabling the country to continue its explosive economic growth.[28] The National Development and Reform Commission (NDRC), which is responsible for planning and implementing national social and economic development, has stated that it intends to double current gas use (currently accounting for 4% of total energy consumption) over the next five years as part of its 12th Five-Year Plan.[29] Chart ___ displays the annual growth natural gas has played in the country's overall energy supply.

Natural Gas Use in Total Chinese Energy Supplies[30]

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
percentage	2.4	2.6	2.6	2.6	2.6	2.8	3	3.5	3.77	3.9

[24] *Id.*
[25] *Id.*
[26] Craig Hart and Hengwei Liu. Advancing Carbon Capture and Sequestration in China: A Global Learning Laboratory. Woodrow Wilson Center Volume 11. 99.
[27] *Id.*
[28] Rigzone Staff, *Shale Gas to Help Meet Chinese Future Supply Demand*, RIGZONE, Aug. 3, 2010, http://www.rigzone.com/news/article.asp?a_id=96919.
[29] Nobuyuki Higashi, *Natural Gas in China: Market Evolution and Strategy*, INT'L ENERGY AGENCY WORKING PAPER SERIES, June 2009, at 9.
[30] National Bureau of Statistics

China relies on both foreign and domestic suppliers to meet its gas supply goals. Internationally, China's three state-owned energy companies (CNOOC, Sinopec, and CNPC) are actively securing foreign sources of gas through long-term supply contracts and purchasing foreign energy companies and their assets.[31] Foreign gas enters the Chinese market through international pipelines and a growing number of liquefied natural gas (LNG) terminals along China's southern coastline.[32] Although China is ideally situated next to countries holding the world's largest reserves of natural gas (Russia, Kazakhstan, and Turkmenistan), only two transnational pipelines currently import gas into the country, both of which originate in Central Asia. Another major gas pipeline, the East-West pipeline, is currently under construction, but these three sources are not sufficient to meet the country's growing energy needs. Since the late 1990s, the country has been building LNG terminals to handle growing amounts of imported gas along the coast.[33] Despite the spate of long-term gas contracts with foreign countries, there are inherent risks involved in relying on foreign imports as the 2007 Global Economic Crisis explicitly illustrated. The worldwide energy market is disconcertingly vulnerable to any number of exogenous shocks that can cause energy prices to wildly fluctuate. Natural disasters, armed conflicts, and the threat of geo-political disputes and unilateral embargos (i.e. OPEC) can hamper supplies and make fossil fuels prohibitively expensive or altogether inaccessible. The central government has accordingly placed a high priority on developing its domestic resources, with a priority on unconventional natural gas.[34]

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[31] Ariana Eunjung Cha, *China Gaining Key Assets in Spate of Purchases*, WASH. POST, Mar. 17, 2009, http://www.washingtonpost.com/wp-dyn/content/article/2009/03/16/AR2009031603293.html.
[32] GEORGE MARCUS ET AL., CHINA AND LONG-TERM ENERGY SECURITY: AN ANALYSIS OF THE POLITICAL, ECONOMIC AND TECHNICAL FACTORS SHAPING ASIAN ENERGY MARKETS, BAKER INSTITUTE CHINA STUDY 12 (Apr. 1999), *available at* http://www.bakerinstitute.org/publications/social-cultural-and-religious-factors-influencing-chinas-energy-supply/view?searchterm=oil.
[33] Higashi, *supra* note 23, at 18.
[34] *Id.*

China has substantial domestic gas resources. According to various estimates, the country is home to between 3.7 and 5 trillion cubic meters of techincally and economically recoverable conventional gas reserves.[35] The CNPC's 2007 China National Petroleum Assessment further estimated 11 trillion cubic meters of recoverable coalbed methane, the only unconventional gas currently being produced.[36] In September of 2010, for example, state petroleum compnay CNPC reported that it was producing 1.1 million cubic meters of coalbed methane for the East-West Pipeline.[37] However, the most significant potential for boosting domestic supplies lies with shale gas, of which the country has estimated recoverable reserves from 26 and 30 trillion cubic meters (Tcf), which is over ten times current conventional reserves.[38] The EIA's 2010 Reference Case predicts that unconventional gas will account for 56 percent of total domestic production by 2035.[39] According to Zhou Dadi, deputy director of the National Energy Expert Advisory Committee and Vice Chairman of China Energy Research Society, domestic natural gas production (including coalbed methane, shale gas, and tight sands gas) in 2030 could reach 300 billion cubic meters. Combined with imports, the predicted recoverable 4,000-5,000 cubic meters could account for up to 10 percent of China's primary energy supply per annum.

Two deeply interwoven obstacles hamper full-fedged development of the countries' unconventional gas reserves. First, China has no integrated national gas grid, and

[35] *Id.* at 6.
[36] Jie Zhu, *China Assesses Conventional Resources in 115 Basins*, OIL & GAS J. (Apr. 19, 2010).
[37] Press Release, *PetroChina Injects 1.1 Million Cubic Meters of Coalbed Methane in Qinshui*, UNCONVENTIONAL GAS CTR, (Sept. 7, 2010), http://www.ugcenter.com/Coalbed/International/News/item67290.php.
[38] *China's Shale Gas 12 Times Conventional Reserves*, GAS INVESTING NEWS, Apr. 6, 2011, http://gasinvestingnews.com/2364-chinas-shale-gas-12-times-conventional-gas-reserves.html.
[39] U.S. ENERGY INFO. ADMIN., *supra* note 7, at 42.

integrating the highly-fragemented domestic market is prohibitively expensive.[40] Natural gas' physical properties require it to be transported by pipeline. Like the United States several decades ago, the Chinese natural gas market is largely localized due to transportation constraints. While the United States has spent much of the past hundred years developing a national infrastructure of transport pipelines, China's infrastructure was built to transport its most abundant fuel: coal. According to the MIT study *The Future of Coal*, "forty-five percent of China's national railway capacity is devoted to the transport of coal."[41] China seeks to remedy this problem by inviting foreign investment to help facilitate the production of its unconventional gas resources as well as its requisite infrastructure.[42] The second problem is directly related to the first- natural gas is more expensive than coal in China.[43] Domestic gas production grew at an annual rate of roughly 15 percent between 2000 and 2007. Geologic factors such as deeper wells and high pressure, loose sandstone, volcanic pools and high sulfur content near or within those wells has made conventional gas development increasingly difficult and expensive.[44] The country's national petroleum companies initially faced a formidable technological learning curve in acquiring the most cost effective methods to efficiently develop the country's unconventional gas reserves.[45] However, by intensively courting both foreign investment firms and international oil companies for capital investment and technology transfers, the national oil companies "can do it by ourselves," and expect to reach exploration and

[40] George Marcus et al., *supra* note 32, at 14.
[41] Connors *supra* note 4, at 63.
[42] INFO. OFFICE OF THE STATE COUNCIL OF THE P.R.C., NDRC: CHINA'S ENERGY CONDITIONS AND POLICIES 39 (Dec. 2007), http://www.china.org.cn/english/whitepaper/energy/237089.htm.
[43] Higashi *supra* note 23, at 4.
[44] *Id.* at 16.
[45] *Asia Assesses its Shale Potential*, PETROLEUM ECONOMIST (May 2010).

development goals "ahead of schedule."[46] In order to speed development, the NDRC announced its plan to "select between 50 to 80 potential shale gas areas, and 20 to 30 exploration areas by 2020."[47] Similar sentiment in the United States caused production to quickly outpace regulation, which was a development opponents of shale development consider disastrous.

The Unconventional Problems of Unconventional Gas

In the United States, a growing debate has focused on whether shale gas production is worth its inherent environmental risks, and if so, whether increased federal regulation could mitigate them. The controversy surrounding unconventional gas stems from the manner in which it is produced- hydraulic fracturing. A heavily criticized 2004 EPA report found that hydraulic fracturing posed "little to no threat" of contaminating drinking water.[48] However, discharges from hydraulic fracturing have allegedly contaminated water supplies in at least 5 states, which include Virginia, Alabama, Wyoming, Montana, and Colorado.[49] The NRDC recently posted a long list of water contamination incidents purportedly caused by hydraulic fracturing, arguing that the lack of effective federal regulation exacerbates its problems.[50] Complaints include: changes in water pressure, contaminated drinking water, and serious health symptoms, such as respiratory and neurological diseases.[51] Conversely, a lengthy, bi-state comparision prepared by the Ground Water Protection Council comparing every single groundwater contamination incident attributed to the oil and gas

[46] Watts, *supra* note 1.
[47] *China to Speed Up Shale Gas Development: Official,* XINHUA NEWS AGENCY (Mar. 24, 2011), http://news.xinhuanet.com/english2010/china/2011-03/24/c_13796707.htm.
[48] Hannah Wiseman, *Untested Waters: The Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation*, 20 FORDHAM ENVTL. LAW REV. 115. (2009)
[49] Angela C. Cupas, Note, *The Not-So-Safe Drinking Water Act: Why We Must Regulate Hydraulic Fracturing at the Federal Level*, 33 WM. & MARY ENVTL. L. & POL'Y REV. 605. (2009).
[50] Amy Mall, *Incidents Where Hydraulic Fracturing is a Suspected Cause of Drinking Water Contamination*, (Mar. 7, 2011), http://switchboard.nrdc.org/blogs/amall/incidents_where_hydraulic_frac.html.
[51] *Id*.

industry as a whole found that not one single incident of groundwater contamination could be attributed to properly conducted hydraulic fracturing.[52] Explaining the process of hydraulic fracturing puts the controversy in context.

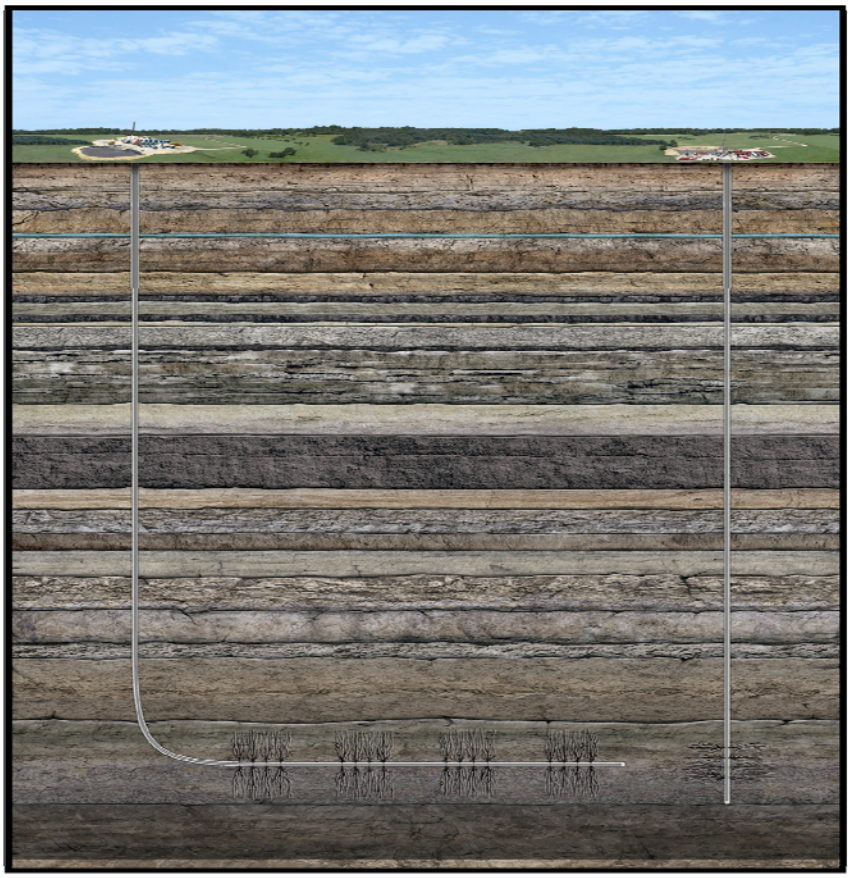
Hydraulic fracturing has been used since the 1940s in conventional gas production, but was not used until the 1990s to produce shale gas.[53] Like other unconventional gases, shale gas is found deep in the ground in large, low permeable, low-pressure rock formations known as shale "plays." A shale "play" must to be "stimulated" in multiple-phase operations to produce commercial gas flow rates and maximum recovery of gas.[54] Historically, shale gas was not developed because of the exorbitant cost and surface damage that resulted from drilling multiple vertical wells to completely drain a play. The advent of horizontal drilling though, now allows wells to be drilled first vertically, then horizontally in order to fully exploit a gas formation without causing the large-scale surface damage that accompanies conventional drilling.[55]

Hydraulic fracturing is a method of well stimulation that "create[s] additional permeability" by injecting millions of gallons of fluid into low pressure gas formations.[56] The pressurized liquid fractures the rock, which allows the gas to escape into the well bore through the newly-created fissures. In order to ensure that the fractured rock stays open, "propping agents" such as sand and/or ceramic beads are pumped into the new fissures.[57] Once the formations have been

[52] Scott Kell, *Combined Texas and Ohio Draft*, (Groundwater Protection Council, Working Paper, forthcoming 2011).
[53] GROUNDWATER PROTECTION COUNCIL AND ALL CONSULTING, *supra* note 13, at 46.
[54] Stephen A. Holditch, *Topic Paper #29: Unconventional Gas*, *in* GLOBAL OIL AND GAS STUDY, NAT'L PETROLEUM COUNSEL 4 (July 18, 2007).
[55] GROUNDWATER PROTECTION AGENCY AND ALL CONSULTING, *supra* note 13, at 9.
[56] *Id.* at 56.
[57] Envt'l Protection Agency, *Hydraulic Fracturing*, http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/index.cfm (last updated May 11, 2011).

fractured and wedged open, more fluid is pumped into the well to deepen the fracture and maintain the requisite pressure at the end of the well.[58]

Contrasting Horizontal and Vertical Drilling



Source: John Perez, Copyright ©, 2008 [59]

Fracturing fluid poses two primary environmental concerns. First, hydraulic fracturing is extremely water-intensive: water can make up to 99 percent of fracturing liquids, which in turn can require between 2 and 5 million gallons of fluid for a single shale gas well.[60] Fracturing often has debilitating effects on local aquifer levels, as local sources often supply the water. Second, there is no standard formula for making fracturing fluid. This has led to the inclusion of

[58] GROUND WATER PROTECTION COUNCIL AND ALL CONSULTING, *supra* note 13, at 56.
[59] *Id* at 46.
[60] *Id.*

a wide array of chemicals to improve the fluid's viscosity, inhibit corrosion in the well bore, and to limit bacterial growth in the well.[61] Typical fracking fluidly consists of about 95 percent water and sand, but it is not uncommon for the remaining portion to contain benzene, toluene, ethybenzene, and xylenes, each of which are hazardous substances.[62] Additionally, all fracturing fluid contains varying concentrations of hydrochloric acid, which helps the fluid dissolve and break apart the shale formation.[63] The introduction of such hazardous substances into the ground inherently threatens soil and plant life; that threat is magnified when a well is drilled near groundwater sources or residential areas.

To keep fracturing fluid from leaking into unintended areas (including groundwater), the well bores are encased in multiple layers of steel and cement to guard against leaks, the width of which thins the deeper the well digs into the ground.[64] Because of the difference in regional geological formations where shale gas is found, there is no standard size or strength for well casings. The dense shale formations themselves ostensibly offer another barrier protecting the surrounding soils, rocks, and aquifers from fracturing fluid contamination.[65]

The vast amounts of the water that has been forced into the wells eventually reaches an end point, and then begin to flow back to the surface through the well bore.[66] The returning fluid is called "flowback," or "produced water." Flowback is a mixture of fracturing fluid, soil particulates that broken apart upon injection and naturally occurring water that is often highly saline, or may contain naturally occurring radioactive materials (NORMs).[67] The introduction of even small amounts of flowback can substantially contaminate water supplies, and although

[61] John Manual, *EPA Tackles Fracking,* 118 ENVTL. HEALTH PERSPECTIVES 5, A199 (May 2010).
[62] Christina L. Madden, *Shale Gas Goes Global*, POLICY INNOVATIONS CARNEGIE COUNCIL (Sept. 2010). http://www.policyinnovations.org/ideas/briefings/data/000186/:pf_printable.
[63] GROUNDWATER PROTECTION COUNCIL AND ALL CONSULTING *supra* note 13, at 63.
[64] *Id*. at 52.
[65] *Id*.
[66] *Id.*
[67] *Id.*

small amounts of fracturing fluid remain trapped underground, recaptured flowback must be properly disposed of. The most common disposal method is to re-inject it back into the earth.[68] The second most common method is to store flow-back in open-air "evaporation pits," which are open-air pools of polluted drilling water and fluid.[69] A third and growing increasingly popular method of disposal is to recycle the flowback when possible, so that it may be used again to frack new wells.[70]

While there are currently no conclusive studies linking hydraulic fracturing to groundwater pollution, there have been a plethora of accidents and complaints from people living near shale gas production fields in the United States. Following the release of a film that concluded fracking fluid was polluting local drinking water supplies, the oil industry issued a statement that blamed groundwater pollution on improper drilling practices, not the fracturing process itself.[71] Ergo, the oil industry and currently available research suggest faithful compliance to established practices would prevent fracking fluid contamination of the surrounding environment during drilling.

[68] *Id.* at 67.
[69] *Id.* at 55.
[70] *Id.*
[71] *Debunking Gasland*, ENERGY IN DEPTH, (June 9, 2010) http://www.energyindepth.org/2010/06/debunking-gasland/.

Deceptively Similar: Chinese and American Regulations and Enforcement

The Chinese and American energy regulatory systems are both "politically complex, fractured, and unwieldy." [72] Despite obvious differences, the similarities are such that China could indeed benefit from the American shale gas experience. Both countries have overarching federal (or in China's case, "Central") laws enforced by their corresponding agencies. Furthermore, China and the United States both exhibit a significant disjunction between the formulation and implementation of federal/central and their enforcement at the local level. Local realities weigh heavily on how standards are enforced in both countries. In the case of unconventional gas production, differences in geological formations require experimentation to determine the most economically viable and safe drilling practices.[73] China and the United States currently have sufficient regulations in place to safely regulate shale gas production. An examination of existing federal/central laws illustrates the similarities between existing regulations, while highlighting their differences. Their enforcement is subsequently addressed to illustrate their true practical effectiveness, and how they may be improved.

Current American Laws

In the United States, the federal government and the individual states regulate unconventional gas production through "cooperative federalism."[74] Oil and gas regulation is similar to many other federal pollution regulations, in that the states themselves are primarily responsible for enforcing minimum federal standards.[75] Thus, while the individual states are

[72] MIT, THE FUTURE OF COAL 69 (2007) *available at* http://web.mit.edu/coal/.
[73] Kate Mackenzie , *Terry Engelder on Shale Gas: the Good, the Bad and the Decline Curves*, FIN. TIMES, July 12, 2010, http://ft.com/energysource.
[74] Angela C. Cupras, *supra* note 49, at 5.
[75] Judith V. Royster, *Environmental Federalism and the Third Sovereign: Limits on State Authority to Regulate Water Quality in Indian Country*, 105 WATER RES. UPDATE 17 (1996) *available at* http://www.utulsa.edu/academics/colleges/college-of-

primarily responsible for oil and gas development through their own regulatory bodies, they are subject to oversight by the Environmental Protection Agency (EPA).[76] Other relevant federal authorities regulate oil and gas drilling in unique settings; the Bureau of Land Management (part of the Department of the Interior) and the U.S. Forest Service (Department of Agriculture), for example, are responsible for regulating mineral development on federally-owned land.[77] Additional setting-specific agencies include, but are not limited to, the Department of the Interior's U.S. Geological Survey (USGS), the Bureau of Ocean Energy Management Regulation and Enforcement (BOEMRE), and the Department of Energy's office of Fossil Energy (DOE/FE).[78] The other pertinent Federal Regulations that fall under EPA jurisdiction include the Clean Air Act; the Resource Conservation and Recovery Act (RCRA), the Clean Water Act; the Comprehensive Environmental Response, Compensation, and Liability Act; the Toxic Substances Control Act; and the National Environmental Policy Act.[79] The cornucopia of laws, regulations, and enforcement agencies has resulted is an un-uniform hodgepodge of conflicting laws and regulations.

The Clean Water Act (CWA) is the primary American law governing surface water pollution. The law creates a framework for regulating the discharge of pollutants from a "point source" into the "navigable waters of the United States" through its National Pollutant Discharge Elimination System (NPDES) permitting scheme.[80] "Point sources" are defined as "any discernable, confined and discreet conveyance," and include pipes, ditches, conduits, wells,

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law/Centers%20and%20Institutes/Native%20American%20Law%20Center/News%20Events%20and%20Publications/Publications.aspx.

[76] *Id.*

[77] GROUNDWATER PROTECTION COUNCIL AND ALL CONSULTING *supra* note 23, at 25.

[78] *Global Shale Gas Initiative*, *supra* note 3.

[79] GROUNDWATER PROTECTION COUNCIL AND ALL CONSULTING *supra* note 23, at 25.

[80] 33 U.S.C. § 1251 (1972).

containers, and [other] vessels.[81] Thus, the CWA would govern the methods used to manage flowback, particularly its transport and storage. The CWA requires the EPA to establish national effluent guidelines (ELG) that consider: (1) best conventional technology to control conventional pollutants; (2) best practical technology currently available to control unconventional pollutants; (3) best available technology "economically achievable; and (4) new source performance standards for conventional pollutants from new sources.[82] Oil and gas production pollution falls within its own ELG classification; shale gas falls unto Subsection C.[83] The EPA has created national standards for over 50 separate categories of industrial pollutants.[84] The National Pollutant Discharge Elimination System requires would-be polluters to apply for, and be granted a permit before discharging enumerated pollutants into liberally-defined "navigable waters." The CWA has no "general" permits, but instead tailors individual permits to the applicable point source.

Individual states may be granted *primacy* in order to create their own surface water regulations, on the stipulation that they are not *less* stringent standards than those imposed by the EPA.[85] If the EPA approves a state's regulatory plan, then the state assumes responsibility for authorizing and issuing NPDES permits. In deciding whether to issue a permit, the issuing agency must consider both the concentration of the pollutant being discharged, and the overall impact the discharge will have on the body of water as a whole. Forty-six states are currently authorized to regulate at least one NPDES component.[86]

[81] Royster, *supra* note 75, at 1.
[82] GROUNDWATER PROTECTION COUNCIL AND ALL CONSULTING *supra* note 23, at 31.
[83] *Id.*
[84] *Id*.
[85] *Id*.
[86] 40 C.F.R. § 122.44(d) (2011).

In 1990, the federal government amended the CWA with the Oil Pollution Act, which both sped up and strengthened the EPA's ability to respond to "catastrophic" oil spills.[87] On December 21, 2010, the U.S. federal government sued BP Petrochemicals under the CWA and the OPA to force it to pay for the damage caused by the Deepwater Horizon well disaster in the Gulf of Mexico- the worst oil disaster in American history to date.[88] Although the OPA greatly enhance the federal government's ability to address the costs associated with oil spills, it does not apply to gas production.

The Safe Drinking Water Act (SDWA) of 1974 if the primary federal law protecting the quality of drinking water sources against both naturally occurring and man-made pollutants.[89] The SDWA requires that the EPA set national health-based guidelines that set a maximum limit on different types of pollutants in local water supplies after conducting a detailed risk and cost assessment.[90] As with the CWA, states may create and enforce their own SDWA regulations so long as they at least meet federal standards. Currently, only ten states lack the "primacy" to regulate underground injection control permits in any manner.

The SDWA specifically addresses hydraulic fracturing through its Underground Injection Control (UIC) program, which regulates the "construction, operation, permitting, and closure of injection wells that place fluids underground for storage or disposal."[91] The general focus of the UIC program is to prevent the contamination of drinking water supplies by ensuring that injected fluids remain within the intended injection zone, so that the fluids do not, or even potentially

[87] 33 U.S.C. § 2701 (2011).
[88] IBTTimes Reporter, *BP, Eight Other Sued by U.S. Govt. for Deepwater Oil Spill*, INT'L BUS. TIMES, Dec. 21, 2010, http://www.ibtimes.com/articles/94210/20101221/bp-eight-others-sued-by-u-s-govt-for-deepwater-oil-spill.htm.
[89] Safe Drinking Water Act § 1421(d) (2011).
[90] *Id.*
[91] 33 U.S.C. § 402 (2011).

threaten current or future public drinking water.[92] The UIC program classifies types of underground injections into five different categories based on the type of waste and depth of injection; injections related to oil and gas production fall under Class II. Class II wells are themselves divided into three separate subclasses: (1) saltwater disposal wells, (2) enhanced oil recovery wells, and (3) hydrocarbon storage wells.[93] The vast majority of oil and gas production wells- including the use of hydraulic fracturing- are classified as Class II wells.

There are approximately 144,000 active Class II wells in the United States today.[94] These wells collectively inject over 2 billion of fluids (including fracturing fluids and flowback) into the ground *every day*.[95] From 1997 until 2004, hydraulic fracturing fell under SDWA's UIC regulations.[96] However, direct EPA control of hydraulic fracturing was to an extent preempted by the Energy Policy Act of 2005.

The Energy Policy Act of 2005 explicitly excludes "the underground injection of natural gas (for storage purposes) and "fluids or propping agents (other than diesel fuels) pursuant to hydraulic fracturing operations related to oil, gas, or geothermal production activities " from CWA and SWDA regulation.[97] The government based the exemption on an EPA study that had concluded hydraulic fracturing only posed a "minimal threat" to drinking water supplies based on secondary studies, reports and interviews.[98] However, the EPA still directly regulates the

[92] GROUNDWATER PROTECTION COUNCIL AND ALL CONSULTING *supra* note 23, at 33.
[93] GROUNDWATER PROTECTION COUNCIL, INJECTION WELLS: AN INTRODUCTION TO THEIR USE, OPERATION, AND REGULATION 9, *available at* https://litigation-essentials.lexisnexis.com/webcd/app?action=DocumentDisplay&crawlid=1&doctype=cite&docid=10+Tex.+Tech.+Admin.+L.+J.+267&srctype=smi&srcid=3B15&key=5e194515681e4eba4824aea51b5859d9 (last visited Apr. 23, 2011).
[94] *Id*.
[95] 40 C.F.R. § 141 (2011).
[96] Amy Mall, Sharon Buccino, & Jeremy Nichols, *Drilling Down: Protecting Western Communities From the Health and Environmental Effects of Oil and Gas Production*, NAT'L RESOURCE AND DEFENSE COUNSEL 15 (2007).
[97] SDWA § 1421(d) (2011).
[98] John Manual, *EPA Tackles Fracking*, 118 ENVT'L HEALTH PERSPECTIVES 5, A199 (May 2010).

injection of brine and diesel into the ground for any purpose.[99] Furthermore, the Ninth Circuit Court of Appeals vacated the exemption for the sediment discharges that cause violation of the CWA.[100] As a result, stormwater discharges from flowback storage pits must be permitted under NPDES.[101]

Were it not for the 2005 Energy Policy Act's "Halliburton Loophole," unconventional gas production, including shale gas, would fall squarely under the jurisdiction of the CWA and SWDA. For its part, China's laws on water pollution and their regulation similarly encompass aspects of both the CWA and the SDWA, but are not subject to similar exemptions.

Current Chinese Laws

In China, the legal system is divided into a tri-partite system of laws, regulations, and rules that apply at various levels of government. The laws rank in descending order as follows: the National People's Committee passes Laws; the State Council passes Regulations; various ministries create Rules, and departments within the ministries create various other normative legal documents.[102] The Ministry of Environmental Protection (formerly the State Environmental Protection Agency (SEPA)) is the federal agency responsible for enforcing environmental laws through its provincial and municipal subsidiaries.[103] National bodies like the NDRC set broad environmental standards and long-term goals, which are regulated and enforced through provincial and municipal-level branches of the Ministry of Environmental Protection

[99] Interview with Ann Codrington, Acting Director, U.S. Env. Prot. Agency Drinking Water Protection Division in Austin, Tex. (January 25, 2011).
[100] GROUNDWATER PROTECTION COUNCIL AND ALL CONSULTING *supra* note 23, at 31.
[101] *Id.*
[102] Donald C. Clarke, *The Chinese Legal System*, GEO. WASH. UNIV. L. SCHOOL (July 4, 2005) http://docs.law.gwu.edu/facweb/dclarke/public/ChineseLegalSystem.html.
[103] MIT *supra* note 72, at 69.

(MEP).[104] To illustrate, the 11th Five Year Plan's air quality goals were met when it reduced total pollutant emissions by 10 percent.[105]

There are currently no Chinese laws that directly address the potential environmental hazards of shale gas production; however, the process is generally regulated by a number of existing laws. Specifically, two laws define the perimeters of what aspects of the process are currently regulated: the Environmental Protection Law and the Water Pollution Prevention and Control Law. Other relevant laws include the National Mineral Resources Law, the Mining Law, the Administrative Law, and the Regulations of the Peoples Republic of China on Sino-foreign Cooperation in the Exploitation of Continental Petroleum Resources, as well as the proposed but yet un-ratified Energy Law.

Pollution from oil and gas production is specifically addressed in the 2003 Clean Production Law. Specifically, the law requires that operators and subcontractors engaging in petroleum production "protect fishery resources and other natural resources and prevent the environment, including the air, sea, rivers, lakes and land, from being polluted or damaged" by observing international practices.[106] Those practices are not clearly pronounced however, and furthermore say nothing as to the proper procedures when international practices are incorrect or non-existent.

The law most pertinent to shale gas production and water pollution is the Law on the Water Pollution Prevention and Control Law (WPPCL), which has attributes of both the American CWA and SDWA. Article 38 of the Water Law states that "protective measures shall

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[104] *Id*.
[105] *China Meets 5-Year Energy-Saving Goal: NRDC*, ENGLISH.NEWS.CN., http://news.xinhuanet.com/english2010/business/2011-01/06/c_13679329.htm (last visited Feb. 17, 2011).
[106] Law of the People's Republic of China on the Promotion of Clean Production (promulgated by China National People's Congress June 29, 2002, effective Jan. 1, 2003) .

be taken. . . while constructing underground engineering facilities or carrying out underground prospecting, mining, and other underground activities."[107] "Other underground activities" certainly encompass the fracturing process. The WPPCL further prohibits the discharge of a long list of chemicals regularly used in American fracturing fluids, such as "any oil, acid, or alkaline solutions or highly toxic liquid waste,"[108] or "any highly toxic soluble waste residue containing mercury, cadmium, arsenic, chromium, lead, cyanide, etc."[109]

Like both the SDWA and CWA, the Water Law utilizes a "cooperative federalism" framework for creating Central and local water standards. The WPPCL requires local governments to synchronize their regulations with nationally set standards, regardless of local economic considerations.[110] Permitted pollutant discharges are capped at set amounts by a system of "total quantity control."[111] Like American regulations, the WPPCL allows the peoples governments of "provinces, autonomous regions, and municipalities" to establish their own standards for items not set by a Central body.[112] Local people's governments are further allowed to set their own standards regarding nationally listed pollutants, but only to the extent that they exceed national standards.[113] Governments are "encouraged" to utilize scientific research when defining those standards, though the law gives no indication of how or what type of research.[114]

The WPPCL has a number of measures directed at protecting drinking water. Drinking water supplies are designated "water source protection zones," divided into two separate

[107] Law of the People's Republic of China on Prevention and Control of Water Pollution (adopted by Standing Committee of the Sixth National People's Congress May 11, 1984, amended Feb. 28, 2008). Article 38.
[108] *Id.* article 29.
[109] *Id*. article 33.
[110] *Id.* articles 4, 13.
[111] *Id.* article 18.
[112] *Id*. article 13.
[113] *Id.*
[114] *Id.*

protection classes, along with "quasi-protection" zones along their periphery.[115] The Law requires local governments to designate these zones, then submit them to the People's governments for approval: if a proposed designation is denied, an environmental protection department of the people's government is tasked to create their own designated zone in conjunction with "the water conservancy administration, state land resources, public health and construction departments."[116] Once approved, zones must be clearly marked by local governments with "explicit boundary marks and obvious warning signs."[117] The zones can only be altered by "the State Council and people's governments of provinces, autonomous regions, and municipalities in order to "adjust [their] scope;" Finally, the Law forbids construction of drainage outlets within these zones, which are analogous to CWA "point sources."[118]

The problem of Flowback storage is also addressed by the WPPCL. Article 30 specifically addresses NORMs, by forbidding the dumping of any mid to high level radioactive substances into a body of water. The release of low-level radioactive substances "must comply with standards of the State for radioactive pollution prevention and treatment."[119] The common, and hazardous American practice of storing flowback in pits is also addressed: Article 33 requires waterproof storage of highly toxic substances in seepage and leak proof containers; Article 35 prohibits the discharge of waste water containing pollutants into "seepage wells or pits, crevices or karst caves; and Article 36 forbids the use of non-leak proof ditches or ponds to transmit or store any toxic wastewater.

Tough punitive measures give the Water Law teeth. Violators are can be fined and ordered to remediate the damage they've caused. In the event that a polluting enterprise or

[115] *Id*. article 56.
[116] *Id.*
[117] *Id.*
[118] *Id.* article 57.
[119] *Id.* article 30.

public institution refuses or is not able to ameliorate pollution they've caused, the Administrative Department of Environmental Protection shall appoint a capable entity to do so on behalf of the enterprise or public institution, which must be later repaid. In the event of serious or extraordinarily serious pollution incidents, the administrative department of environmental protection may, upon the approval of the people's government, order it to close, and impose upon each of the directly liable person in charge and other directly liable persons a fine of not more than 50% of the income obtained from the enterprise or public institution in the previous year. For less serious pollution events, the fine is calculated on the basis of 20% of the direct losses caused by the accident; if the accident is serious or extraordinarily serious, it is calculated on the basis of 30% of the direct losses caused by the accident.

The Mineral Resources Law (MRL) also plays an important regulatory role for shale gas production, in that it requires a unified regional registration system for the exploration of mineral resources.[120] In order to gain permission for exploration and extraction of minerals, an expansive production plan must first be submitted for approval; if granted, a permit is issued.[121] Such approval is delegated to the Department of Geology and Mineral Resources under the people's governments or provinces, autonomous regions, and municipalities directly under the Central Government for the supervision and administration. The qualifying criteria for approval though, are vague, and require adherence to: "qualifications prescribed by the State, and the department in charge of examination and approval shall, in accordance with law and relevant State regulations examine the enterprise's mining area, its mining design or mining plan, production and technological conditions and safety and environmental protection measures." The Law does not define those criteria.

[120] Mineral Resources Law of the People's Republic of China (adopted Sixth National People's Congress on March 19, 1986, amended August 29, 1996). Article 24.
[121] *Id,* Article 15.

The Regulations of the Peoples Republic of China on Sino-foreign Cooperation in the Exploitation of Continental Petroleum Resources is specifically aimed at the types of partnerships currently proliferating in the exploration and production of shale gas. The regulations are designed to address and encourage much-needed foreign investment in the domestic petroleum market by guaranteeing the rights of foreign companies. Notably, it is also the only law that has specifically addressed unconventional production, though only in order to give exclusive coalbed methane production rights to a specified national oil company.[122] The law requires foreign operators to "observe the laws, regulations and standards of the State on environment protection and operational safety, to conform to international practice, protect farmland, aquatic resources, forest reserves and other natural resources, and prevent pollution of and damage to the atmosphere, seas, rivers, lakes, groundwater and other land environments."[123] No mention is made of the Laws' applicability to the national petroleum companies though, who have ultimate control of actual projects.

Although Chinese environmental laws have been derided as "vague, aspirational" policy pronouncments as opposed to actual, enforceable laws,[124] China clearly has sufficient laws to ensure the protection of its water supplies during its pending shale revolution. However, the country's poor record of environmental enforcement leaves much room for doubt as to whether existing laws would actually be effective in preventing the pitfalls of fracturing.[125] An examination of the existing enforcement mechanisms of both

[122] Regulations of the People's Republic of China on Exploitation of On-shore Petroleum Resources in Cooperation with Foreign Enterprises (promulgated by decree No. 317 of the State Council of the People's Republic of China, Sep. 23, 2001, adopted September 18, 2007) Article 30.
[123] *Id*. article 22.
[124] Alex Wang, *The Downside of Growth: Law, Policy, and China's Environmental Crisis*. 2 PERSPECTIVES, http://www.oycf.org/Perspectives2/8_103100/downside_of_growth.htm.
[125] Jingyun Li & Jingjing Liu, *Quest for Clean Water-China's Newly Amended Water Pollution Control Law*, WOODROW WILSON INT'L CTR. FOR SCHOLARS 5 (Jan. 2009), *available at*

the United States and China could help in ascertaining a viable solution to protecting groundwater supplies during shale gas development.

Enforcing the Laws

Both China and the United States rely on a multi-tiered system of authority, which radiate from the federal or Central levels. In the United States, "cooperative federalism" is only possible through widespread public participation in environmental enforcement.[126] There is a growing trend towards increased public participation in Chinese environmental legislation as well; the Water Pollution Law allowed a period for public comments before it was enacted.[127] However, China principally relies on Central supervision of local governments to ensure competent enforcement of its laws. Although both methods of regulation have their flaws, a comparison illustrates potential improvements.

In the United States, delegating regulation of hydraulic fracturing to the individual states has resulted in a wide variety of local regulations, mandated and enforced by state environmental protection agencies. Some states regulate by Draconian decree based on the precautionary principal: New York, for example, recently issued a seven month moratorium on hydraulic fracturing, forbidding all drilling until a more comprehensive study can be completed that would prove drilling in the Marcellus Shale poses no threat to New York City's water supply.[128] Others are less severe. Pennsylvania is home to the United States' largest shale gas formation: the Marcellus Shale, and Department of Environmental Protection has gradually increased

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http://www.wilsoncenter.org/index.cfm?topic_id=1421&fuseaction=topics.documents&doc_id=496229&group_id=233293.

[126] Envt'l Protection Agency, TSINGHUA UNIVERSITY ENVIRONMENTAL POLICY INSTITUTE: SYMPOSIUM ON ENVIRONMENTAL LAW & REGULATION (Apr. 2008) *available at* http://www.epa.gov/ogc/china/cooperation.htm.

[127] Li & Liu *supra* note 125.

[128] *New York Governor Orders Ban on Fracking Until July 1*, PLATTS OIL AND GAS, Dec. 12, 2010, http://www.platts.com/RSSFeedDetailedNews/RSSFeed/NaturalGas/8290685.

regulatory rigidity since it began producing shale gas. Pennsylvania is the only state to allow disposal of partially treated flowback into the states waterways, rivers, and streams.[129] Since word of the link between groundwater pollution and hydraulic fracturing began to permeate the public psyche, the state has embraced a policy of open information. [130] Recent events in the birthplace of shale-drilling technology showcase the problem of inconsistent shale regulatory policies and the continuing relevance of the EPA's authority.

Texas regulates oil and gas production through the Texas Railroad Commission (RRC), which is responsible for overseeing one of the largest concentrations of wells in the country.[131] The RRC maintains a large number of pollution prevention policies such as guaranteeing a response to pollution complaints within 24 hour complaint response policy and maintaining over 56,000 monitoring wells.[132] However, on August 6, 2010 a landowner in Parker County complained that he smelled methane in his property, which was located near a shale gas fracturing operation.[133] The RRC began investigations four days later for what turned into two months of investigations with the company conducting the fracturing operations.[134] The EPA investigated the property on November 23, at which time the investigators smelled methane in the complainant's house.[135] On December 7, 2010, the EPA issued an "Emergency Order" based on its own study that proclaimed the Railroad Commission "had not acted to protect" the public health under its jurisdiction, and ordered the alleged polluter to immediately halt production and

[129] David B. Caruso, *Tainted Waters Result From Gas Boom*, THE VICTORIA ADVOCATE, Jan. 4, 2011.
[130] *Id.*
[131] TEX. R.R. COMM'N, http://www.rrc.state.tx.us/about/divisions/aboutog.php (last visited May 4, 2011).
[132] Leslie Savage, Chief Geologist, Presentation at Groundwater Protection Council Annual UIC Conference (Jan. 26 2011).
[133] *Id*.
[134] *Id*.
[135] Codrington, *supra* note 99.

provide freshwater to the affected families.[136] The Texas Railroad Commission vehemently opposed the Order, and is currently challenging it in federal court.[137] Whether or not incidents like the Parker County investigation could be avoided through increased federal regulation is unclear, but the dispute itself alongside discrepancies in local regulations evidences strains in the effectiveness of "cooperative federalism."

In China, environmental laws are enforced by the oversight of the Central government. The Environmental Protection Law relegates responsibility for maintaining local environmental integrity to the country's local governments.[138] Environmental regulations are accordingly enforced at the local level through Central Government Regional Supervision Centers (RSCs) and local government Environmental Protection Bureaus (EPBs).[139] The RSCs are responsible for, among other things: (1) supervising implementation of Central laws; (2) investigating major pollution events; (3) coordinating and settling trans-boundary environmental disputes; (4) supervising emergency responses to pollution incidents; (5) inspecting local enforcement teams; and (6) receiving and coordinating complaints.[140] However, serious constraints limit the effectiveness of the RSCs in overcoming one of China's most pressing obstacles: local protectionism evidenced by the "information asymmetry" between the Central and local governments.[141] First and foremost, there are just six centers for the entire country, staffed with 30-40 people each.[142] Given the sheer size of the country and wide spectrum of responsibilities delegated to the Centers, staffers face overwhelming work loads. Second, the Centers are

[136] *Statements on EPA Order in Parker Co., Texas*, BARNET SHALE ENERGY EDU. COUNCIL, Dec. 8, 2010, http://www.bseec.org/content/statements-epa-order-parker-co-tx.
[137] *Id*.
[138] Li & Liu *supra* note 125.
[139] Scott Moore, *Commentary: Shifting Power in Central-Local Environmental Governance in China: the Regional Supervision Centers*, 11 CHINA ENVT. SERIES 188 (2010/2011).
[140] *Id.* at 189.
[141] *Id.* at 190.
[142] *Id.* at 191.

severely underfunded. Furthermore, the fact that they are funded by local governments can lead to conflicts of interest at best, and graft and complicity.[143] Third, the RSCs are legally weak, and lack enforcement authority over local environmental bureaus.[144] At a recent Environmental Law Symposium at Tsinghua University, solutions were proposed to strengthen the RSC's relevance and effectiveness by developing RSC-specific laws and granting the centers better funding and increased authority.[145] Furthermore, increased transparency in environmental information could help to make the public a stronger partner in environmental enforcement.

The Promising Role of Transparency in Effectively Regulating Shale Gas

An informed public is often one of the strongest methods of ensuring that environmental laws are enforced. Laws and regulations that allow the general public access to information and statistics have created a positive feedback mechanism: the more aware the general public is, the more pressure they exert on the local or federal government to enforce existing regulations. Transparency can also encourage polluters to self-regulate.[146] Such initiatives have helped bridge the gap between federal and state regulations for the petroleum industry in both the United States and China. Large-scale environmental disasters in both countries have served to catalyze transparency by raising local awareness, which afterwards manifests itself in new regulations and enforcement standards. The United State's Exxon Valdez disaster and China's Songhua River Spill are perhaps the best examples of the effects a public spotlight on the oil and gas industry can have.

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[143] *Id.*
[144] *Id.*
[145] EPA *supra* note 126.
[146] Ma Jun, *Public Disclosure in China: Fighting Pollution with Open Information*, NRDC AND CHINA ENVT'L CULTURE PROMOTION ASS'N., http://www.greenlaw.org.cn/enblog/?p=2823 (last visited Dec. 14, 2010).

In 1990, the Exxon Valdez spilled over 11 million gallons of crude oil into waters off the coast of Alaska, resulting in America's largest ever oil spill.[147] The spill occurred in the "navigable waters" of the United States, and as a result the federal government was responsible for leading the clean up effort under the CWA. The existing standards' deficiencies were highlighted for the entire nation to see, as a slow response and delayed clean up effort resulted in large scale wildlife destruction.[148] Public outrage directly led to federal passage of the Oil Pollution Act (OPA) of 1990.[149] OPA, among other things, raised requisite ship construction standards, set requirements for emergency response measures, and increased the financial responsibility requirements of ship owners.[150]

In China, the Songhua River Accident played a similar role in shaping environmental regulations, and more importantly, their enforcement. On November 13, 2005, a workshop of two-benzene plant belonging to the Jilin Petrochemical Company in Jilin Province exploded, and as a result roughly 100 tons of benzene, nitrobenzine, and other hazardous chemicals poured into the Songhua River, which flows into Russia.[151] The local Environmental Protection Bureau and Officials at the factory initially denied that any pollution had in fact occurred, and attmepted to mitigate the damage themselves.[152] However, increased media attention focused on the disjunct between the Central government's policy-making and local enforcement. While the Central Government's response was considered adequate by a number of international observers, it was greatly

[147] Envt'l Protection Agency, *Exxon Valdez Fact Sheet*, http://www.epa.gov/emergencies/content/learning/exxon.htm (last visited Mar. 3, 2011).
[148] *Id.*
[149] *Id*.
[150] 33 U.S.C. §§ 2701–2761 (2011).
[151] Nat Green, *Positive Spillover? Impact of the Songhua River Benzene Incident on China's Environmental Policy,* WOODROW WILSON INT'L CTR. FOR SCHOLARS 2 (Mar. 2009) *available at* http://www.wilsoncenter.org/index.cfm?topic_id=1421&categoryid=EE4F578C-D321-2150-ABD87895FEF607D8&fuseaction=topics.doc_topics&doc_id=514852&group_id=233293.
[152] *Id.*

hampered by the dearth of "public information and. . . lack of centralized emergency response procedures."[153] The fallout facilitated discussions of accountability, helped to speed up the creation of Regional Supervision Centers and helped elevate SEPA to ministerial status as the MEP in the Central Government's administrative hierarchy. Furthemore, the accident facilitated passage of the Water Pollution Control Act.[154]

Currently, both China and the United States have federal regulations that mandate publication of pollution information. The United States passed the Emergency Planning and Right To Know Act (EPCRA) in 1986, which encourages and supports emergency preparedness by requiring both the local and federal governments be given detailed information about the presence of potential chemical hazards.[155] EPCRA requires industries bringing hazardous wastes into communities to provide: Emergency Planning Notification, Emergency Release Information, Hazardous Chemical Inventory Reporting, and Toxics Release Inventory Reporting.[156] The EPA's Toxics Release Inventory (TRI) program maintains a searchable database of toxic chemical releases and waste management activities to inform and guide policy decisions of both local communities and the federal government.[157] The National Resource Defense Council (NRDC) credits these programs with drawing national attention to parties responsible for creating which types of pollution.[158]

Both the CWA and SDWA also have provisions for mandatory public disclosure, which are both thoroughly explained on the EPA's website.[159] The CWA's website, for example, provides extensive water pollution maps that allow members of the public to view local effluent

[153] *Id.* at 3.
[154] *Id* at 4.
[155] EPCRA §§ 311–12 (2011).
[156] *Id.* §§ 302, 04, 11, 12, 13.
[157] Envt'l Protection Agency, *Toxic Inventory Release Program*, Dec. 12, 2010, http://www.epa.gov/tri/.
[158] Jun *supra* note 146.
[159] 33 U.S.C. § 402 (2011)

limitations, violations, and results of investigations. The SDWA similarly maintains a database (the Safe Drinking Water Information System) which is viewable at the EPA's Envirofacts Database.[160] The SDWA further requires publication of annual consumer confidence and state compliance reports, which detail, among other items, annual changes in local water quality.[161]

Nearly all American states require some degree of information disclosure, though they vary greatly. Some American states have detailed, explicit mechanisms in place to allow for the public dissemination of environmental information. Wyoming for example, recently passed legislation that requires all oil and gas producers to disclose fracking fluid ingredients to the Wyoming Oil and Gas Conservation Commission.[162] The state government website lists the information on a well-by-well basis, and includes comprehensive maps detailing well locations. Pennsylvania maintains a web page solely dedicated to the Marcellus shale play, where it publishes a comprehensive list of complaints, investigations, violations, and disciplinary actions taken to maintain shale gas production standards.[163] Other states have followed suit. Pennsylvania, Arkansas, and Colorado have recently passed legislation that requires the complete disclosure of well-specific information, which the public may request.[164] More extreme disclosure legislation has been proposed in Texas, that would require creation of a website with mandatory disclosures of both the ingredients and their percentages used in each hydraulic fracturing operation.[165]

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[160] ENVT'L PROTECTION AGENCY, PUBLIC ACCESS TO INFORMATION AND PUBLIC INVOLVEMENT/EPA 816-F-04-039, June 2004, *available at* www.epa.gov/safewater.
[161] *Id.*
[162] WYO. OIL AND GAS CONSERVATION, http://wogcc.state.wy.us/ (last visited Apr. 13, 2011).
[163] *Marcellus Shale*, PA. DEPT. OF ENVT'L PROTECTION, Apr. 26, 2011, http://www.dep.state.pa.us/dep/deputate/minres/oilgas/new_forms/marcellus/marcellus.htm.
[164] Kate Galbraith, *Hydraulic Fracturing Bill Could Force Disclosure*, N.Y. TIMES, Mar. 24, 2011, www.nytimes.com/2011/03/25/us/25ttfracking.html.
[165] *Id.*

Making the information available to the general public has resulted in further information dissemination through the efforts of independent public organizations. The publicly-run website Fractracker for example, allows the public to examine extensive and detailed map displaying the location of shale gas operations across the country.[166] A more extensive example is the Groundwater Protection Council's Risk Based Data Management System (RBDMS).[167] The RBDMS is an online resource available to the general public that makes available a wealth of information on current hydraulic fracturing operations and the rules governing them. More importantly, the RBDMS hosts a "Chemical Registry," that allows companies involved in fracturing operations to voluntarily disclose the ingredients of their fracturing fluids. There are currently two shortcomings: first, companies are encouraged, but not required to disclose the percentages of chemicals used in their fracking coktails; second, there is no oversight to verify that the companies are disclosing everything.[168] As a further example of self-regulation, the amount of complaints and bad press generated by river dumping in Pennsylvania has caused the state's largest shale developers to voluntarily cease dumping flowback into rivers, despite the lack of solid evidence of damages.[169] However, voluntary public disclosure of the fracking ingredients would have been unheard of just five years ago, and the effort is certainly a step in the right direction.

Finally, the federal government is re-examining whether shale gas should be federally-regulated due to a mounting number of public complaints and concerns from accidents allegedly stemming from loose federal standards. On March 18, 2010, the EPA announced that it was

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[166] FRACKTRACKER, www.fractracker.org (last visited Dec. 27, 2010).
[167] *Risk Based Data Management System*, GROUNDWATER PROTECTION COUNCIL, http://rbdmsonline.org/GWPC/ (last visited May 2, 2011).
[168] E-mail from Paul Jehn, Technical Director RBDMS, Groundwater Protection Council. (January 28, 2011, 11:47:00 EST) (on file with author).
[169] Caruso, *supra* note 129.

conducting a study to re-examine the safety of hydraulic fracturing.[170] Some members of Congress have also attempted to re-assert federal control over shale gas production. The Fracturing Responsibility and Awareness of Chemicals Act was introduced in both the United States House of Representatives and the Senate in June 2009. The bill ostensibly had two purposes: (1) to repeal the 2005 Energy Act's exemption of fracturing fluid from the Safe Drinking Water Act's definition of forbidden underground injections, and (2) to require the States to publicly disclose the chemicals (but not the proprietary chemicals formulas) used in the fracking process on an "appropriate internet website."[171] The bill did not pass, but was relegated to the Senate Environment and Public Works Committee for further study on whether to pass the bill by itself, or as part of more comprehensive legislation.[172]

In China, transparency initiatives are the just beginning to take root, but they do exist. The Water Pollution Prevention and Control Act is the first medium-specific environment legislation that requires the environmental protection administration departments of the local people's governments to periodically disclose pollution quantity control targets.[173] Furthermore, the Water Law also requires environmental protection administration department of to State Council to "name and shame" local governments who fail to meet their quantity control targets.[174] Similarly, local governments are further required to publicly name enterprises responsible for

[170] Heather Rousseau, *EPA Announces Study to Re-Examine the Health Risks of Hydrofracking*, CIRCLE OF BLUE WATERNEWS, http://www.circleofblue.org/waternews/2010/world/epa-announces-study-to-re-examine-the-health-risks-of-hydrofracking/ (July 29, 2010).
[171] H.R. 2766, 111th Cong. 1st Sess. (June 9, 2011); S. 1215 111th Cong. 1st Sess. (June 9, 2009).
[172] *S. 1215: Fracturing Responsibility and Awareness Act*, GOVTRACK, Dec. 2, 2010, http://www.govtrack.us/congress/bill.xpd?bill=s111-1215.
[173] WPPCL Article 19.
[174] *Id.*

polluting water supplies.[175] The Water Law however, is only the most recent addition to a growing body of laws that encourage transparency and public participation.

The first significant example is the Clean Production Law of 2003, which required emissions and other environmental data.[176] The Environmental Impact Assessment Law of 2003 requires partial public disclosure of the environmental impact assessments completed for permit applications.[177] The first Ministry-level disclosure law is the "Measures on Open Environmental Implementation (trial)," passed on February 8, 2007 by the MEP to promote public participation in circumventing pollution. The centerpiece of the Measures is that they require enterprises to disclose their environmental information both "timely and accurately."[178] The Measures also encourage citizen involvement, in that "citizens, legal persons and other organizations" are allowed to "apply to environmental administrations for accessing government environmental information."[179] Finally, Article 18 of the Measures requires an environmental administration to reply within 15 working days after receipt of a [request]; if it is unable to do so, the time limit may be extended by personal request to the regulatory inspector.[180] The regulation has so far now proven somewhat successful; more than 300 firms in violation of existing standards have been "named and shamed," forcing them to take action to conform to requisite standards and in certain instances to submit to third-party verification.[181]

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[175] *Id.*
[176] INST. OF PUB. & ENVT'L AFFAIRS & NATURAL RES. DEFENSE COUNCIL, BREAKING THE ICE ON ENVIRONMENTAL OPEN INFORMATION: THE POLLUTION INFORMATION TRANSPARENCY INDEX 9, (2009).
[177] The Environmental Impact Assessment Law of the People's Republic of China (promulgated Oct. 28, 2002 by the Standing Committee of the National People's Congress, adopted September 1, 2003).
[178] *Id*., Article 4.
[179] *Id*., Article 5
[180] *Id*. Article 18
[181] Ma Jun, *Public Disclosure in China: Fighting Pollution with Open Information*, NRDC AND CHINA ENVIRONMENTAL CULTURE PROMOTION ASSOCIATION, Dec. 14, 2010, http://www.greenlaw.org.cn/enblog/?p=2823.

The Center for Legal Assistance to Pollution Victims (CLAPV) performed an environmental disclosure study from July to October of 2010 to determine current levels of awareness among local environmental protection agencies in accordance with the Measures.[182] Specifically, the project tried to answer: (1) what kinds of environmental information the local environmental protection departments disclose on their own initiative; (2) what kind of environmental information the local enterprises disclose; (3) how do the environmental protection departments deal with disclosure application; and (4) what obstacles did NGOs experience when they try to obtained environmental information.[183]

The study found that local governments had indeed made progress in disclosing environmental information by listing companies that exceeded the permissible amounts of pollutants.[184] However, it also found disparity amongst the regions, and that timeliness and incomplete disclosure were the effort's primary shortcomings.[185] It further found that current disclosure of environmental information by large companies was limited. Most companies have not yet published information on their individual environmental impacts, because the large companies "are big taxpayers and the government would protect them…[when they] refuse to disclose their environmental information with excuses."[186] That the Regulations do not generally make mandatory environmental disclosure requirements for enterprises, but rather mainly encourage enterprises to take their own initiative in providing provide the relevant information serves to exacerbate the problem of partial disclosure.[187]

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[182] CTR. FOR LEGAL ASSISTANCE TO POLLUTION VICTIMS & ARTICLE 19, ACCESS TO ENVIRONMENTAL INFORMATION IN CHINA: EVALUATION OF LOCAL COMPLIANCE, (Dec. 2010), *available at* http://right2info.org/news/china-new-report-shows-progress-in-environmental-information-disclosure-but-pollution-data-still-withheld.
[183] *Id*.
[184] *Id*.
[185] *Id.*
[186] *Id*.
[187] *Id.*

Informational shortcomings in both China and the United States prevent complete enforcement of national environmental regulations. However, increased transparency in both countries is a strong step towards better and safer regulation of shale gas development. In the United States, the regulatory future of shale gas development will hinge on the results of the current EPA study. Regardless of its ultimate conclusions, both countries should continue to strengthen the mandatory disclosure of environmental information in order to better enforce national environmental laws.

Conclusion- Better Transparency is Key to Safe Shale Gas Development

China is ideally situated to become a global model for the responsible, safe development of its shale gas reserves. In doing so, it would be wise to take heed of America's controversial past developing its shale reserves.

The American example of shale gas' development illustrates the benefits and burdens of rapid production. The country has greatly increased its reserves of natural gas, at the cost of widespread environmental insecurity in producing states. Although not a direct parallel to China, the two countries' geopolitical, environmental, and regulatory frameworks are sufficiently similar to draw conclusions. Transparency initiatives in both countries are helping to better enforce environmental regulations. Although transparency cannot necessarily prevent pollution, it can help to minimize the harm when accidents do occur by facilitating better preparedness.

In the United States, public pressure facilitated the initial disclosure of previously secret fracturing fluids. Since then, different state agencies have followed a domino effect, gradually ratcheting up their level of regulation of unconventional gas production. Discrepancies still exist though, which could best be addressed by requiring the extractive industries to disclose their fracturing constituents. Their percentages would serve to strengthen emergency response measures, mitigate existing damage, and further build trust between the public, the extractive industries, and local and federal government.

China could take a number of preemptive steps to avoid taking unnecessary environmental risks. The country's laws are more than sufficient to mitigate and remedy any potential damage caused by any phase of fracturing. Increased transparency and required disclosure of environmental information would help ensure that the country is able to safely and effectively develop its shale gas reserves. Known American fracturing constituents should be added to the

list of chemicals enumerated under the WPPCL, so that they may be addressed through national standards under the Law's "quantity controls." Furthermore, the country should continue to encourage disclosure requirements within the extractive industries, in order to raise public awareness, increase disaster preparedness, and increase the public's role in enforcing existing regulations.

Whether or not the NDRC adopts tougher laws specifically aimed at unconventional gas production, one thing is certain: given predicted demand curves, shale gas and hydraulic fracturing are not going away in either China or the United States. Green energy will not have a significant place either country's energy portfolio for generations to come, so increased natural gas use will be a major factor in reducing CO2 and other GHG emissions.[188] Therefore, embracing the safe, widespread development of the country's unconventional gas reserves is China's best option to mitigate its deadly addiction to coal.

[188] James Fallows, *Dirty Coal, Clean Future,* 73 THE ATLANTIC MONTHLY 306, 5 (Dec. 2010).