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ALLAN INGELSON AND TINA HUNTER*

A Regulatory Comparison of Hydraulic Fracturing Fluid Disclosure Regimes in the United States, Canada, and Australia

ABSTRACT

Numerous state, provincial, and federal governments in the United States, Canada, and Australia have created guidelines, legislation, and/or regulations (or are in the process of doing so) in response to public concerns about water contamination from hydraulic fracturing. This article will compare and analyze three national regimes in the leading states and provinces in which laws have been amended, proposed, or adopted to address public concerns about the chemicals and additives in hydraulic fracturing fluids used to produce unconventional hydrocarbons. New regulations, recent legislative amendments, and, in some cases, new statutes have been proposed or adopted in the past few years. Most of the state and provincial laws require public disclosure of some information about the contents of hydraulic fracturing fluids. At the same time, governments interested in attracting investment capital to develop their shale oil and gas resources recognize the importance of protecting the intellectual property rights (trade secrets) of those parties that have developed hydraulic fracturing fluids.

INTRODUCTION

In response to declining conventional hydrocarbon reserves in the United States, horizontal drilling and hydraulic fracturing technologies are now used to facilitate commercial production from reservoirs such as coal seams and shale where historically it was not economic to do so.¹ Technological innovation has significantly increased natural gas production and oil in the United States, and American and Canadian oil and gas companies are in the process of exploring for and producing shale oil and gas in Canada.² After a meeting of Canadian energy ministers in

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1. Diane Rahm, *Regulating Hydraulic Fracturing in Shale Gas Plays: The Case of Texas*, 39 ENERGY POLICY 2974, 2974 (2011).

2. Petroleum Technology Alliance Canada & Science and Community Environmental Knowledge, *The Modern Practices of Hydraulic Fracturing: A Focus on Canadian Resources*, 1 (2012), CANADIAN ASSOCIATION OF PETROLEUM PRODUCERS, <http://www.capp.ca/>

August 2013 to discuss “responsible shale oil and gas development,” the following statement was issued:

Ministers recognized that the North American energy landscape is changing rapidly as technological innovation and increasing affordability of horizontal drilling and multi-stage fracturing technologies have unlocked vast unconventional ‘shale’ oil and gas resources . . . Governments play a key role in modernizing existing policy and regulatory frameworks, to better understand the implications of its development for the environment and human health and safety, and engaging in meaningful communications and consultations with the public.³

During the period of 2004 to 2010, natural gas production through hydraulic fracturing of coal seams in Australia increased by 22 times, and has facilitated liquefied natural gas as the quickest growing national export commodity.⁴ Canada and Australia are following the United States’ lead in developing their shale gas resources, and all three countries are experiencing significant expansion of hydraulic fracturing.⁵

As shale hydrocarbon development has increased, the potential for water contamination from chemicals in hydraulic fracturing fluids has become a contentious issue.⁶ A variety of fluids have been developed and tailored to the properties of individual oil and gas reservoirs to facilitate economic hydrocarbon production in shales from which it was historically not economical to produce.⁷ Some of the fluids contain small amounts of chemicals and additives that may be hazardous, and residents in areas where hydraulic fracturing is proposed or has occurred have raised concerns about the potential for water contamination from the hydraulic fracturing process. In most cases it is oilfield service companies that fracture the wells, not the well operators, and it is these ser-

canadaIndustry/naturalGas/ShaleGas/Pages/default.aspx#operating (last visited April 19, 2014) [hereinafter PTAC & SCEK].

3. ENERGY & MINES MINISTERS’ CONFERENCE, RESPONSIBLE SHALE DEVELOPMENT: ENHANCING THE KNOWLEDGE BASE ON SHALE OIL AND GAS IN CANADA 3 (Yellowknife, Northwest Territories 2013).

4. *Can Australia Become the World’s Leading LNG Exporter?*, ABC NEWS, <http://www.abc.net.au/news/2013-10-14/macfarlane-lng-exports/5014018> (last updated Oct. 21, 2013).

5. Susan Sakmar, *The Global Shale Gas Initiative: Will the United States Be the Role Model for the Development of Shale Gas Around the World?*, 33 HOUS. J. INT’L L. 369, 386–87, 391–92 (2011).

6. Chris Boling, *Hydraulic Fracturing and Chemical Disclosure: What You Do Not Know Could Hurt You*, 46 LOY. L.A. L. REV. 257, 260–61 (2013).

7. See Alexis Maule et al., *Disclosure of Hydraulic Fracturing Fluid Chemicals Additives: Analysis of Regulations*, 23 NEW SOLUTIONS 167, 168–70 (2013).

vice companies that often have developed the fracturing fluids that are used to produce oil and natural gas.⁸ Recently, landowners and environmental non-governmental organizations (NGOs) in the United States and Canada have demanded disclosure of the chemicals added to hydraulic fracturing fluids. The owners of the hydraulic fracturing technology are reluctant to disclose this information, and want to protect these trade secrets from competitors.⁹

This article focuses on the United States, Canada, and Australia because the three countries are federal nations with considerable shale fracking experience.¹⁰ The article evaluates the strengths and weaknesses of the state, provincial, and federal government regulatory systems in these countries. Legal systems in all three countries support the protection of intellectual property rights, including trade secrets, in their respective oil and gas industries. In determining the extent to which the contents of hydraulic fracturing fluids are to be disclosed, governments weigh public health and safety concerns against potential economic benefits. The experience in these three selected nations provides insight into the different approaches used to manage the challenges posed by the division of legislative powers in regard to environmental protection and the promotion of oil and gas development investment in competing states, provinces, and countries.¹¹ In comparing the United States, Canada, and Australia, the U.S. federal system is the oldest, from which the drafters of the British North America Act (1867 Canadian Constitution)¹² have drawn lessons. In Australia there is a more recent federal constitu-

8. See, e.g., PTAC & SCEK, *supra* note 2, at 24.

9. POE LEGGETTE ET AL., NORTON ROSE FULLBRIGHT, TRADE SECRETS AND THE REGULATION OF HYDRAULIC FRACTURING: TOWARD A GLOBAL PERSPECTIVE 9 (2013), available at <http://www.nortonrosefulbright.com/files/20140205-trade-secrets-and-the-regulation-of-hydraulic-fracturing-112410.pdf>; John D. Furlow & John R. Hays Jr., *Disclosure With Protection of Trade Secrets Comes to The Hydraulic Fracturing Revolution*, 7 TEX. J. OIL, GAS & ENERGY L. 289, 306 (2012).

10. The article examines the national laws of the United States, Canada, and Australia; the U.S. states of Alabama, Arkansas, California, Colorado, Idaho, Illinois, Indiana, Kansas, Louisiana, Mississippi, Michigan, Montana, New Mexico, New York, Oklahoma, North Dakota, Pennsylvania, South Dakota, Tennessee, Texas, Utah, West Virginia, and Wyoming; the Canadian provinces of Alberta, British Columbia, New Brunswick, and Saskatchewan; and the Australian states of Queensland and Western Australia. See discussion *infra* Parts III and IV.

11. See generally J. OWEN SAUNDERS, ED., MANAGING NATURAL RESOURCES IN A FEDERAL STATE: ESSAY FROM THE SECOND BANFF CONFERENCE ON NATURAL RESOURCES LAW (Toronto: Carswell, 1986) (example of a general discussion of this issue).

12. Constitution Act, 1867, 30 & 31 Vict, c. 3 (U.K.), reprinted in R.S.C. 1985, App. II, No. 5 (Can.), available at <http://canlii.ca/t/ldsw>.

tion, one that has emerged by drawing upon the U.S. experience but applied in a British Commonwealth context, similar to Canada.¹³

In Part I, the article explains the hydraulic fracturing process. Part II provides an overview of the regulatory frameworks in the United States, Canada and Australia. In Part III, the article discusses the federal laws that govern the disclosure of hazardous chemicals in each of the countries. Finally, Part IV examines the emerging state and provincial disclosure requirements in the United States, Canada, and Australia, with an emphasis on the type of information that needs to be disclosed to the general public, provisions regarding trade secret protection, and the disclosure of information for medical diagnosis and safety reasons, and concludes with an evaluation of the regulatory regime.

I. THE CONTROVERSIES SURROUNDING HYDRAULIC FRACTURING

For more than six decades, oil and gas well operators in the United States and Canada have fracked wells to increase the level and duration of hydrocarbon production.¹⁴ The modern technique began in 1947, when an improved hydraulic fracturing process was tested in Western Kansas and turned out to be a safer and more effective process for increasing natural gas production.¹⁵ Since then, the process has been deployed in other United States and Canadian oil and gas fields and in other hydrocarbon producing countries around the world.¹⁶

Hydraulic fracturing is a process that increases the space in hydrocarbon-producing reservoirs and facilitates hydrocarbons to flow into the wellbore at a higher rate and in a larger volume.¹⁷ In 2005, the American National Petroleum Council estimated that natural gas producers would frack 80 percent of U.S. natural gas wells drilled from 2005 to

13. See Greg Taylor, *The Division of Powers in Federal Systems: Comparative Lessons for Australia*, in GABRIELLE APPLEBY, NICHOLAS ARONEY & THOMAS JOHN, EDs., *THE FUTURE OF AUSTRALIAN FEDERALISM: COMPARATIVE AND INTERDISCIPLINARY PERSPECTIVES*, 96, 98–99 (N.Y.: Cambridge University Press, 2012) (noting that the Australian model is based on a choice between the United States and Canadian models, with Canadian federalism historically influenced by U.S. federalism, and with the Australia system modeled closely after the United States).

14. *Id.*; ROBERT BOTT ET AL., *OUR PETROLEUM CHALLENGE: CANADIAN RESOURCES. GLOBAL MARKET*. 47, 58–60, 140 (J.J. Kubik, ed., 8th ed. 2013).

15. G.C. HOWARD & C.R. FAST, *HYDRAULIC FRACTURING* 8 (Henry L. Doherty ed., 1970).

16. NORMAN J. HYNÉ, *NONTECHNICAL GUIDE TO PETROLEUM GEOLOGY, EXPLORATION, DRILLING, AND PRODUCTION* 425 (2d ed. 2001); BOTT ET AL., *supra* note 14, at 58–60, 140.

17. U.S. DEPT. OF ENERGY, *HYDRAULIC FRACTURING WHITE PAPER, A-1* (2004), available at http://www.epa.gov/ogwdw/uic/pdfs/cbmstudy_attach_uic_append_a_doe_whitepaper.pdf

2010.¹⁸ As Daniel Steinway and Thomas Jackson note, “experts have estimated that over 90 [percent] of all oil and gas wells in the [United States] today” are hydraulically fractured. Without hydraulic fracturing, domestic unconventional oil and gas would be significantly limited.”¹⁹

Wells are hydraulically fractured by injecting sand, water, and chemicals into oil and gas formations under pressure to create cracks or fractures in the rock that become conduits for hydrocarbons to flow into the wellbore.²⁰ Fracking fluids usually consist of more than 90 percent water mixed with chemical polymers.²¹ The type of chemicals added to the hydraulic fracturing fluid can vary depending on the types of shale in different sedimentary basins due to a variety of geological conditions in various areas.²² Some chemicals added to hydraulic fracturing fluids may cause negative human health effects in their pure form,²³ but these chemicals are significantly diluted in hydraulic fracturing fluids²⁴ and are toxic to humans only through direct inhalation, ingestion, or skin contact.²⁵

The concerns of landowners and environmental groups about water contamination and health and safety impacts have prompted litigation and investigation.²⁶ The first lawsuit in Canada in which a land-

18. James M. Inhofe & Frank Fannon, *Energy and the Environment: The Future of Natural Gas in America*, 26 ENERGY L.J. 349, 370 (2005).

19. Daniel M. Steinway & Thomas C. Jackson, *Hydraulic Fracturing and the Shale Gas Boom*, (April 1, 2011) available at <http://www.ogfj.com/articles/print/volume-8/issue-4/features/hydraulic-fracturing-and-the-shale-gas-boom.html>.

20. HYNE, *supra* note 16, at 422–23. See generally HOWARD & FAST, *supra* note 15 (detailed discussion of the technical aspects of the hydraulic fracturing process).

21. HYNE, *supra* note 16, at 423; EPA, EVALUATION OF IMPACTS TO UNDERGROUND SOURCES OF DRINKING WATER BY HYDRAULIC FRACTURING OF COALBED METHANE RESERVOIRS 4-2 (2004) [hereinafter EPA USDW EVALUATION 2004].

22. See EPA USDW EVALUATION 2004, *supra* note 21, at 3-5 (discussing a variety of chemicals comprising hydraulic fracturing fluids).

23. *Id.* at 4-3, 4-10 tbl. 4-1. When present in harmful concentrations, the chemicals can cause a variety of health effects in humans, including mild skin irritation, eye irritation, nausea, diarrhea, abdominal pain, severe burns and tissue damage, “heritable genetic damage,” internal organ damage, and cancer. *Id.* at 4-10 tbl. 4-1.

24. *Id.* at 4-3.

25. *Id.* at 4-17, 4-10 tbl. 4-1.

26. In 2013, two Michigan residents filed a suit in U.S. federal court and alleged that the Bureau of Land Management “failed to examine the impacts of water usage by hydraulic fracturing and the management of wastewater.” Sidley, Sidley Austin LLP, *This Week in Hydraulic Fracturing*, 36 NEWS & INSIGHTS 1 (September 2 to September 8, 2013). See B. NICHOLSON & S. DILLARD, FULLBRIGHT & JAWORSKI, LLP, ANALYSIS OF LITIGATION INVOLVING SHALE AND HYDRAULIC FRACTURING 1 (updated Nov. 1, 2012), available at <http://www.fullbright.com>. See generally Berish v. S.W. Energy Pod. Co., 763 F.Supp. 2d 702 (M.D. Pa. 2011) (The plaintiffs alleged “pollutants and other industrial waste, including frac[k] fluid and other hazardous elements including barium and strontium, were released into the ground

owner has alleged that water contamination has been caused by shale gas hydraulic fracturing operations is currently underway.²⁷ In response to public concerns about water contamination, in 2004 the U.S. Environmental Protection Agency (EPA) initiated a multiphase study of the potential for water contamination from hydraulic fracturing fluids injected into coal bed methane (CBM) wells.²⁸ The concerns about drinking water contamination have focused on the potential transport of hydraulic fracturing fluid to drinking water sources through fractures created in the hydraulic fracturing process.²⁹

In the first phase, the EPA completed a literature review surrounding the science of hydraulic fracturing and coal basins, requested information from state regulators and the public about groundwater contamination attributed to hydraulic fracturing, reviewed reports about contamination, and carried out visits to CBM fields.³⁰ The EPA concluded that the risk of hydraulic fracturing fluid migration into subsurface aquifers can be significantly decreased by three factors: (1) the concentration and flow back of fluids; (2) underground mitigating effects; and (3) dense geological barriers.³¹ In addition, the EPA noted that the low concentration of potentially toxic chemicals in hydraulic fracturing fluids combined with effective fluid recovery practices would significantly decrease the risk to drinking water sources.³² Because the first phase of the EPA investigation ultimately revealed that there was no evidence directly linking hydraulic fracturing to water contamination and concluded that the injection of hydraulic fracturing fluids into CBM wells posed “little or no threat to” drinking water sources in the United States,³³ the second phase—a more detailed, site-specific study of contamination complaints—did not proceed.³⁴

Numerous state and provincial governments have developed regimes directed toward the public disclosure of hydraulic fracturing fluids. These provisions tie into existing national governmental laws that

and contaminated the water supply utilized by the Plaintiffs.”); *Fiorentino v. Cabot Oil & Gas Corp.*, 750 F.Supp. 2d 506, 509 (M.D. Pa. 2010) (“Plaintiffs allege that the Defendants improperly performed hydraulic fracturing and other natural gas production activities which allowed the release of methane, natural gas, and other toxins onto the Plaintiffs’ land and into their groundwater.”).

27. *Ernst v. EnCana Corp.*, 2013 ABQB 537.

28. EPA USDW EVALUATION 2004, *supra* note 21, at 1-2, 1-7.

29. *Id.* at 1-6.

30. *Id.*

31. *See id.* at 7-5

32. *See id.* at 4-3 (noting that “fluid and fluid additives may contain constituents of potential concern,” but also that the constituents are “significantly diluted”); *see id.* at 4-15.

33. *Id.* at 7-5.

34. *Id.* at 7-5.

regulate the broader area of toxic chemical and hazardous substances disclosure for health, safety, and environmental protection. Before examining the emerging state and provincial regimes, this article will first provide an overview of the regulatory frameworks in the three countries, and consider the pre-existing federal government reporting and disclosure requirements for hazardous chemicals.

II. AN OVERVIEW OF REGULATORY FRAMEWORKS IN THE UNITED STATES, CANADA, AND AUSTRALIA

Jurisdiction over oil and gas and water resources can be based on ownership and on specific legislative powers outlined in the respective constitutions of the United States, Canada, and Australia.³⁵ The foundations for federal or state/provincial jurisdiction may be aligned or be in tension. The U.S. federal experience in regard to jurisdiction over mineral development and environmental regulation reflects regional diversity. In particular, the federal government secured those regions outside of the original Thirteen Colonies (even though some also ceded some land to the federal government) through cessions from foreign governments, including Spain and France.³⁶ Historically, the U.S. federal government initially owned large pieces of land from which it created numerous states, rather than bringing together states that previously owned land.³⁷ When the federal government created a state, it frequently reserved much of the land and the minerals to itself.³⁸ In several states, the U.S. federal government still owns more than two-thirds of the land of the state, in particular in Western states where unconventional oil and gas development is proceeding.³⁹ The impact of federal ownership on Western states has prompted significant conflict, and several county and state governments have attempted to challenge federal jurisdiction.⁴⁰

35. Robert Fischman, *The Federalism Dynamic in Natural Resources Law*, in LAWRENCE MACDONNELL & SARAH BATES EDS., *THE EVOLUTION OF NATURAL RESOURCES LAW AND POLICY*, 161, 163–67 (IL: ABA Publishing 2010).

36. See PAUL W. GATES, *HISTORY OF PUBLIC LAND LAW DEVELOPMENT* 33–57 (Wash. D.C.: U.S. Govt. Print Office, 1968).

37. ERIC PEARSON, *ENVIRONMENTAL AND NATURAL RESOURCES LAW* 147–53 (LexisNexis, 4th ed. 2012).

38. *Id.*

39. See U.S. Bureau of Land Mgmt., *Public Land Statistics*, tbl. 1-3 at 7 (2011), available at http://www.blm.gov/public_land_statistics/pls11/pls2011.pdf (Federal lands amount to 85 percent of Nevada and over 60 percent of each of Alaska, Idaho, and Utah, but under one percent of each of Connecticut, Delaware, Maine, New York, and Rhode Island.).

40. See *United States v. Nye County*, 920 F. Supp. 1108 (D. Nev. 1996) (federal government suing a county that had passed a county ordinance to challenge federal ownership); *Nuclear Energy Inst., Inc. v. EPA*, 373 F.3d 1251 (D.C. Circ. 2004) (Nevada attempting to challenge disproportionate impact of federal lands decisions on state.).

In Canada, Section 109 of the Constitution Act, 1867 provides that provincial governments own the oil, gas, and other natural resources on provincial lands.⁴¹ Much of the unconventional gas development to date has occurred on provincial lands. As a result, provincial regulators in major oil and gas producing provinces such as Alberta and British Columbia play a key role in regulating unconventional oil and gas development, including taking the lead in developing requirements for public disclosure of hydraulic fracturing fluid contents. This is similar to the United States, where numerous state governments have changed existing laws or developed new laws in response to the public demand for more information about the chemical contents of hydraulic fracturing fluids.

Divided jurisdiction between federal and state/provincial governments in the United States and Canada has prompted coordination challenges with regard to energy and environmental issues. Federal trade secret protection laws may be at odds with state/provincial laws regulating the disclosure of chemical fluid contents. As far as some natural resource issues are concerned, there is the long-standing practice of “cooperative federalism,” in which the federal and state or provincial governments have coordinated their activities within their respective spheres of jurisdiction to address issues.⁴²

Due to its lack of federal lands, Australia’s national government is in a substantially different position than the federal governments in North America.⁴³ The legislative powers of the Australian Commonwealth (federal government) are outlined in the Australian Constitution. The trade and commerce powers, external affairs powers, and jurisdiction in relation to Aboriginal issues are all relevant to mineral development.⁴⁴ The Commonwealth powers have been applied to regulate mineral development, especially during the era of broad judicial read-

41. Constitution Act, 1867, 30 & 31 Vict., c. 3, s. 109 (U.K.), *reprinted in* R.S.C. 1985, App. II, No. 5, *available at* <http://canlii.ca/t/ldsw>.

42. See ERIN RYAN, *FEDERALISM AND THE TUG OF WAR WITHIN* 93–97 (Oxford: Oxford University Press 2011). In Canada, the federal government and most of the provincial governments have concluded agreements to coordinate the environmental assessment process; to manage and regulate the development of offshore oil and gas resources in Atlantic Canada, the Newfoundland and Nova Scotia governments have entered into agreements with the federal government. See PENNY BECKLUMB & TIM WILLIAMS, *FEDERAL ENVIRONMENTAL ASSESSMENT. OVERVIEW OF THE LAW AND RECENT ISSUES* Pub. No. 2011-87-E (Library of Parliament 2011).

43. Michael Crommelin, *Federal-State Cooperation on Natural Resources: The Australian Experience*, in J. OWEN SAUNDERS, ED., *MANAGING NATURAL RESOURCES IN A FEDERAL STATE* 295, 310 (Toronto: Carswell, 1986).

44. *Commonwealth of Australia Act, 1900* (Cth), ss. 51(i), 51(xxix), 51 (xxvi).

ings of Commonwealth enunciated constitutional powers.⁴⁵ Federal legislative powers regarding oil and gas regulation are limited to the corporations power (s51(20) of the Constitution), and interstate and overseas trade (s51(i)).⁴⁶ Therefore, the Australian federal government has jurisdiction only within its specifically enumerated constitutional powers, with all other jurisdiction under the regulatory ambit of the states. The residual constitutional power in Australia is explicitly at the state level, with most mineral resources also subject to proprietary ownership at the state level.⁴⁷ Ownership, and therefore the regulation, of mineral and petroleum resources fall within the regulatory jurisdiction of the individual states. The exception is the so-called “water-trigger,” a matter of national environmental significance under section 24D of the Environmental Protection and Biodiversity Conservation Act 1999 (Cth), which requires all CBM activities (although not shale gas activities)⁴⁸ to be referred to the Commonwealth for assessment and approval.⁴⁹

Due to a difference in the historical pattern of private land ownership and more significant role for the U.S. federal government in mineral development, there appears to be a more centralized model of federalism in the United States than in Canada. Australia and Canada are more similar in their approach to oil and gas jurisdictional issues; however, Australia’s division of powers concerning oil and gas appears to be more decentralized than in Canada.

45. This era occurred particularly during the late 1970s and the 1980s, where the High Court of Australia was judicially active, considerably expanding the scope of several enumerated powers under s51 of the constitution. In particular the External Affairs power, s51 (xxix), was expanded with the decision of *Commonwealth v. Tasmania* 158 CLR 1 (1983). See PAUL MARTIN ED., *ENVIRONMENTAL GOVERNANCE AND SUSTAINABILITY* 197 (2012).

46. *Commonwealth of Australia Act, 1900* (Cth), ss. 51 (20), 51 (i); Richard Cullen, *The Encounter Between Natural Resources and Federalism in Canada and Australia*, 24 *UNIV. BRIT. COLUM. L. REV.* 275, 277–78 (1990).

47. See Crommelin, *supra* note 43, at 296. The Commonwealth Government had held proprietary ownership rights to resources in the Northern Territory but transferred all such rights other than those related to uranium to the territorial government when Northern Territory self-government was established in 1978. *Id.* at 300–301. Self-government was pursuant to the *Northern Territory (Self Government) Act, 1978* (Cth).

48. Coal bed methane, also known as coal seam gas, is methane that has been extracted from coal seams. This usually occurs through the dewatering of coal measures, and generally involves the use of hydraulic fracturing in less than 10 percent of cases. Conversely, shale gas is the extraction of methane from the geologically tight shale rock formations. The extraction of shale gas requires the use of hydraulic fracturing to create porosity and permeability in the shale rocks. See generally Allan Ingelson, *Sustainable Development and the Regulation of the Coal Bed Methane Industry in the United States*, 20 *J. NAT. RES. & ENVTL. L.* 51 (2005–2006).

49. HYNNE, *supra* note 16, at 423–25.

III. PRE-EXISTING FEDERAL LAWS GOVERNING THE DISCLOSURE OF HAZARDOUS CHEMICALS

A. United States

In the United States, state occupational health and safety statutes require disclosure of hazardous chemical information on Material Safety Data Sheets (MSDS).⁵⁰ For many years the MSDS reporting system has provided trade secret protection for hazardous products.⁵¹ In the United States petroleum industry, the Bureau of Land Management (BLM) is the main federal government agency that regulates shale oil and gas development on federal onshore lands.⁵² Regulations designed for conventional oil and gas exploration govern drilling and hydraulic fracturing activities, including those in the emerging shale gas industry, were created in 1982 and revised in 1988.⁵³ Several scholars have noted a lack of rigor in U.S. federal regulations to prompt disclosure about the chemical and additive contents of hydraulic fracturing fluids.⁵⁴ New federal legislation has been proposed, which is called the Fracturing Responsibility and Awareness of Chemicals Act.⁵⁵ The proposed act would eliminate an exemption for hydraulic fracturing under the Safe Drinking Water Act.⁵⁶ The proposed legislation provides for the disclosure of detailed information about the contents of hydraulic fracturing fluids both before hydraulic fracturing operations proceed and after the industrial operations are completed.⁵⁷

The proposed federal legislation mandates public disclosure of the total volume of water used in the fluid and the trade name, supplier, purpose, ingredients, Chemical Abstract Service (CAS) number, maximum ingredient concentration in additive (percent by mass), and maximum ingredient concentration in hydraulic fracturing fluid (percent by

50. LEGGETTE ET AL., *supra* note 9, at 9.

51. *Id.*

52. U.S. DEPT. OF THE INTERIOR, BUREAU OF LAND MGMT., WHAT WE DO, *available at* <http://www.blm.gov/wo/st/en.html>.

53. *See, e.g.*, 43 C.F.R §3162.3-2 (1988).

54. Hannah J. Wiseman, *The Private Role in Public Fracturing Disclosure and Regulation*, 3 HARV. BUS. L. REV. ONLINE 49, 50 (2013), <http://www.hblr.org/2013/02/the-private-role-in-public-fracturing-disclosure-and-regulation/>; Maule et al., *supra* note 7, at 171.

55. Fracturing Responsibility and Awareness of Chemicals Act of 2013, H.R. 1921, 113th Cong. (2013), *available at* <https://www.govtrack.us/congress/bills/113/hr1921/text>.

56. *Id.* §2(a).

57. *Id.* §2(b) (“(b) Disclosure of Hydraulic Fracturing Chemicals; Medical Emergencies; Proprietary Chemical Formulas- Section 1421(b) of the Safe Drinking Water Act (42 U.S.C. 300H(b)) is amended by adding: (4)(A) Regulations included under paragraph (1)(C) shall include additional information.”).

mass) for each chemical used (including base fluid).⁵⁸ For hydraulic fracturing operations on U.S. federal lands, to qualify for trade secret status⁵⁹ the operator must submit to the BLM an affidavit that identifies the federal statute or regulation that allows withholding of the information from the BLM or prohibits the BLM from disclosing the information; affirms that the information is not publicly available; and affirms that the release of the information would likely harm the operator's competitive position.⁶⁰ The information is to be provided to the BLM or disclosed on the FracFocus website.⁶¹

B. Canada

Canada's provincial occupational health and safety statutes also require disclosure of hazardous chemical information on Material Safety Data Sheets (MSDS).⁶² As has been the case in the United States, oil companies in Canada are investigating the potential for shale oil and gas production from federal lands. Canada's national energy regulator, the National Energy Board (NEB), recently released a new federal regulatory development in September 2013, including new information filing requirements for hydraulic fracturing operations and fluid contents applicable on federal lands in northern Canada (the Northwest Territories and Nunavut).⁶³ In these territories, hydraulic fracturing of oil and gas wells is regulated under the Canada Oil and Gas Operations Act.⁶⁴ According to the 2013 "Filing Requirements For Onshore Drilling Operations Involving Hydraulic Fracturing," applications for authorizations for drilling and hydraulic fracturing operations are to include an "Environmental Protection Plan" (EPP).⁶⁵ Filing requirement 19 indicates that the applicant is to "[d]escribe the procedures for the selection, evaluation, and use of chemical substances, including process chemicals and drilling fluid ingredients." The 19th filing requirement does not prescribe

58. BRANDON J. MURRILL & ADAM VANN, CONG. RESEARCH SERV. HYDRAULIC FRACTURING: CHEMICAL DISCLOSURE REQUIREMENTS 14 (2012), available at <http://www.fas.org/sgp/crs/misc/R42461.pdf>.

59. See *id.* at 8.

60. DEP'T OF THE INTERIOR, BUREAU OF LAND MGMT. 4310-84P, 43 C.F.R. pt. 3160, 32, available at http://www.blm.gov/pgdata/etc/medialib/blm/wo/Communications_Directorate/public_affairs/hydraulicfracturing.Par.91723.File.tmp/HydFrac_SupProposal.pdf.

61. MURRILL & VANN, *supra* note 58, at 5.

62. LEGGETTE ET AL., *supra* note 9, at 9.

63. NAT'L ENERGY BD., FILING REQUIREMENTS FOR ONSHORE DRILLING OPERATIONS INVOLVING HYDRAULIC FRACTURING 19 (2013) available at http://publications.gc.ca/collections/collection_2013/one-neb/NE23-175-2013-eng.pdf.

64. Canada Oil and Gas Operations Act, R.S.C. 1985, c. O-7.

65. NAT'L ENERGY BD., *supra* note 63, at 13.

more specific information than what is indicated above. The 20th filing requirement directs the applicant to “[i]ndicate if the applicant is willing to publically disclose the chemicals used in the hydraulic fracture fluids.”⁶⁶

At this time it is unclear whether the NEB will approve hydraulic fracturing programs in the future unless the operator is prepared to disclose the types of chemicals and additives to be used. There is also a lack of clarity as to the specific information that may or may not need to be disclosed to the Canadian federal energy regulator. However, in regard to Canadian voluntary best industry practices, it is interesting to note that in 2011 the leading national upstream oil industry association (called the Canadian Association of Petroleum Producers (CAPP)) adopted “new industry guiding principles and operating practices for hydraulic fracturing” and that the “industry actively supports disclosing the content of fracturing fluids in operations.”⁶⁷

All substances manufactured or used in Canada, including those in hydraulic fracturing fluids, have been regulated by the federal government under the Canadian Environmental Protection Act (CEPA) since 1999.⁶⁸ The Act provides for the evaluation of human health and environmental risks from these substances and creates timelines for the regulation of toxic substances.⁶⁹ CEPA has protected the environment for several decades by establishing a national framework under which no new substances, including chemicals in hydraulic fracturing fluids, can be introduced into the country prior to an evaluation of their toxicity.⁷⁰ The legislation requires that the manufacturer of a new substance notify Canada’s Federal Minister of the Environment and furnish comprehensive information about the substance. At the time that the party submits information to support the notification about the new substance, a request in writing may be made to treat the information as confidential under the Hazardous Products Act.⁷¹ To protect the health and safety of workers, suppliers of substances controlled under the CEPA need to provide health and safety information on the labels of containers and in MSDS reports, including the identity of the chemical in a product if it exceeds the specified minimum concentration.⁷²

66. *Id.* at 14.

67. BOIT ET AL., *supra* note 14, at 60.

68. Canadian Environmental Protection Act, S.C. 1999, c. 33.

69. *Id.* §§ 45, 46(5).

70. *Id.* §§ 70 to 71.

71. Hazardous Products Act, R.S.C. 1985, c. H-3 (Can.).

72. In the context of hydraulic fracturing fluids, the information that must be provided to support a claim of confidentiality includes the following:

If the requirements of the Act are satisfied, the Canadian federal government recognizes the confidentiality of the trade secret claimed by a hydraulic fracturing fluid developer or owner.⁷³ The Controlled Product Regulations provide further details on the information reporting process in Canada.⁷⁴ As in the United States, if publication of the specific identity of a substance would cause the loss of a trade secret, the party concerned about protecting its trade secret must employ a masked name to avoid discovery of the specific chemistry of the substance in question.⁷⁵ Unlike the United States, Canada's Hazardous Materials Information Review Act⁷⁶ requires oversight by a special federal government agency called the Hazardous Materials Review Commission, which reviews and registers information pertaining to trade secrets.⁷⁷

C. Australia

In Australia, the Industrial Chemicals (Notification and Assessment) Act requires the industrial chemicals used in drilling and hydraulic fracturing to be listed on the national Australian Inventory of Chemical Substances, which is maintained by the National Industrial Chemicals Notification and Assessment Scheme (NICNAS).⁷⁸ All new chemicals, including those used for fracking, must be assessed by NICNAS. Most chemicals listed on NICNAS have not been assessed for human health and environmental impacts, nor has NICNAS assessed

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1. The hydraulic fracturing fluid company claims that the information is confidential;
 2. The company reports that the information pertaining to the hydraulic fracturing fluid is not publicly available;
 3. The information is not, and in the past has not been reasonably obtainable by third parties through a legitimate vehicle, except with the notifier's consent;
 4. The party has made reasonable efforts and will continue those efforts to protect the confidentiality of the hydraulic fracturing fluid;
 5. If the contents of the hydraulic fracturing fluid are disclosed, that disclosure may be reasonably expected to cause significant damage to the competitiveness of the hydraulic fracturing fluid company;
 6. The company indicates that disclosure of the hydraulic fracturing fluid contents may be reasonably expected to cause significant financial loss to itself or significant financial gain to a competitor.

See LEGGETTE ET AL., *supra* note 9, at 19.

73. *Id.*

74. Controlled Products Regulations, SOR/80-66 (Can.).

75. Masked Name Regulations, SOR/94-261 (Can.).

76. Hazardous Materials Information Review Act, R.S.C. 1985, c. 24 (Can.).

77. *Id.* §§ 11, 13, 15.

78. See Suzanne Benn, *Managing Toxic Chemicals in Australia: A Regional Analysis of the Risk Society*, 7 J. OF RISK RES. 399 (2004) (Can.).

any chemicals used in hydraulic fracturing.⁷⁹ The Australian government recognizes this gap in chemical assessment, and a joint project between NICNAS, the Commonwealth Scientific Industrial Research Organisation (CSIRO), the Department of Environment, and Geoscience Australia is currently undertaking an independent assessment of the chemicals used in drilling and hydraulic fracturing associated with CBM.⁸⁰ This study will assess the occupational, public health, and environmental risks associated with the chemicals used in the hydraulic fracturing process.⁸¹ Similarly, new legislation in Western Australia, Australia's leading shale gas jurisdiction, has introduced strict mandatory disclosure requirements that are fully supported by the peak producers' body of the Australian Petroleum Production and Exploration Association (APPEA).

The American, Canadian, and Australian governments have created regimes at the federal level that address health and safety concerns associated with controlled substances generally. Although some of these substances include chemicals that may be added to hydraulic fracturing fluids, the studies are not specifically concerned with such chemicals. At the state/provincial level, however, regimes are emerging that are explicitly directed toward hydraulic fracturing fluids.

IV. EMERGING STATE AND PROVINCIAL DISCLOSURE REQUIREMENTS

A. United States

Significant changes have occurred in U.S. state regulatory systems during the last five years. For example, Wyoming received criticism for the lack of a rigorous environmental protection regulatory framework to manage the environmental impacts from unconventional natural gas wells in the Powder River Basin.⁸² As a result, in September 2010 its state government became the first to change its regulatory system to compel disclosure of hydraulic fracturing fluid contents to the Wyoming Oil and Gas Conservation Commission (WOGCC).⁸³ The state regulations outline

79. STANDING COMM. ON ENERGY RES., NATIONAL HARMONISED REGULATORY FRAMEWORK FOR NATURAL GAS FROM COAL SEAMS 66 (2013) [hereinafter HARMONISED FRAMEWORK].

80. *Id.*

81. *Id.*

82. See generally Steffen Jenner & Alberto J. Lamadrid, *Shale Gas vs. Coal: Policy Implications from Environmental Impact Comparisons of Shale Gas, Conventional Gas, and Coal on Air, Water, and Land in the United States*, 53 ENERGY POL'Y 442 (2013), available at http://www.fraw.org.uk/files/extreme/jenner_lamadrid_2013.pdf.

83. See MURRILL & VANN, *supra* note 58, at 10.

the disclosure process to be followed, the parties responsible for providing the information, the type of information that must be disclosed, and the time by which the information must be provided.⁸⁴ Detailed information about the chemical contents of the fluids must be disclosed to the Wyoming oil and gas industry regulator, including all proposed “chemical additives, compounds and concentrations or rates to be mixed and injected” during each stage in the hydraulic fracturing process.⁸⁵ However, Wyoming exempts the disclosure of fluid information to the public if the oil and gas operator claims that the information is a trade secret. This is not unusual, as most state governments endorse the protection of trade secrets claimed by developers and owners of hydraulic fracturing fluids.⁸⁶ In Wyoming, for example, trade secret protection for fluids is recognized in the Wyoming well stimulation guidelines.⁸⁷ However, the state law does not address how a request for the protection of trade secrets will be evaluated, or what standard will be used to decide whether the information will be confidential under the Public Records Act,⁸⁸ and this prompted a lawsuit.⁸⁹

In 2012, several environmental groups in Wyoming initiated a lawsuit alleging that the WOGCC (1) failed to adequately scrutinize the validity of a request for trade secret protection, and (2) applied the confidentiality protection afforded under the Wyoming Public Records Act too broadly.⁹⁰ In the litigation, the plaintiffs argued that the state government should require disclosure of all hydraulic fracturing fluid chemicals used in an operation.⁹¹ They argued that an operator should only be

84. Oil Gen ch. 3 WYO. CODE R. § 45(a)–(h) (2014).

85. Oil Gen ch. 3 WYO. CODE R. § 45(d). (The guidelines for well stimulation provides that the Owner or Operator shall provide detailed information about the chemical additives, compounds, and concentrations or rates proposed to be mixed and injected.).

86. Examples of states that recognize and support trade secret claims include: Alabama, Arkansas, Colorado, Idaho, Illinois, Indiana, Louisiana, Montana, New Mexico, North Dakota, Ohio, Oklahoma, Pennsylvania, South Dakota, Tennessee, Texas, and Wyoming. See discussion *supra* Part IV.A.

87. Oil Gen ch. 3 WYO. CODE R. § 45(f).

88. WYO. STAT. ANN. § 16-4-201 (2013).

89. An environmental group challenged a decision of a WOGCC supervisor that the contested information was a trade secret and therefore did not have to be disclosed to the public based on section 203(d)(v) of the Wyoming Public Records Act, WYO. STAT. ANN. §16-4-203(d)(v). The district court affirmed the Supervisor’s decision, decided in favor of the state, and concluded that the agency’s supervisor acted neither arbitrarily nor capriciously. This decision was appealed, and now the Wyoming Supreme Court has ruled. *Powder River Basin Resource Council v. Wyoming Oil and Gas Conservation Commission and Haliburton Energy Services, Inc.*, 2014 WY 37, 320 P.3d 222 (Wyo. 2014).

90. *Powder River Basin Res. Council v. Wyo. Oil & Gas Conservation Comm’n*, Civ. Action 94650, 7th Judicial Dist., Natrona County, Wyo. (Mar. 23, 2012).

91. See *Powder River Basin*, 320 P.3d at 227.

allowed to withhold the fluid chemical formula if it can successfully prove that there will be particular harm if that information is disclosed.⁹² The hydraulic fracturing fluid formula developer, on the other hand, argued that if the specific chemicals are disclosed, industry competitors could determine the formula and secure a competitive advantage.⁹³ The district court affirmed the Supervisor of the Oil and Gas Commission's denial of a request for public records specifying the chemicals used in hydraulic fracturing operations, and the environmental NGOs appealed.

On March 12, 2014, the Wyoming Supreme Court held that the appellants did not follow the specified procedures regarding the disclosure of information required under the Wyoming Public Records Act. The court concluded that it was the responsibility of the district court to independently determine whether hydraulic fracturing fluid information had to be disclosed, instead of reviewing the administrative decision of the Supervisor. Since Wyoming's adoption of disclosure laws in 2010, numerous state governments have followed suit and have amended their legislation or regulations, and some are in the process of doing so.⁹⁴

In this section, the article explores the regulatory systems of U.S. states, including the type of information to be disclosed, trade secret protection, time of disclosure, and disclosure for health and safety reasons. Many U.S. states mandate the disclosure of detailed information about the chemicals and additives in hydraulic fracturing fluids.⁹⁵ A California law, for example, provides that the identification of chemical constituents of fluid additives, concentrations of additives, the chemical composition of flow back fluids, and health and safety data are not considered

92. *Id.*

93. *Id.* at 243.

94. California is one example where comments on draft regulations are being solicited. See CAL. GOV'T, DEP'T OF CONSERVATION, "DISCUSSION DRAFT" OF CALIFORNIA HYDRAULIC FRACTURING REGULATIONS RELEASED, available at http://www.conservation.ca.gov/dog/general_information/Pages/DDraftHFRregs.aspx.

95. These states include Louisiana (Hydraulic Fracture Stimulation Operations, LA. ADMIN. CODE tit. 43, pt. XIX, § 118 (1911)); Mississippi (Mississippi State Oil & Gas Board (MSOGB), Rule 1.26—Requirements for Hydraulic Fracture Stimulation—Report of Shooting or Treating); New Mexico (N.M. CODE R. § 19.15.16.19(B), (2012)); Colorado (COLO. SEC'Y STATE, DEP'T OF NAT. RES., OIL & GAS CONSERVATION COMM'N, PRACTICE AND PROCEDURE 200-SERIES: GENERAL RULES); Texas (16 TEX. ADMIN. CODE § 3.29 (2012)); Utah (UTAH ADMIN. CODE, r. 649-3-39 (2013)); Montana (Montana Board of Oil and Gas, Final Hydraulic Fracturing Rules, MONT. ADMIN. R. 36.22.1106 (2011)); New York (Bill S2284-2013); Pennsylvania (Pennsylvania Oil and Gas Act, 58 PA. CONS. STAT. §§ 3222(b.1) & 3222.1 (Hydraulic Fracturing Chemical Disclosure Requirements) (2012)); West Virginia (W. VA. CODE § 22 (Environmental Resources)); Michigan (STATE OF MICHIGAN, DEP'T OF ENVTL. QUALITY, SUPERVISOR OF WELLS INSTRUCTION 1-2011: HIGH VOLUME HYDRAULIC FRACTURING WELL COMPLETIONS); and California (California Legislature, 2013 to 2014 Regular Session, Assembly Bill No. 7).

to be a trade secret.⁹⁶ Other state governments, such as Arkansas, Colorado, Louisiana, Mississippi, Montana, Oklahoma, Tennessee, and Texas, require disclosure of the chemical family of additives to hydraulic fracturing fluid.⁹⁷

In states such as Indiana, Louisiana, Michigan, Mississippi, Montana, and New Mexico, the type of information that needs to be disclosed is limited to hazardous chemicals, which are regulated under the U.S. Occupational Safety and Health Administration (OSHA).⁹⁸ In New Mexico, the division does not require the reporting of information beyond the MSDS data.⁹⁹ Other state governments do not limit their public disclosure requirements to chemicals regulated under OSHA.¹⁰⁰ Currently in the United States, the information to be disclosed is inconsistent among the states. This can lead to confusion on the part of companies operating in more than one state, and public questioning as to why uniform information is not disclosed throughout the country.

State laws also vary in their disclosure requirements. Some states require the disclosure of a CAS number when it is available,¹⁰¹ while other states do not require such disclosure.¹⁰² In some states, hydraulic

96. The California Division of Oil, Gas and Geothermal Resources issued its first draft regulations on November 15, 2013 and its draft emergency interim regulations on January 1, 2014. For further discussion of this issue see ELIZABETH A. LAKE, UNITED STATES: CALIFORNIA'S NEW HYDRAULIC FRACTURING REGULATIONS: IMPLICATIONS AND NEXT STEPS (Nov. 26, 2013), available at <http://www.mondaq.com/unitedstates/x/277642/Environmental+Law/Californias+New>.

97. Arkansas (178-00-001 ARK. CODE R. § B-19 (2011)); Colorado (COLO. CODE REGS. § 404-1:205A (2012)); Louisiana (LA. ADMIN. CODE tit. 43, pt. XIX, § 118 (2011)); Mississippi (MSOGB, Rule 1.26—Requirements for Hydraulic Fracture Stimulation—Report of Shooting or Treating); Montana (MONT. ADMIN. R. 36.22.1106 (2011)); Oklahoma (OKLA. ADMIN. CODE § 165:10-3-10(b) (2010)); Tennessee (TENN. COMP. R. & REGS. 0400-53-01-.03 (2013)); and Texas (16 TEX. ADMIN. CODE § 3.29 (2012)).

98. 29 C.F.R. § 1910.1200 (2013).

99. N.M. CODE R. §19.15.16.19(B) (2012).

100. Alabama (ALA. ADMIN. CODE r. 400-1-9.04 (2014)); Arkansas (178-00-001 ARK. CODE R. § B-19 (2011)); California (California Legislature—2013–14 Regular Session, Assembly Bill No. 7); Colorado (COLO. CODE REGS. § 404-1:205A (2012)); Idaho (IDAHO ADMIN. CODE r. 20.07.02.056 (2012)); Illinois (S.B. 1715 Hydraulic Fracturing Regulatory Act (2013)); North Dakota (N.D. ADMIN. CODE § 43-02-03-27.1 (2012)); Ohio (OHIO REV. CODE § 1509.10 (2012)); Oklahoma (OKLA. ADMIN. CODE § 165:10-3-10(b) (2010)); South Dakota (S.D. ADMIN. R. 74:12:02:19 (2012)); Tennessee (TENN. COMP. R. & REGS. 0400-53-01-.03 (2013)); Texas (16 TEX. ADMIN. CODE § 3.29 (2012)); Utah (UTAH ADMIN. CODE, r. 649-3-39 (2013)); West Virginia (W. VA. CODE § 22 (Environmental Resources)); and Wyoming (Oil Gen ch. 3 WYO. CODE R. § 45(d) (2014)).

101. Alabama, Arkansas, California, Colorado, Idaho, Illinois, Louisiana, Mississippi, Montana, New Mexico, Ohio, Oklahoma, South Dakota, Tennessee, Texas, and Wyoming. See *infra* note 197.

102. Indiana, Michigan, North Dakota, Pennsylvania, Utah, and West Virginia.

fracturing fluid developers or owners are explicitly required to substantiate their claim for trade secret protection, but in other states there is no such requirement.¹⁰³ Some states allow members of the public to challenge a fluid developer's claim for trade secret protection,¹⁰⁴ while in others there is no explicit provision to do so. In states such as Colorado, Ohio, Pennsylvania, and Texas, the state governments have specified a process for challenging the developer's claim for trade secret protection.¹⁰⁵

Several states regulate provision of fluid information disclosure for health and safety reasons, as with the proposed federal legislation.¹⁰⁶ Medical reasons are invoked for the disclosure of information about the chemical contents of the fluids in some states.¹⁰⁷ However, other state governments do not provide for disclosure, even to assist with the diagnosis and treatment of workers exposed to hydraulic fracturing fluid chemicals in the event of a fluid spill or release.¹⁰⁸

With respect to the timing of information disclosure, the majority of state governments require disclosure of the contents of the hydraulic fracturing fluids only after the hydraulic fracturing operations have been performed. Other states require disclosure both before and after the hydraulic fracturing operations.¹⁰⁹ Often, the information must be disclosed

103. Such as Arkansas, California, Colorado, Illinois, Ohio, Oklahoma, Pennsylvania, Tennessee, Texas, West Virginia, and Wyoming. See *infra* text accompanying notes 104 to 110.

104. Colorado, Illinois, Louisiana, Ohio, Pennsylvania, Tennessee, and Texas.

105. In Colorado, there are two ways to challenge the trade secret: 1) via complaint to the Director of the Colorado Oil and Gas Conservation Commission (COLO. CODE REGS. 404-1:522 (1994)); or 2) via district court action pursuant to the Oil and Gas Conservation Act, COLO. REV. STAT. § 34-60-114 (1963); in Ohio, challenges are governed by OHIO REV. CODE ANN., §1509.10(H)(1) (2012); in Pennsylvania, the process for challenge is governed by 58 PA. CONS. STAT. §3222 (2012), see also VINSON & ELKINS LLP, HYDRAULIC FRACTURING FLUID DISCLOSURE REQUIREMENTS (2013), available at <http://www.velaw.com/uploadedFiles/VEsite/Resources/HydraulicFracturingFluidDisclosureRequirements.pdf>; in Texas, the process is described in 16 TEX. ADMIN. CODE § 3.29(f)(3) (2012).

106. Fracturing Responsibility and Awareness of Chemicals Act of 2013, H.R. 1921.

107. Examples include Alabama, Arkansas, California, Colorado, Idaho, Illinois, Louisiana, Montana, New York, Ohio, Tennessee, Texas, and West Virginia.

108. For example, Indiana, Michigan, Mississippi, New Mexico, North Dakota, Oklahoma, South Dakota, Utah, and Wyoming.

109. Alabama, Arkansas, Colorado, Louisiana, Michigan, Mississippi, Montana, New Mexico, North Dakota, Ohio, Oklahoma, Pennsylvania, South Dakota, Tennessee, Texas and Utah. Only California, Idaho, Illinois, Indiana, West Virginia, and Wyoming also require disclosure before the hydraulic fracturing operations occur.

within 30 days of completing the hydraulic fracturing operations, but in some states a longer period of 60 days is allowed.¹¹⁰

In the United States, the stringency of regulations regarding hydraulic fracturing fluid content disclosure at the state level differs significantly, even though numerous states have modelled their legislation based on the approach adopted in Texas and subsequently followed in Pennsylvania. The requirements describing the information that needs to be disclosed vary widely in each state and this lack of uniformity prompts confusion for oil and gas companies that operate in several states. Another weakness of the regulatory system in the United States is that in some state regulations disclosure is limited to hazardous chemicals only. The level of detail on chemicals and additives required to be disclosed often depends on how the states address the issue of trade secret protection, as the legislation and regulations usually allow companies to withhold information from disclosure at the regulator's discretion or to submit fewer details about proprietary chemicals, except, perhaps, in emergencies. Even if a disclosure law does not prevent information from public disclosure, other state laws, such as an exemption in an open records law, may do so. Finally, the lack of established criteria for evaluating trade secret protection claims is another weakness of the regulatory regime in the United States.

However, there are states that have strengthened their disclosure requirements by asking applicants to substantiate those claims. It is important to have a process in place to challenge trade secret claims because it facilitates increased public scrutiny, increases process transparency, and builds public confidence in the regulatory process. With regard to the timing of disclosure, a few state laws require at least some disclosure of information about fracturing fluid chemical composition before fracturing is performed, but these states typically require less detailed information to be provided before fracturing than afterward. Overall, while the United States does have requirements in each state for the disclosure of hydraulic fracturing fluid contents, the inconsistent state regulations creates confusion, particularly for oil and gas companies operating in more than one state.

B. Canada

Unconventional hydraulic fracturing operations in shales are more recent in Canada than in the United States due to the fact that this

110. See, e.g., Colorado (COLO. REV. STAT. ANN. § 404-1:205A (2014)); Ohio (S.B 315 Section 1509.10); and Pennsylvania (Pennsylvania Oil and Gas Act, 58 PA. CONS. STAT. § 3222 (2012): Hydraulic Fracturing Chemical Disclosure Requirements).

innovative extraction technology was pioneered in the state of Texas. To date, only three provinces, British Columbia, Alberta, and New Brunswick, have created more detailed provisions to regulate hydraulic fracturing fluids.¹¹¹

1. British Columbia

British Columbia (B.C.) has hosted most of the shale gas exploration and production operations in Canada thus far.¹¹² In B.C., the main provincial oil and gas industry regulator is the B.C. Oil and Gas Commission (OGC), pursuant to the Oil and Gas Activities Act.¹¹³ In November 2013, a joint press release from the OGC, the B.C. Ministry of Natural Gas Development, and the Alberta Energy Regulator estimated that there is 449 trillion cubic feet (tcf) of marketable natural gas in the Montney formation.¹¹⁴ On January 1, 2012, the OGC mandated public disclosure of the contents of hydraulic fracturing fluids.¹¹⁵ The B.C. Drilling and Production Regulation requires specific information to be collected by the well permit holder, recorded in hydraulic fracturing fluid records, and provided to the provincial regulator within 30 days after the completion of the well.¹¹⁶ Section 37 provides that “[t]he well holder must provide records detailing the type, quality and supplier of every chemical ingredient injected into the well.”¹¹⁷ Indeed, the well permit holder must maintain detailed records of the composition of all fracking fluids that are used in a well for which the well permit holder is responsible, including, but not limited to, the well authorization number; the fracture date; an identification of the fluid ingredients and a description of the purpose of each; an identification of the ingredient concentration in the additive and in the hydraulic fracturing fluid; the chemical ab-

111. PAUL PRECHT & DON DEMPSTER, JURISDICTIONAL REVIEW OF HYDRAULIC FRACTURING REGULATION, REPORT FOR NOVA SCOTIA HYDRAULIC FRACTURING REVIEW COMMITTEE 6 (2012), available at <http://www.novascotia.ca/nse/pollutionprevention/docs/Consultation.Hydraulic.Fracturing-Jurisdictional.Review.pdf.mju>; ENERGY & MINES MINISTERS' CONFERENCE, *supra* note 3, at 3.

112. BOTT ET AL., *supra* note 14, at 59.

113. PRECHT & DEMPSTER, *supra* note 111, at 8.

114. NAT'L ENERGY BD. ET AL., THE ULTIMATE POTENTIAL FOR UNCONVENTIONAL PETROLEUM FROM THE MONTNEY FORMATION OF BRITISH COLUMBIA AND ALBERTA—ENERGY BRIEFING NOTE 4 (Nov. 2013), available at <http://www.neb-one.gc.ca/clf-nsi/rnrgynfmrtn/nrgyrprt/ntrlgs/lmtptntlmntnyfrmtn2013/lmtptntlmntnyfrmtn2013-eng.html>.

115. PRECHT & DEMPSTER, *supra* note 111, at 9.

116. *Drilling and Production Regulation*, OIL AND GAS ACTIVITIES ACT, B.C. Reg. 282/2010, § 37(1) “Fracturing Fluids Records,” available at http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/282_2010#section37.

117. British Columbia Oil and Gas Activities Act Drilling and Production Regulation, SOR/2009-315.

tract service number of each ingredient; an identification of the total volume of water injected with the ingredients; and the trade name and supplier of each ingredient.¹¹⁸

As with U.S. states, the province of B.C. supports the protection of trade secrets. For any ingredient that is subject to a claim for exemption through the Hazardous Material Information Review Act, the registry number must be provided.¹¹⁹ However, a special federal government agency, the Hazardous Materials Review Commission, has to review and register information pertaining to trade secrets.¹²⁰

2. Alberta

On December 19, 2012, the provincial oil industry regulator, the Alberta Energy Regulator (AER),¹²¹ announced its decision to increase public access to information about the contents of hydraulic fracturing fluids used in the province and issued Directive 059.¹²² Sections 2.4 and 4.3.1 of the directive provide for the disclosure of detailed information about the contents of hydraulic fracturing fluids: “[I]licensees must submit summary electronic fracture fluid composition and fracture fluid water source data to the ERCB within 30 calendar days from the conclusion of an operation.”¹²³

Directive 059 requires licensees to disclose “fracture components” such as carrier fluids, proppants, and additives to the fracture fluid,¹²⁴ as

118. *Id.* at § 37.

119. B.C. OIL & GAS COMM’N, FRACTURE FLUID REPORT UPLOAD MANUAL 11 (Jan. 12, 2012), available at <http://www.bcogc.ca/node/6068/download?documentID=1208&type=.pdf>.

120. Hazardous Materials Information Review Act, R.S.C. 1985, c. 24.

121. On June 17, 2013, the decades old Energy Resources Conservation Board (ERCB) was replaced by a new oil and gas industry regulator called the Alberta Energy Regulator (AER) in order to streamline the provincial oil and gas project approval process. See Responsible Energy Development Act, Alta. Reg., 90/2013, (2014).

122. Energy Res. Conservation Bd., *ERCB Improves Public Access to Hydraulic Fracturing Fluid Information FracFocus.ca Coming Soon to Alberta*, ALBERTA ENERGY REGULATOR (Dec. 19, 2012), available at <http://www.aer.ca/about-aer/media-centre/news-releases/news-release-2012-12-19-nr2012-14>; Energy Res. Conservation Bd., *Directive 059: Well Drilling and Completion Data Filing Requirements*, ALBERTA ENERGY REGULATOR (Dec. 19, 2012), available at <http://www.aer.ca/documents/directives/Directive059.pdf> [hereinafter Directive 059].

In Alberta, an ERCB directive is considered to have the force of a regulation. See Nickie Vlavianos, *A Single Regulator for Oil and Gas Development in Alberta? A Critical Assessment of the Current Proposal*, CAN. INST. OF RES. LAW, Number 113 (2012).

123. Directive 059, *supra* note 122, at § 2.4.

124. The following information must be provided to the AER:

1. Carrier Fluid including the Fluid Type from the list provided in the AER user guide; the volume of carrier fluid in cubic metres to be used;

well as “component ingredients.”¹²⁵ For each ingredient, certain information is to be provided to the AER. However, if the ingredient is considered to be a trade secret, the information will be withheld from the public.¹²⁶

Therefore, as in the United States, the Alberta provincial government also recognizes and supports the protection of trade secrets. For substances considered to be hazardous under the *Hazardous Materials Information Review Act (HMIRA)*,¹²⁷ the AER follows the Act and allows trade secrets to be protected from disclosure through the provisions of HMIRA registry numbers.¹²⁸ In the absence of the AER Directive 059, it would be more difficult to protect a trade secret involving non-hazardous ingredients for which HMIRA registrations are unavailable. However, as some oil and gas companies are now developing fracturing

2. Proppant—the type of Proppant used as indicated on the list in the user guide; Trade Name—the trade name of the proppant, i.e., the name that the supplier uses to identify the proppant; and Supplier—the name of the proppant supplier.
3. Additive—when Additive is to be used, the following information is to be provided: Trade Name—the trade name of the additive, i.e., the name that the supplier uses to identify the additive; Supplier—the name of the additive supplier; Purpose—the purpose of the additive indicated on the user list. If an additive has more than one purpose, the primary purpose is to be indicated. Volume/Weight—the volume or weight of the additive used is to be provided; Unit of Measure—the unit of measure for the additive from the list in the user guide. *Id.* at s. 4.3.1.

125. Each component-type record must have one or more component ingredients attached. For each component-type, the licensee is to provide a maximum concentration for all ingredients that must total a minimum of 100 percent. For each fractured-interval record, the maximum concentration in the hydraulic fracturing fluid indicates the maximum concentration of all ingredients in all component types and must be a minimum of 100 percent. *Id.* at s. 4.3.1.b.

126. The Directive states:

Whether or not the ingredient is considered to be a trade secret, the well licensee is to indicate whether or not the ingredient is considered to be hazardous under the Government of Canada’s Workplace Hazardous Material Information System (WHMIS) or nonhazardous. If the ingredient is a trade secret and is considered to be hazardous, then, in the Hazardous Materials Information Review Commission (HMIRC #) field, the licensee is to enter the HMIRC number indicating that the ingredient is exempt from the HMIRC requirement to disclose the chemical identity or concentration of the ingredient on the basis that it is confidential business information (i.e., a trade secret), and in the Ingredient Name field, enter the chemical family name of the ingredient.

Id. at 26–27.

127. *Hazardous Materials Information Review Act*, R.S.C., ch. 24 (3rd Supp.), Part III (1985).

128. *Id.*

fluids based on green chemicals (which are extremely valuable trade secrets),¹²⁹ the government does not require the disclosure of non-hazardous chemicals if the developer claims that they are trade secrets.¹³⁰ Therefore, it is expected that numerous trade secret claims will be made for non-hazardous ingredients in Alberta.

3. Saskatchewan

In the province of Saskatchewan there is increasing shale oil and gas production from the Bakken shale that extends from North Dakota into Saskatchewan.¹³¹ Currently, there do not appear to be regulations in the province that specifically address the disclosure of the hydraulic fracturing fluid contents, although a new regulation could be created based on the existing Hydraulic Fracturing Fluids and Propping Agents Containment and Disposal Guidelines.¹³² These guidelines have required the reporting of information on flowback fluids to the Department of Energy and Resources since 2000.¹³³ The guidelines require operators to continuously work on methods to reduce the impact of fracturing fluids and sands on the environment, such as selecting environmentally friendly additives, using no-leak containment devices, minimizing the volume of fracturing fluids used, and recycling sands.¹³⁴

4. New Brunswick

On June 23, 2011, the eastern province of New Brunswick mandated the disclosure of all proposed and actual contents of all fluids and chemicals used in the hydraulic fracturing process.¹³⁵ In New Brunswick, the information that is required to be disclosed includes the type of base fluid and the total volume of hydraulic fracturing fluid to be employed; all additives including their trade names, suppliers, and their purpose;

129. PTAC & SCEK *supra* note 2, at 24.

130. If the ingredient is a trade secret and is considered non-hazardous, the oil and gas company has to fill out the Chemical Abstract Service # field, to enter "trade secret," and in the Ingredient Name field, to enter the chemical family name of the ingredient. Directive 059, *supra* note 122, at 26–27.

131. See Stephanie B. Gaswirth et al., *Assessment of Undiscovered Oil Resources in the Bakken and Three Forks Formations, Williston Basin Province, Montana, North Dakota, and South Dakota*, U.S. Geological Survey Fact Sheet 3013 (2013).

132. Sask. Energy & Mines Petroleum Dev. Branch, *Saskatchewan Hydraulic Fracturing Fluids and Propping Agents Containment and Disposal Guidelines*, Information Guideline GL 2000-01, (Oct. 1, 2000), available at <http://www.economy.gov.sk.ca/PDBENV11>.

133. *Id.* at 4.

134. *Id.* at 3.

135. GOV'T OF N.B., RESPONSIBLE ENVIRONMENTAL MANAGEMENT OF OIL AND NATURAL GAS ACTIVITIES IN NEW BRUNSWICK 88 (February 15, 2013) available at <http://www2.gnb.ca/content/dam/gnb/Corporate/pdf/ShaleGas/en/RulesforIndustry.pdf>.

the chemical ingredient name and the CAS number of each ingredient; the maximum concentration of each chemical; and the Current Material Safety Data Sheets.¹³⁶ On February 15, 2013, the New Brunswick government adopted industry rules for “Responsible Environmental Management of Oil and Natural Gas Activities in New Brunswick.”¹³⁷ Under the rules, mandatory disclosure of the hydraulic fracturing fluid contents is now required at least 30 days before hydraulic fracturing operations proceed.¹³⁸ Disclosure before hydraulic fracturing operations are conducted makes the New Brunswick regime similar to the Wyoming system and different from most of the state and provincial systems discussed in the article. New Brunswick also requires a risk assessment be submitted to evaluate the potential health and environmental risks of each additive and the practices that will be used to manage these risks.¹³⁹ Within 30 days after completion of the hydraulic fracturing activities, online post disclosure is required and may be posted on the FracFocus.ca website.¹⁴⁰

In the three Canadian provinces that have adopted a more comprehensive regulatory regime covering disclosure of fluid contents thus far, all of the provincial regulatory regimes stress the importance of public disclosure of the chemical additives in the fracturing operations. As there are only a few provinces to date that have tailored their oil and gas regulatory systems to address the emerging hydraulic fracturing chemical disclosure issue, Canada has not experienced the lack of uniform state information disclosure requirements apparent in the United States. However, since most trade secret protection provisions rely on the HMIRA in Canada, one can expect to see a higher degree of uniformity, at least at the trade secret protection claims level. Of the few provinces in Canada that have revised their disclosure requirements, B.C. and Alberta are following the trend of most U.S. states that this article has discussed. New Brunswick has a stronger regulatory regime with respect to the timing of the public disclosure, since it is the only provincial government in Canada that requires disclosure of the contents of fluids for a proposed hydraulic fracturing program before any hydraulic operations are commenced, a risk assessment, and public disclosure of hydraulic fracturing fluid contents. Alberta’s approach to disclosure has closed a gap with respect to trade secret claims that deal with non-hazardous substances, since it offers a simple procedure to register such a substance as a trade secret. In the absence of this regulation, it would have been more diffi-

136. *Id.* at 89.

137. *Id.* at 40.

138. *Id.* at 89.

139. *Id.* at 90.

140. *Id.*

cult to protect a trade secret involving non-hazardous ingredients for which HMIRA registrations are unavailable.

C. Australia

Without exception, all unconventional gas resources in Australia occur on land. The recovery of unconventional gas resources is generally divided into geographic regions according to the source rock for the gas, and is essentially divided between eastern and western Australia.¹⁴¹ In the younger sedimentary basins of the eastern half of Australia, there is a dominance of coal resources and associated coal bed methane resources.¹⁴² The four dominant coal basins in eastern Australia are the Bowen and Surat Basins (Queensland), and the Gunnedah and Sydney Basins (New South Wales).¹⁴³ In the central and western parts of Australia shale gas resources dominate, and are primarily found in the Canning and Perth Basins in Western Australia, the Amadeus, Georgina, and Beetaloo Basins in the Northern Territory, and the Cooper-Eromanga Basin in South Australia.¹⁴⁴

Since all shale gas and CBM are found onshore, the exploration for and extraction of the gas is regulated by the relevant states; there is no enumerated power for the Commonwealth to regulate petroleum and mineral activities under the Australian constitution.¹⁴⁵ Rather, each Australian state has the capacity to regulate activities for the “peace, welfare and good government” of that state.¹⁴⁶ As such, state acts and accompanying regulations, guidance notes, and other non-binding information resources govern the exploration for, and extraction of, unconventional gas in Australia. Accordingly, chemical disclosure requirements relating to the hydraulic fracturing process are stipulated in the relevant legislation of each state.

141. AUSTRALIAN COUNCIL OF LEARNED ACADEMICS, *ENGINEERING ENERGY: UNCONVENTIONAL GAS PRODUCTION FINAL REPORT 48* (2013) available at <http://acola.org.au/PDF/SAF06FINAL/Final%20Report%20Engineering%20Energy%20June%202013.pdf> [hereinafter ACOLA].

142. *Id.*

143. *See id.* (discussing the coal fields of NSW and Queensland, and the geological description of the eastern sediments and basins); *see also* GEOSCIENCE AUSTRALIA, *AUSTRALIAN IN SITU COAL RESOURCES* (map of coal resources), available at http://www.ga.gov.au/corporate_data/74097/74097.pdf; ACOLA, *supra* note 141, at 48.

144. ACOLA, *supra* note 141, at 48.

145. The only powers by which the Commonwealth could regulate the extraction of Unconventional Gas Resources (UGR) is under Section 51(i) of the constitution (Interstate and overseas trade and commerce), or 51(XX) of the constitution (Corporations Power).

146. For example, the preamble (section a) of the Constitution of Queensland, 2001; section 5 of the *Constitution Act 1902* (N.S.W.); and section 2(1) of the *Constitution Act 1889* (W. Austl.) (to make laws for the peace, order, and good Government).

Although the Australian national government has no jurisdiction over the regulation of hydraulic fracturing activities and cannot compel states to require the disclosure of chemicals,¹⁴⁷ the Council of Australian Government's Standing Council of Energy and Resources endorsed the National Harmonised Framework for Natural Gas from Coal Seams (the Framework).¹⁴⁸ The Framework is not a legislative document, but rather is intended to provide guidance to governments regulating CBM within their respective jurisdictions.¹⁴⁹ Although titled a framework for gas from coal seams, the Framework applies to hydraulic fracturing activities in general, not just hydraulic fracturing related to CBM, therefore providing a framework for shale gas activities.¹⁵⁰

The Framework identifies 18 leading practices to be followed across all jurisdictions to "build a robust national regulatory regime."¹⁵¹ One of these leading practices is that of full public disclosure of the chemicals used in hydraulic fracturing activities.¹⁵² When making information publically available, the Framework requires a balance between the level of public disclosure and the need to protect intellectual property rights to encourage growth in research, development, and innovation.¹⁵³ Where full public disclosure is not possible, arrangements should be in place to allow full disclosure to the regulator on a confidential basis. At present, no such confidential arrangements in Australian state jurisdictions exist. Full public disclosure of chemical use is recommended as part of this leading practice. While being mindful of the need to balance public disclosure against intellectual property, the Framework notes that the disclosed information should include names of the companies producing fracturing fluids and associated products; proprietary names (trade names) of compounds (fracturing fluid additives) being produced; chemical names of each additive used in each of the fluids; CAS numbers of each of the chemical components used in each of the fluids; general purpose and function of each of the chemicals used; maximum concentration (percent by mass) of the chemicals used; and any

147. The Standing Council on Energy and Resources (SCER) is a body established by the Council of Australian Governments (COAG), and its members are the relevant Ministers for energy and resources from the Commonwealth, states, territories, and New Zealand. SCER has particular policy responsibility, on behalf of COAG, regarding regulation and oversight of the energy and resources market in Australia. See STANDING COUNCIL ON ENERGY & RES., TERMS OF REFERENCE (2010), available at <http://www.scer.gov.au/files/2011/09/Final-ToR-COAG-Sec-Updated-Membership-Jan-2012.pdf>.

148. HARMONISED FRAMEWORK, *supra* note 79, at 9.

149. *Id.* at 7.

150. *Id.* at 9.

151. *Id.* at 7.

152. *Id.* at 63.

153. *Id.*

material safety data sheets for the chemicals or chemical products used.¹⁵⁴ In order to protect commercially sensitive information, these categories of information should be contained in separate groupings/lists so that specific combinations or formulas used for proprietary products cannot be determined.¹⁵⁵

1. Queensland

Commercial CBM extraction in Australia occurs exclusively in Queensland at present. Systematic extraction of petroleum has occurred in Queensland since 1960, and CBM has become a significant source of gas in Queensland, supplying over 75 percent of the gas market and providing over 98 percent of the proved and probable gas resources in Queensland.¹⁵⁶ Much of Queensland's CBM that is currently being developed or produced is earmarked for export markets.¹⁵⁷ As a result of the rapid expansion of the export market, huge CBM infrastructure developments are currently occurring in the Bowen and Surat Basins.¹⁵⁸ The development of pipelines, liquid natural gas processing, and port facilities are associated with the gas infrastructure in Central Queensland around the Gladstone region.¹⁵⁹

The act initially responsible for onshore petroleum extraction was the Petroleum Act 1923 (Qld). This framework was seen as painfully inadequate for the regulation of the development of CBM, leading to the introduction of the Petroleum and Gas (Production and Safety) Act 2004 (Qld) (PGPSA).¹⁶⁰ This act was meant to replace the antiquated 1923 act, however, some tenements that were granted under the 1923 act have native title¹⁶¹ conditions attached to them and are unable to be regulated under the PGPSA. As such, there are two acts applying to the regulation

154. *Id.* at 63–64.

155. *Id.* at 64.

156. QUEENSL. GOV'T DEP'T OF NATURAL RES. & MINES, QUEENSLAND'S PETROLEUM EXPLORATION, DEVELOPMENT AND POTENTIAL 2012-2013 (May 2012), available at <http://mines.industry.qld.gov.au/assets/coal-pdf/queenslands-petroleum-2014.pdf>.

157. See AUSTR. GOV'T BUREAU OF RES. & ENERGY ECON., GAS MARKET REPORT JULY 2013, 31 (2013), available at <http://bree.slicedlabs.com.au/sites/default/files/files/publications/gas-market/gasmarketreport-201307.pdf>.

158. QUEENSL. GOV'T, CSG TO LNG OPPORTUNITIES IN QUEENSLAND 4 (2012), available at [http://www.jie.or.jp/2013/events/130612sankou4\(english\).pdf](http://www.jie.or.jp/2013/events/130612sankou4(english).pdf).

159. *Id.*

160. This Act was hastily introduced in 2004 to address the increasing community and legal issues associated with coal bed methane production. See *Petroleum and Gas (Production and Safety) Act, 2004* (Queensl.), available at: <https://www.legislation.qld.gov.au/Bills/51PDF/2004/PetGasProSafB04Exp.pdf>.

161. Native title is the recognition by Australian law that some Indigenous people have rights and interests to their land that come from their traditional laws and customs. It was

of the extraction of CBM in Queensland, although all regulation primarily occurs under the PGPSA.

The current regulatory approach in Queensland for CBM extraction and the impact of CBM projects is based on the philosophy of “adaptive environmental management.”¹⁶² This method of “learning by doing”¹⁶³ is implemented primarily through the imposition of layered monitoring and reporting duties on the CBM operator alongside obligations to compensate for harm caused.¹⁶⁴ This regulatory approach seeks to put in place a system to monitor and instigate change where necessary.¹⁶⁵ Such adaptive management frameworks are “widely used to address unknown and unintended impacts when making important management decisions” regarding the environmental impacts of CBM extraction activities.¹⁶⁶ Such legislative adaptation is regulated under the PGPSA and the Environmental Protection Act 1994 (QEPA), where a plethora of legislative changes have been made to accommodate such an adaptive management approach.¹⁶⁷ The requirement for the disclosure of the chemicals used in the stimulation of wells, including the hydraulic fracturing of wells, was implemented as part of this adaptive management regime when it became apparent there was widespread community concern regarding hydraulic fracturing.¹⁶⁸ The environmental regulation of hydraulic fracturing activities and the requirement for chemical disclosure in Queensland occurs under QEPA.¹⁶⁹ The Act has the broad objective of protecting “Queensland’s environment while allowing for development that improves the total quality of life, both now and in the

recognized in *Mabo v. Queensland II* (1992) 175 C.L.R 1. It is legislated under the *Native Title Act 1993* (Austl.).

162. QUEENSL. GOV’T, DEP’T OF ENV’T & HERITAGE PROTECTION, ADAPTIVE MANAGEMENT (2012), available at <http://www.ehp.qld.gov.au/management/coal-seam-gas/adaptive-management.html>.

163. “Adaptive management” is a process of decision-making in the face of uncertainty, in order to reduce this uncertainty over time through system monitoring. It is a tool used to not only change the system, but also to learn about the system. See ADAPTIVE ENVIRONMENTAL ASSESSMENT AND MANAGEMENT 1–16 (C. S. Holling ed., John Wiley & Sons 1978).

164. Nicola Swayne, *Regulating Coal Seam Gas in Queensland: Lessons in Adaptive Environmental Management Approach?*, 29 ENV’T & PLANNING J. 163 (2012).

165. *Id.*

166. *Id.*

167. There have been over 300 amendments to the Petroleum and Gas (Production and Safety) Act, 2004 (Queensl.) (Austl.) since its commencement in 2004.

168. Such widespread concern is reported in many media reports, and is a source of activism for such community groups. See, e.g., Lock the Gate Alliance, available at <http://www.lockthegate.org.au>.

169. The QEPA requires such disclosure under the environmental Risk Authority required under Chapter 5 Part 1 of the Environmental Protection Act, 1994 (Queensl.) (Austl.).

future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).¹⁷⁰ The QEPA sets out a program for the identification and protection of important elements of the environment, and creates a range of regulatory tools for controlling the activities of individuals and companies.

A critical environmental tool of QEPA is the Environmental Authority (EA), which an operator must undertake for a prescribed Environmentally Relevant Activity (ERA) under the Environmental Protection Regulation 2008 (Qld) (EPR).¹⁷¹ The EA licenses a company to undertake a petroleum activity, and includes the authority to undertake hydraulic fracturing activities. When applying for an EA, operators of petroleum activities must include an assessment of the likely impact of each relevant activity on the environmental values.¹⁷² The Application Requirements for Petroleum Activities Guideline assists companies in identifying the impacts of the petroleum activity on the environment through a risk assessment, and in turn proposing environmental protection commitments to help the administering authority decide the conditions of the EA.¹⁷³ Where hydraulic fracturing is planned as part of the petroleum activities, the operator must include as part of the risk assessment under the EA the details of the proposed chemicals to be used in hydraulic fracturing; the toxicity of the chemicals; the mixture of the chemicals; and the geology of the seams to be fracked.¹⁷⁴

The EA is also required to provide evidence that fluids used in stimulation activities will not include restricted stimulation activities.¹⁷⁵ Restricted Stimulation fluids are defined in section 206(2) of the QEPA as fluids used for the purpose of stimulation, including fracturing, that contain petroleum hydrocarbons (or chemicals that produce) containing benzene, ethyl benzene, toluene or xylene in more than the maximum

170. *Environmental Protection Act, 1994* (Queensl.) s 3 (Austl.).

171. A prescribed Environmentally Relevant Activity (ERA) is an activity that requires approval and monitoring by either Local Government or State Government due to its potential to impact the environment. Prescribed ERA's are defined under Schedule 2 of the *Environmental Protection Regulation 2008*, and include aquaculture, sewage treatment, metal recovery, surface coating, and asphalt manufacturing. *Id.*

172. *A Guide to Application Requirements for Activities with Impacts to Land* s 1.1 (Queensl.) available at <http://www.ehp.qld.gov.au/era/land-impacts-em961>.

173. *See id.* at s 3.

174. Dep't of Env't & Heritage Protection, *Fracking and Heritage Protection* (2013) <http://www.ehp.qld.gov.au/management/non-mining/documents/fracking-btex.pdf>.

175. *Id.*

amounts prescribed under regulation 81B of the Environmental Plan (EP).¹⁷⁶

The EA is assessed by the Department of Environment and Heritage Protection (DEHP), and may include any conditions the regulator considers necessary or desirable.¹⁷⁷ All EAs approved by the environmental regulator are included in a Public Register.¹⁷⁸ This register outlines the EA number, the governing local government area, the tenure holder, and the type of tenure (for example, Authority to Prospect or Petroleum Lease).¹⁷⁹ Each EA outlines the type of activity carried out, the conditions of the EA, and, where well stimulation occurs, the list of chemicals that will be used.¹⁸⁰

When the holder of a resources permit intends to undertake hydraulic fracturing activities, they are required to provide a Notice of Intention to Undertake Hydraulic Fracturing Activities (NOI) to the Landholder.¹⁸¹ This notice must be provided to the landholder at least 10 days prior to a fracturing activity, and is required to list the chemicals the holder of the resources permit expects to use during the hydraulic fracturing activities.¹⁸² However, given that the properties of coal seams vary from location to location, it is recognized that the permit holder may need to alter the chemicals and volumes used to adequately fracture the coal seam. Consequently, there is also a requirement in Queensland to provide a report upon completion of the hydraulic fracturing program.¹⁸³

Once the hydraulic fracturing activity has been completed, a permit holder is required to provide a Notice of Completion of Hydraulic Fracture Activities (NOC) to the Landholder within 10 days after completing a hydraulic fracturing activity to the Landholder.¹⁸⁴ The Notice of

176. QUEENSL. DEP'T ENV'T & HERITAGE PROTECTION, APPLICATION REQUIREMENTS FOR PETROLEUM ACTIVITIES GUIDELINE 57 (2013) <http://www.ehp.qld.gov.au/management/non-mining/documents/application-requirements-petroleum-guideline.pdf>.

177. *Environmental Protection Act 1994* (Queensl.) s 203 (Austl.).

178. See QUEENSL. DEP'T ENV'T & HERITAGE PROTECTION, LIST OF ENVIRONMENTAL AUTHORITIES, available at <http://www.ehp.qld.gov.au/management/env-authorities/list.php>.

179. See *id.*

180. See, e.g., QUEENSL. DEP'T ENV'T & HERITAGE PROTECTION, ENVIRONMENTAL AUTHORITY PERMIT EPPG00146313, available at <http://www.ehp.qld.gov.au/management/env-authorities/pdf/eppg00146313.pdf> (showing an example of a permit).

181. A landholder is defined as a landowner or an occupier of the land. *Petroleum and Gas (production and Safety) Regulation 2004* (Queensl.) s 1A p 1 (3) (Austl.).

182. Dep't of Natural Res. & Mines, *Intended Hydraulic Fracture Activities: Information For Landowners and Occupiers*, <http://mines.industry.qld.gov.au/assets/land-tenure-pdf/PGGD03-Intention-fraccing-infosheet.pdf>.

183. *Id.*

184. *Id.* at s 2 30A(f).

Completion outlines whether the well was completed, partially completed, abandoned or otherwise altered compared to the activities outlined on the NOI, the chemicals used in the activity, and the amounts used.¹⁸⁵

The permit holder is also required to lodge a detailed completion report for the hydraulic fracturing activities to the Regulator.¹⁸⁶ The Hydraulic Fracturing Completion Report (HFRC) must provide a summary of the operations performed at each stage in carrying out the hydraulic fracturing activities, including the volume and type of chemical used at each stage.¹⁸⁷ It must also include a Hydraulic Fracturing Fluid Statement, which outlines the composition of the hydraulic fracturing fluid, including the quantity of each component of the hydraulic fracturing fluid, the concentration of each component in the hydraulic fracturing fluid, and the name of any chemical compound contained in the hydraulic fracturing fluid.¹⁸⁸

In summary, under current legislation in Queensland, the chemicals used in hydraulic fracturing activities are disclosed under the requirements of an EA, and made available on a public register. The landholder receives additional notification of chemicals used in hydraulic fracturing activities prior to hydraulic fracturing activities under a NOI, and after hydraulic fracturing activities have been compiled through a NOC.

2. Western Australia

Community activism relating to CBM activities in Eastern Australia, social media, and American films such as *Gasland* have influenced attitudes regarding the development of shale gas in Western Australia.¹⁸⁹ In response to these community concerns, the Western Australian government commissioned an independent analysis of the capacity of the existing regulatory framework to effectively regulate shale gas activities. The resulting report, *The Regulation of Shale, Coal Seam and Tight Gas Activities in Western Australia* (the Hunter Report), recognized that regulatory reform was required in order to provide community assurance.¹⁹⁰ Particularly, the report determined that it was necessary to draft envi-

185. *Id.* at 46(a)

186. *Id.*

187. *Id.*

188. *Id.*

189. See Tina Hunter, *Regulation of Shale, Coal Seam and Tight Gas Activities in Western Australia: An Analysis of the Petroleum and Geothermal Energy Act 1967 (Western Australia) to Regulate Onshore Gas Activities in Western Australia*, 18 MURDOCH U. ELECTRONIC J.L. 29, 36 (2011).

190. *Id.* at 51.

ronmental management regulations, and that chemicals used in the hydraulic fracturing process should be disclosed in a full and transparent manner.¹⁹¹ The Western Australia Department of Mines and Petroleum (WADMP), who regulates all petroleum activities in Western Australia, concurred with the recommendation, indicating that it would require that chemicals be included in Environment Plans, while protecting personnel and commercially sensitive information, and enacted the Petroleum and Geothermal Energy Resources (Environmental) Regulations 2012 (WA) (PGER(E)R) to achieve full disclosure.¹⁹²

In order to undertake a shale gas activity, the titleholder is required to submit an Environment Plan (EP) for approval.¹⁹³ The environment plan must include an implementation strategy for the activity, including measures to ensure that the environmental performance objectives and environmental performance standards in the EP are met.¹⁹⁴ The required implementation strategy must identify the specific systems, practices, and procedures to be used to ensure that the environmental impacts and risks of the activity are reduced to as low as is reasonably practicable.¹⁹⁵ It also must ensure that the environmental performance objectives and environmental performance standards in the EP are met.¹⁹⁶

The requirements for an EP are outlined in the Guidelines for the Preparation and submission of an Environment Plan (the EP Guidelines). Specific guidance regarding chemical disclosure as part of the EP are outlined in the Chemical Disclosure Guideline (Chemical Guidelines).¹⁹⁷ The Chemical Guidelines stipulate that chemical disclosure is required for all “down-hole” petroleum or geothermal related activities, not just hydraulic fracturing, and includes seismic surveys, drilling, hydraulic fracturing, well testing, and waste disposal or storage. All chemicals used in the drilling and hydraulic fracturing activity are required to be

191. DEP'T OF MINES AND PETROLEUM, DEPARTMENT OF MINES AND PETROLEUM RESPONSE TO REPORT: REGULATION OF SHALE, COAL SEAM AND TIGHT GAS ACTIVITIES IN WESTERN AUSTRALIA 4 (2011).

192. See DEP'T OF MINES & PETROLEUM, ABOUT THE REFORMING ENVIRONMENTAL REGULATION STRATEGY (2012), available at <http://www.dmp.wa.gov.au/15824.aspx>.

193. *Petroleum and Geothermal Resources Act 1967*, Petroleum and Geothermal Energy Resources (Environmental) Regulations 2012 (W. Austl.), pt 2 div 3 r. 6 (outlining requirement); pt 2 div 3 r.13 (outlining required contents of EP); and pt 2 div 3 rr 14–17 (incorporated in r. 13).

194. *Id.* at 15(1-2).

195. *Id.* at 11.

196. *Id.* at 15(3).

197. See DEP'T OF MINES & PETROLEUM, CHEMICAL DISCLOSURE GUIDELINE (2013) (superseding the DEP'T OF MINES & PETROLEUM, CHEMICAL DISCLOSURE INFORMATION NOTE (2012)) [hereinafter CHEMICAL DISCLOSURE GUIDELINE].

disclosed.¹⁹⁸ This requirement includes details of any chemicals or other substances that may be: “(a) in, or added to, any treatment fluids to be used for the purposes of drilling or hydraulic fracturing undertaken in the course of the activity; or (b) otherwise introduced into a well, reservoir or subsurface formation in the course of the activity.”¹⁹⁹

The reporting of chemicals used in petroleum activities is based on “systems-based” disclosure, where the “system” refers to each systematic stage of petroleum activities, including well drilling, well construction, well testing, hydraulic fracturing, production, and well closure (as appropriate).²⁰⁰ Specific products and chemicals are used for each system, and therefore are required to be reported as an individual system. This “systems-based” disclosure means that product information is disclosed separately from its chemical ingredients. In this way, details about products and chemicals are still provided to WADMP without compromising commercially sensitive information about product recipes. This differs from the initial disclosure requirements under the 2012 Information Note, which required that sensitive proprietary information be disclosed, and “alternative/suitable products/additives should be sought if full public disclosure cannot be achieved, or if approval to release the

198. *Petroleum and Geothermal Energy Resources (Environmental) Regulations 2012* (W. Austl.) r 15(9).

199. *Id.*

200. The WADMP requires all chemical disclosure information to be submitted using the Chemical Disclosure Reporting Template, to be attached as an Appendix to the EP and Summary EP. This enables the Appendix to be easily updated and resubmitted to DMP should future modifications be made to product and chemical use, as well as standardizing information for ease of use and comparison. The “systems-based” Chemical Disclosure Reporting Template comprises three separate tables which must be completed for each system in the petroleum activity:

1. PART A. Well and system details;
2. PART B. Product list, including product name, Material Safety Data Sheet (MSDS), supplier name, purpose of use (such as Corrosion inhibitor, oxygen scavenger, biocide demulsifier, proppant, friction reducer), and product percentage content in system; and
3. PART C. Chemical ingredient list, which comprises a compilation of all chemical ingredients of every product identified in Part B. Each chemical should be identified only once in the chemical list, even if it is an ingredient in multiple products. Chemical ingredients within contingency products should be incorporated into the chemical list, as if they are going to be used. The scientific chemical name should be used—consistent with the International Union of Pure and Applied Chemistry (IUPAC) naming convention. A CAS number is required for each chemical in this part. Where there are substances for which CAS numbers are not available the CAS for the bulk chemical component should be cited.

See CHEMICAL DISCLOSURE GUIDELINE, *supra* note 197, at 4.

necessary details is not forthcoming from the manufacturer, supplier, importer or service operator.”²⁰¹

This requirement was problematic for both operators and service companies, particularly given the small scale of operations in Western Australia.²⁰² The reaction of both companies and the peak industry body, the Australian Petroleum Production and Exploration Association (APPEA), compelled the WADMP to reconsider its requirements, seeking to achieve a balance between public interest and protection of trade secrets, which resulted in reforms in August 2013 to the public disclosure requirements for down-hole chemicals, providing assurance to operators and service companies that trade secrets will be preserved, while at the same time ensuring that down-hole chemicals will be selected based on their suitability for the activity rather than their patent status.²⁰³ This means that new, patented chemicals that are more appropriate to an activity will be selected, rather than older, patent-free chemicals that are only being used because their composition is not secret.

The “systems-based” approach allows operators to have greater flexibility with their choice of products. It can potentially allow use of commercially sensitive products that are more efficient (thereby reducing the need to use larger quantities of common chemicals) and more environmentally friendly. It can also allow use of scientifically beneficial products, such as products that enable a better understanding of underground petroleum activities, hydrogeology, or tracking fluid movement.²⁰⁴

However, this “systems-based” disclosure does not make any provision for exempting proprietary chemicals from being publicly disclosed.²⁰⁵ Indeed, the operator is required to inform the supplier or manufacturer that all chemical information disclosed to DMP will be made publicly available.²⁰⁶ When the requested information is not forthcoming from a supplier or manufacturer, the operator should consider selecting alternative products and/or suppliers that will be able to meet chemical disclosure requirements. However, it is important to note that chemical disclosure requirements in Western Australia represent a quan-

201. DEP’T OF PETROLEUM & MINES, CHEMICAL DISCLOSURE INFORMATION NOTE, s 3 (2012).

202. LEGGETTE ET AL., *supra* note 9, at 4 (This information was gained from confidential conversations with APPEA and chemical companies. Similar concerns in the United States have been documented in Norton Rose Fulbright.).

203. CHEMICAL DISCLOSURE GUIDELINE, *supra* note 197, at 2 (superseding the original version, DEP’T OF PETROLEUM & MINES, CHEMICAL DISCLOSURE INFORMATION NOTE (2012)).

204. *Id.* at 4.

205. *Id.*

206. *Id.*

tum leap in disclosure, since Western Australia is among the first petroleum-producing jurisdictions in the world to require public disclosure of the chemicals used in not only hydraulic fracturing, but for *all* fluids used down-hole for all activities, including drilling and cementing.

The Chemical Reporting Disclosure Template is required to be included in the EP and the summary EP under section 15(9) of the PGER(E)R.²⁰⁷ Whereas the EP may contain commercially confidential information for the regulator, the summary EP, which contains only publicly available information and not commercially sensitive information, is made publically available on the WADMP website.²⁰⁸ This public disclosure of the summary EP implements the recommendation of the Hunter Report that the WADMP should “provide full, transparent disclosure of all chemicals used in Western Australia hydraulic fracturing operations.”²⁰⁹

Unlike the United States and Canada, chemicals used in hydraulic fracturing activities in Australia are not disclosed in a central register, such as FracFocus. Rather, as outlined above, there are different methods of disclosure for Western Australia and Queensland, where the chemicals are recorded in different registers and in different ways. However, state governments are investigating the application and deployment of a central registry system similar to the FracFocus Chemical Disclosure Registry.²¹⁰

Western Australia and Queensland differ in their respective approaches to disclosure requirements, which can be attributable to the system of regulation. The preemptive regulatory approach of Western Australia means that the requirements for disclosure are clearly set out in the environment regulations and the associated Chemical Guidelines. As the chemical disclosure requirements in Queensland have partially developed as part of the adaptive management approach to regulating CBM activities, disclosure of chemicals to be used in hydraulic fracturing are required prior to the activity. Initially, there were no separate requirements outside of the environmental plan to disclose the chemicals used in fracturing process. However, as public interest, and ultimately dismay, relating to the fracking process has progressed, there has been a legislative response by the Queensland government. Such legislative response has included the need for disclosure to landholders both prior to

207. *Id.*

208. See GOV'T W. AUSTR., DEP'T MINES & PETROLEUM, THE ENVIRONMENTAL REGULATORY AND ASSESSMENT SYSTEM, available at <https://ace.dmp.wa.gov.au/ACE/Public/PetroleumProposals> (providing a list of proposals).

209. Hunter, *supra* note 189, at 14.

210. HARMONISED FRAMEWORK, *supra* note 79, at 63.

hydraulic fracturing and after completion. This differs from Western Australia where disclosure is only required prior to the activity.

CONCLUSION

In the three countries that this article has examined, the United States, a pioneer in shale oil and gas development, has developed the largest number of individual state hydraulic fracturing fluid disclosure regulatory systems. In all three countries, there is lack of uniform public disclosure requirements between the federal government and the respective state or provincial laws. None of the countries have uniform public disclosure laws among the constituent states or provinces that are in the process of developing shale oil and gas regulatory regimes. Whether the contents of the fracking fluids need to be disclosed before the fracturing operations or after the fracturing operations (or both) varies among different states, as does the extent to which the fluid developer or owner may limit disclosure of the chemical contents of the fluid. The opportunity for concerned members of the public to challenge the validity of alleged trade secret claims also varies among different states; some governments have adopted procedures to evaluate the validity of fluid trade secret claims and others have not. Some state laws specifically address disclosure requirements for the chemical family of additives to fluids and others do not. These regulatory differences between states have the potential to cause confusion for oil and gas companies and members of the public, and lead to inconsistent regulation of the disclosure of fracking fluid contents in the United States and Australia. Clearly the existing regimes are inadequate in this regard.

The recent provisions that this article has analyzed reflect a balancing act on the part of all governments to facilitate increased disclosure to the general public about the contents of the fluids that are being used while respecting the intellectual property rights of fluid developers. In light of increasing public concern in all three countries (and other nations considering shale oil and gas development) about water contamination from fracking and the potential environmental, health, and safety impacts, most of the federal, state, and provincial governments require disclosure of some information about the contents of the fracturing fluids. At the same time, to encourage oil and gas investment in their respective jurisdictions, governments recognize and support the intellectual property rights of the service companies that have developed fluids. State and provincial governments usually require that some general information about the fluid be disclosed, such as the "chemical family" of each substance for which protection of the trade secret is sought. In light of the litigation in Wyoming, the first state to adopt state fluid disclosure laws in the United States, other governments would be wise to consider

the amount of public resources required to evaluate the merits of trade secret claims on a case-by-case basis before they adopt schemes to address the trade secret disclosure issue.

Typically, state and provincial laws in the three countries require disclosure about the type of chemicals, the volume of the base fluid and the trade name (if applicable), as well as the quantity and function of each additive along with its trade name and supplier. In both Canada and the United States, information about the fluid contents is disclosed to some government regulatory agencies or departments, or on the FracFocus website, or on publically accessible websites. States such as Texas, Pennsylvania, Ohio, Colorado, Utah, New Mexico, and the provinces of British Columbia and Alberta provide examples of jurisdictions that require disclosure of the contents of the fluids to the regulator on a publicly accessible website within prescribed time periods after the fracking operations have been completed. One specific weakness of the different state regulatory regimes in the United States is that in numerous jurisdictions it is unclear whether the claims made by industry operators are accurate and complete. A few states, such as Wyoming, have mandated disclosure of information on hydraulic fracturing activities before the operations proceed. Several state governments such as Colorado and Pennsylvania have mandated timely disclosure of fluid contents to medical professionals in order to help diagnose and treat exposure of oilfield workers to chemicals in fracturing fluids.

Unlike the United States and Canada, chemicals used in Australian fluids are not disclosed in a central register, such as FracFocus. Rather, there are a variety of methods of disclosure employed in the states of Western Australia and Queensland, where chemicals are recorded in different ways. Currently in Australia, state governments are investigating the deployment of a central registry system like FracFocus.

There should be laws in every jurisdiction for timely disclosure to provide a reasonable level of diagnosis and medical treatment for workers or members of the public exposed to these chemicals. Adopting uniform fluid content disclosure requirements in these three countries would reduce confusion on the part of both the public and companies operating in multiple jurisdictions. The recent laws that this article examined reveal broad based support on the part of state and provincial governments for more public disclosure about the contents of fracturing fluids. Increased public disclosure will address some concerns about contamination of drinking water from hydraulic fracturing in the United States, Canada, and Australia, and in other nations developing their shale oil and gas resources.