NATURAL RESOURCES JOURNAL

Volume 54
Issue 2 *Hydraulic Fracturing*

Fall 2014

Goal-Oriented Disclosure Design for Shale Oil and Gas Development

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ABSTRACT

States have acted quickly to respond to the public's demand for information on the chemicals used in hydraulic fracturing. Proponents of these disclosure requirements have relied on a number of policy rationales. However, the resulting disclosure systems may not be achieving stated goals. Ineffective disclosure requirements risk undermining public confidence in the disclosure process and waste an important opportunity to put these disclosures to work. This article suggests using a Goal-Oriented Disclosure Design approach to HFC disclosure, built around the goals for disclosure, the information end users need to target in pursuit of each goal, and the feedback loops those end users can trigger. The article then walks through the design steps for a disclosure regime intended to fully inform first responders and medical professionals, so that they may timely treat and diagnose patients who may have been exposed to hydraulic fracturing chemicals.

INTRODUCTION

Recent advances in horizontal drilling[1] and hydraulic fracturing[2] have enabled the oil and gas industry to mine fossil fuels previously be-

* Policy Director, Harvard Law School Environmental Law Program. The author wishes to acknowledge the contributions of Alexa Shasteen, HLS '14, Alex Gast, HMS '16, Dr. E. Boyer, Professor of Emergency Medicine and Director of Toxicology, University of Massachusetts Medical School; and Dr. Eike Blohm, University of Massachusetts Medical School.

1. Horizontal (or directional) drilling enables operators to drill horizontally through the formation, increasing the surface area that may be drained by a single well. *See* Salamy, S.P., Saradji, B.S., Okoye, C.O., Mercer, J.C., Yost II, A.B., *Recovery Efficiency Aspects of Horizontal Well Drilling in Devonian Shale*, SPE/DOE 16411, Low Permeability Reservoirs Symposium (May 18-19, 1987), *available at* http://www.netl.doe.gov/kmd/cds/disk7/disk1/EGS%5CRecovery%20Efficiency%20Aspects%20of%20Horizontal%20Well%20Drilling%20in%20D.pdf; U.S. Energy Info. Admin., DOE/EIA-TR0565, *Drilling Sideways: A Review of Horizontal Well Technology and its Domestic Application* (Dec. 1993), *available at* http://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/drilling_sideways_well_technology/pdf/tr0565.pdf.

2. Hydraulic fracturing refers to one stage in shale oil and gas well development. After a well has been drilled, a service company injects many gallons of a water- or oil-based fluid containing chemicals into the well at high pressure, forcing the liquid through holes in the casing into the target formation. The action stimulates well production by fracturing the rock and allowing oil and gas molecules to escape. *See* Int'l Energy Agency, *Golden Rules for a Golden Age of Gas: World Energy Outlook Special Report on Unconventional Gas* (2012), *available at* http://www.worldenergyoutlook.org/media/weowebsite/2012/

yond our technical and economic reach. Although well operators have employed these technologies to extract oil and natural gas from shale formations since the mid-1990s, "only in the past 5 years has shale gas been recognized as a 'game changer' for the U.S. natural gas market."[3] The Energy Information Administration (EIA) published its first estimate of U.S. shale gas reserves in 2005,[4] and by 2011 nearly 40 percent of domestic natural gas reserves were embedded in these formations.[5] Shale gas now accounts for one-third of domestic natural gas production.[6] While shale and other "tight" oils represent just 12 percent of total domestic oil production,[7] this number is likely to grow. From 2009 to 2011, two-thirds of the growth in domestic oil reserves was credited to tight oil in two states, North Dakota and Texas.[8] Production has spiked as well. While only a few hundred shale oil wells were operating in the United States in 2011, in 2012 oil and gas companies drilled 4,000 more.[9]

The public is divided in its support for hydraulic fracturing and shale oil and gas production.[10] As shale oil and gas development intensi-

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goldenrules/weo2012_goldenrulesreport.pdf; George E. King, Apache Corporation, *Hydraulic Fracturing 101: What Every Representative, Environmentalist, Regulator, Reporter, Investor, University Researcher, Neighbor and Engineer Should Know about Estimating Frac Risk and Improving Frac Performance in Unconventional Gas and Oil Wells*, SPE 152596, Hydraulic Fracturing Technology Conference (Feb. 6-8, 2012), *available at* http://fracfocus.org/sites/default/files/publications/hydraulic_fracturing_101.pdf.

3. U.S. ENERGY INFO. ADMIN, REVIEW OF EMERGING RESOURCES: U.S. SHALE GAS AND SHALE OIL PLAYS (July 2011), at 4, *available at* http://www.eia.gov/analysis/studies/usshalegas/pdf/usshaleplays.pdf.

4. U.S. ENERGY INFO. ADMIN., U.S. CRUDE OIL, NATURAL GAS, AND NATURAL GAS LIQUIDS PROVED RESERVES, 2007 ANNUAL REPORT (Feb. 2009), at 7, http://www.eia.gov/naturalgas/crudeoilreserves/archive/2007/full.pdf.

5. U.S. ENERGY INFO. ADMIN., U.S. CRUDE OIL, NATURAL GAS, AND NATURAL GAS LIQUIDS PROVED RESERVES, 2012 ANNUAL REPORT, (APRIL 2014), at 10, Table 3 and Fig. 10, *available at* http://www.eia.gov/naturalgas/crudeoilreserves/pdf/uscrudeoil.pdf.

6. *Id.* at 12, Table 3.

7. *Cf.* U.S. ENERGY INFO. ADMIN., U.S. CRUDE OIL, NATURAL GAS, AND NATURAL GAS LIQUIDS PROVED RESERVES, 2012 ANNUAL REPORT (April 2014), at 27–28, Table 7 (indicating 2012 total oil production was 1,941 million barrels) *with id.* at 9, Table 2 (indicating 2012 tight oil production was 228 million barrels, or 12.4 percent of total production), *available at* http://www.eia.gov/naturalgas/crudeoilreserves/pdf/uscrudeoil.pdf. "Tight" oil is oil found in low-permeability (dense) formations, usually shale and sandstone.

8. *Id.* at 2, Table 2.

9. Leonardo Maugeri, *The Shale Oil Boom: A U.S. Phenomenon* (Belfer Center for Science and International Affairs, Harvard Kennedy School, Discussion Paper 2013-05, June 2013), *at* 1, *available at* http://belfercenter.ksg.harvard.edu/files/draft-2.pdf.

10. *See, e.g.*, PEW RESEARCH CENTER, ENERGY: KEY DATA POINTS (2014), *available at* http://www.pewresearch.org/key-data-points/energy-key-data-points/ (reporting that in March 2013, 48 percent of respondents favored the increased use of fracking to extract oil and natural gas from underground rock formations, 38 percent opposed the increase, and

fies,[11] expanding into new communities across the United States,[12] public awareness and health concerns have grown,[13] causing public support for hydraulic fracturing and shale oil and gas production to remain deeply split.[14] These concerns are reflected in calls for bans,[15] increased government regulation,[16] and greater federal oversight.[17] Industry trade groups have opposed most of these efforts, arguing that hydraulic fracturing is a time-tested technology that does not pose unacceptable risks to public health or the environment.[18]

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14 percent did not respond or know; but in September 2013, 44 percent favored the increase, 49 percent opposed the increase, and 7 percent did not respond or know).

11. Maugeri, *supra* note 9, at 4 (noting "because of the dramatic decline of shale wells, oil companies resort to intensively drilling for new wells that offset the loss of production from older wells.")

12. NAT'L ENERGY TECH. LABORATORY, MODERN SHALE GAS DEVELOPMENT IN THE UNITED STATES: AN UPDATE (2013), at 22–23, and table 5, *available at* http://www.netl.doe.gov/File%20Library/Research/Oil-Gas/shale-gas-primer-update-2013.pdf (describing "developing," "emerging," and "frontier" shale plays in 17 states).

13. *See, e.g.*, Christopher Behnan, *Fracking Raises Environmental, Water Concerns in Livingston in 2013*, LIVINGSTON DAILY (Dec. 25, 2013), http://www.livingstondaily.com/article/20131225/NEWS01/312250004/-Fracking-raises-environmental-water-concerns-Livingston-2013; Melinda Taylor, *Anti-Fracking Ordinances and Public Trust in Unconventional Drilling*, UT ENERGY CENTER BLOG (Nov. 13, 2013), http://www.utexas.edu/law/centers/energy/blog/2013/11/anti-fracking-ordinances-and-public-trust-in-unconventional-drilling/.

14. PEW RESEARCH CENTER, *supra* note 10.

15. *See, e.g.*, Paul Rogers, *Top Climate Scientists Call for Fracking Ban in Letter to Gov. Jerry Brown*, SAN JOSE MERCURY NEWS (Nov. 12, 2013), http://www.mercurynews.com/science-environment/ci_24509392/top-climate-scientists-call-fracking-ban-letter-gov; Michael Wines, *Colorado Cities' Rejection of Fracking Poses Political Test for Natural Gas Industry*, NEW YORK TIMES (Nov. 7, 2013), http://www.nytimes.com/2013/11/08/us/colorado-cities-rejection-of-fracking-poses-political-test-for-natural-gas-industry.html?_r=0.

16. Mark Drajem, *Tougher Fracking Regulation Backed by 66%, Poll Shows*, BLOOMBERG NEWS (Dec. 13, 2012), *available at* http://www.bloomberg.com/news/2012-12-14/tougher-fracking-regulations-backed-by-66-poll-shows.html (reporting results of a Bloomberg News National Poll conducted Dec. 7-10, 2012); Jason Dearen, Alicia Chang, *Fracking off California Coast Draws Call for Greater Regulation*, SAN JOSE MERCURY NEWS (Aug. 3, 2013), *available at* http://www.mercurynews.com/california/ci_23789784/fracking-off-california-coast-draws-call-greater-regulation.

17. *See, e.g.*, NRDC POLICY BASICS: FRACKING (Feb. 2013) *available at* http://www.nrdc.org/legislation/policy-basics/files/policy-basics-fracking-FS.pdf (stating that the "NRDC believes there needs to be strong federal governance of fracking to protect drinking water, air quality, and human health").

18. *See, e.g.*, Letter from Mickey Thompson, Exec. Dir., Domestic Energy Producers Alliance, to Director, Bureau of Land Management, U.S. Department of Interior (Aug. 22, 2013) (on file at Regulations.gov, http://www.regulations.gov/#!docketBrowser;rpp=25;po=125;dct=PS;D=BLM-2013-0002;refD=BLM-2013-0002-0001); Interview by Fox Business News of Jack Gerard, President, American Petroleum Institute (May 17, 2012), *available at* http://video.foxbusiness.com/v/1644302464001/states-look-to-ban-fracking/ ("We've been using this technology for over 65 years. We've drilled 1.2 million wells and there has

Regulators must navigate this contentious debate while trying to determine what level of regulation will minimize public health concerns and environmental risks. Their efforts are hampered by a lack of information about shale oil and gas extraction and the potential risks these activities pose.[19] As a result, many new state requirements have led with the submission of data to state agencies to help regulators learn more about the possible risk drivers, such as hydrogen sulfide measurements at the wellhead[20] and fracturing water withdrawal reports.[21] Of all the information that could be collected from industry about shale oil and gas extraction, the public and many advocacy groups have focused their attention on the chemicals used in hydraulic fracturing fluid.[22] In response, 23 states have issued hydraulic fracturing chemical (HFC) disclosure requirements in the past three years,[23] making this the most widespread type of state disclosure requirement.

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never been a case of groundwater contamination as a result of hydro fracturing. But what you see is a lot of nonsensical political rhetoric . . .").

19. *See, e.g.*, U.S. Gov't Accountability Office, GAO-12-874, Unconventional Oil and Gas Development: Key Environmental and Public Health Requirements (Sept. 2012) (citing state and federal agency concerns that lack of information is challenging inspection and enforcement activities); Susan Phillips, *Research on Marcellus Drilling Hampered by Lack of Data, Lack of Funding, and Concerns of Bias*, State Impact: NPR.org (Oct. 24, 2011), *available at* http://stateimpact.npr.org/pennsylvania/2011/10/24/research-on-marcellus-drilling-hampered-by-lack-of-data-lack-of-funding-and-concerns-of-bias/.

20. *See, e.g.*, 25 Pa. Code 78.77(a)(1989).

21. *See, e.g.*, Ohio Rev. Code Ann. § 1509.06(A)(7)(a) (West 2012).

22. *See, e.g.*, Peter Behr, *Fight Escalates over Chemical Secrecy in Hydraulic Fracturing*, EnergyWire (June 25, 2012), http://www.eenews.net/stories/1059966361; Theo Colborn, Carol Kwiatkowski, Kim Schultz & Mary Bachran, *Natural Gas Operations from the Public Health Perspective*, Hum. & Ecological Risk Assessment: An Int'l J. 17:5 (Sept. 2011), 1039–56, *available at* http://cce.cornell.edu/EnergyClimateChange/NaturalGasDev/Documents/PDFs/fracking%20chemicals%20from%20a%20public%20health%20perspective.pdf; South Dakota Board of minerals and Env't meeting Minutes (Jan. 17, 2013), *available at* http://denr.sd.gov/boards/2013/bme0113mins.pdf (observing "considerable concerns expressed across the country by some groups and members of the public over the use of the process and the chemicals used").

23. *See* Ala. Admin. Code r. 400-1-9.04 (2013); 178 Ark. Code R. § 1-B-19 (2013); Cal. Pub. Res. Code § 3160 (2013); 2 Colo. Code Regs. § 404-1:205A (2012); Idaho Admin. Code. R. 20.07.02.056 (2012); 225 Ill. Comp. Stat. 732/1-35, 1-75(F) (2013); Ind. Code § 14-37-3-8(B) (2012); Ind. Emergency Rule 12-292 (2012); Kan Admin. Regs. § 82-3-1401 (2013); La. Admin. Code tit. 43, § 118 (2013); Mich. Supervisor of Wells Instruction 1-2011; Miss. Code Ann. § 26-2:1.26 (2013); Mont. Admin. R. 36.22.608 and 1015 (2011); N.M. Admin. Code § 19.15.16.19 (2012); N.D. Admin. Code § 43-02-03-27.1 (2012); Ohio Rev. Code Ann. § 1509.10 (2012); Okla. Admin. Code § 165:10-3-10 (2012); 58 Pa. Cons. Stat. § 3201 et seq. (2012); 25 Pa. Code § 78.122 (2011); S.D. Admin. R. 74:12:02:19 (2013); Tenn. Comp. R. & Regs 0400-53-01 (2013); Tex. Nat. Res. § 91.851 (2011); 16 Tex. Admin. Code § 3.29 (2012); Utah Admin. Code § 649-3-39 (2012); W. Va. Code R. § 35-8 (2013); 3 Wy. Code R. § 45 (2010).

Proponents of HFC disclosure requirements have relied on a number of policy rationales. The Federal Bureau of Land Management (BLM) re-proposed a rule to regulate hydraulic fracturing on federal and tribal lands in May 2013.[24] Comments that were submitted about this proposal[25] articulated at least nine reasons to require HFC disclosures: (1) to provide information to nearby landowners wishing to test their water supplies; (2) to satisfy the public's "right to know"; (3) to enable authorities to determine if surface water or groundwater contamination has occurred following a spill; (4) to establish liability for contamination; (5) to inform first responders and medical personnel; (6) to monitor environmental and health impacts over time; (7) to reduce risk of contamination;[26] (8) to set minimum standards for companies that wish to engage in hydraulic fracturing; and (9) to help the public hold companies and regulators accountable for their actions. Stakeholders in other policy settings have also argued that HFC disclosure requirements may improve corporate governance by informing shareholders and investors,[27] leverage landowner bargaining power with oil and gas companies,[28] and provide companies with a "social license," or community acceptance, to drill.[29] Many of the practical considerations are echoed in the academic body of literature describing the value of HFC disclosure requirements[30] and other types of disclosure laws.[31]

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24. Oil and Gas; Hydraulic Fracturing on Federal and Indian Lands, 78 FED. REG. 31636 (proposed May 24, 2013) (to be codified at 43 C.F.R. pt. 3160).

25. The author reviewed the first 800 entries in Regulations.gov for Docket No. BLM-2013-0002. Analysis on file with the author.

26. These comments did not explain *how* disclosing the chemicals would reduce risk. Commenters may believe disclosure will generate regulation, or drive companies to change their formulations rather than admit to using highly toxic chemicals.

27. Richard A. Liroff, Ph.D., Executive Director, Investor Environmental Health Network, Testimony before the Committee on Natural Resources, Texas House of Representatives (June 26, 2012), *available at* http://www.iehn.org/overview.naturalgashydraulicfracturing.php.

28. Rob Nikolewski, CAPITOL REPORT NEW MEXICO (Nov. 18, 2011), *available at* http://www.capitolreportnewmexico.com/2011/11/fracking-rules-adopted-in-nm-sorry-lamb-chop/ (quoting Steve Henke, New Mexico Oil and Gas Association).

29. *See* Keith B. Hall, *Hydraulic Fracturing: Trade Secrets and the Mandatory Disclosure of Fracturing Water Composition*, 49 IDAHO L. REV. 399 (2013), 409, n. 90.

30. *See, e.g.*, Sara Gosman, *Reflecting Risk: Chemical Disclosure and Hydraulic Fracturing*, 83 GA. L. REV. (2014), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2231674; Hannah Wiseman, *The Private Role in Public Fracturing Disclosure and Regulation*, 3 HARV. BUS. L. REV. ONLINE 49 (2013), *available at* http://www.hblr.org/2013/02/the-private-role-in-public-fracturing-disclosure-and-regulation/.

31. *See, e.g.*, Christian J. Meier-Schatz, *Objectives of Financial Disclosure Regulation*, 8 J. INT'L L., 219–48 (1986), *available at* scholarship.law.upenn.edu/cgi/viewcontent.cgi?article=1674&context=jil; Griffith L. Garwood, Robert J. Hobbs & Fred H. Miller, *Consumer Disclosure in the 1990s*, 9 GA. ST. U. L. REV. 777 (1992-1993); Michael D. Guttentag, *An Argument*

Still, states have not adequately considered these policy rationales when designing HFC disclosure requirements. Even though state legislators or regulators have justified creating HFC disclosure requirements with one or more of these policy goals, state HFC disclosure laws are falling short of achieving them. For instance, some states intended the rules to help inform landowners who were sampling for relevant chemicals in baseline (pre-drilling) testing of their drinking water.[32] However, of the 23 states with HFC disclosure requirements, only six require disclosure before a well has been fractured.[33] Post-fracturing disclosures mean that chemical information is not yet available when a landowner sets out to conduct baseline water quality testing.[34] Many state lawmakers may agree with one Texas legislator's statement, that HFC disclosure laws are intended to respond to public demands "that light be shed on the types of substances being injected into the ground. I think that the public's confidence in hydraulic fracturing will be strengthened simply by lifting the curtain and disclosing this information."[35] However, where state laws limit disclosures to those chemicals designated as "hazardous chemicals" under the Occupational Safety and Health Act,[36] under-reporting of chemicals[37] occurs, which undermines the public's trust in the regulation process.

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for Imposing Disclosure Requirements on Public Companies, 32 FLA. ST. U. L. REV. 123 (2004); Bernard C. Kerkkainen, *Information as Environmental Regulation: TRI and Performance Benchmarking, Precursor to a New Paradigm?*, 89 GEO. L. J. 257 (2001).

32. *Protecting Public Health, Safety & Welfare in the Conduct of Oil and Gas Operations: Proposed Rulemakings Related to HB 07–1341* (Aug. 31, 2007) (Colorado Oil and Gas Conservation Commission noting that "Colorado communities need chemical disclosure in advance of commencement of operations . . . for targeted monitoring of those chemicals used.").

33. 178-00 ARK. CODE R. § 001:B–19(k)(7)–(8), (l)(3)(C) (Lexis 2011); CAL. PUB. RES. CODE § 3160(d)(1)(D) (West 2013); IDAHO ADMIN. CODE r. 20.07.02.056 (2002); 225 ILL. COMP. STAT. 732/1–35(b)(8) (2013); MONT. ADMIN. R. 36.22.608, 36.22.1015 (2012); 3 WY. CODE r. § 45(d) (Lexis 2010).

34. *But see* Keith B. Hall, *Hydraulic Fracturing: Trade Secrets and the Mandatory Disclosure of Fracturing Water Composition*, 49 IDAHO L. REV. 399 (2013), at 424–25; BD. OF OIL AND GAS CONSERVATION AND THE DEP'T OF NAT. RES. AND CONSERVATION OF THE STATE OF MONT., in the Matter of the Adoption of New Rules I through V regarding Oil and Gas Well Stimulation: Notice of Adoption, at 1690. Montana Administrative Register Notice 36-22-157, No. 16, Aug. 25, 2011, *available at* http://www.mtrules.org/gateway/ShowNoticeFile.asp?TID=3578.

35. Jacquelyn Pless, *Fracking Fracas*, STATE LEGISLATURES MAGAZINE (May 2012) (quoting Rep. Janet Nelson), *available at* http://www.ncsl.org/research/energy/fracking-fracas.aspx.

36. 29 C.F.R. § 1910.1200(c) (2013); N.M. CODE R. § 19.15.16.19(B) (Lexis 2012).

37. Rodney White, *Disclosing More Detail about Fracking Chemicals Might be Wise*, THE BARREL: THE ESSENTIAL PERSPECTIVE ON GLOBAL ENERGY (Mar. 2, 2012), *available at* http://blogs.platts.com/2012/03/02/disclosing_more/ (quoting Matthew Watson, Environmen-

Conversely, disclosure laws may require information that does not increase risk awareness, and may trigger competitiveness concerns. Fracturing fluids contain chemical products (with names such as Supermax[38] and OGC-7[39]), which in turn contain any number of chemicals. Risk assessments likely would not turn on the identity of each product but on the combination of constituent chemicals across all products present in the fracturing fluid.[40] Yet only a few states make it clear that companies may report all chemicals used to stimulate a well in one list, rather than by product.[41] Moreover, most states require operators to describe the purpose of each product. Companies express concerns that reporting HFCs by product, and describing the purpose of that product, may facilitate reverse-engineering efforts by competitors.[42] Absent a clearly articulated goal for this additional information, it may not be warranted to request this information. In fact, one service provider announced in early 2014 that it would begin reporting a master list of chemicals used at each well; Baker Hughes noted that this approach should allow the company to dispense with trade secret assertions.[43]

Even the right level of disclosure may not achieve stated goals if the target audience is wrong. As will be discussed, most HFC disclosure laws have targeted the general public. In the past, chemical disclosure laws for consumer products have informed the public's purchasing decisions and driven the market to lower-toxic alternatives. Here, however, most members of the public purchase oil and natural gas through intermediaries such as electric utilities and gas stations. Therefore, the pub-

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tal Defense Fund, that Halliburton and other service companies have indicated that "probably half" of the chemicals used in fracturing are not regulated by OSHA).

38. Supermax is a surfactant that has 22 ingredients, including methanol, 2-butoxyethanol, and naphthalene. It is manufactured by Superior Well Services. *See* FracFocus form for Well # 21-079-60357, www.fracfocus.org.

39. OGC-7 is a Petroleum Distillate Blend manufactured by Benchmark. *See* FracFocus form for Well # 42-173-35129, www.fracfocus.org.

40. An exception to this would be if a chemical product spilled at the surface of the well, before being blended into the fracturing fluid.

41. *See, e.g.*, 2 Colo. Code Regs. 401-1, App. I, Statement of Basis for Rule 205A (acknowledging concerns of reverse engineering and therefore allowing "operators to report the required information in a format that does not link chemical ingredients . . . to their respective hydraulic fracturing additive").

42. *See* Bridget DiCosmo, *Colorado Crafts Model Deal for Protecting CBI in Fracking Disclosure Rules*, INSIDE EPA (Dec. 20, 2011) (describing Colorado's new rule as a way to reduce "reverse-engineering" concerns), *available at* http://insideepa.com/Risk-Policy-Report/Risk-Policy-Report-12/20/2011/colorado-crafts-model-deal-for-protecting-cbi-in-fracking-disclosure-rules/menu-id-1098.html.

43. Mike Soraghan, *Baker Hughes Phasing out 'Trade Secrets' in FracFocus Disclosure*, E&E PUBLISHING, LLC (Apr. 24, 2014).

lic has a less direct way to exert their purchasing power to drive safer extraction practices.

Carefully designed reporting and disclosure regimes ensure the information collected is a means to an end—preparedness of emergency personnel, knowledge of a risk, or motivation to reduce that risk—rather than a dead end. Thoughtful regulation design may take more work up front, but it pays dividends down the line. Effective disclosure requirements trigger feedback mechanisms that complement and reinforce other regulatory requirements, and build the public trust in the government's ability to manage the risks associated with shale oil and gas production.

Thus, this article proposes a "goal-oriented" approach to the design of HFC disclosure systems. Under this approach (which I will refer to as "Goal-Oriented Disclosure Design"), the drafters of new design requirements would begin with a specific policy goal, such as informing medical professionals or reducing the use of carcinogens in fracturing fluid formulations. Then, the drafters would identify the target audience that might be leveraged in pursuit of that goal. Sometimes the link is direct: in order to fully inform medical professionals about the chemicals being used, the state need only share the information directly with the medical community. However, to drive safer formulations of fracturing fluid, many states may need to rely on intermediate audiences, such as insurers, lenders, electric utilities, or the general public. When multiple audiences are possible, designers would identify feedback loops to determine where the greatest leverage exists to achieve the policy goal. An insurer will have leverage over some companies, but not over those that self-insure; the general public can call on elected officials to do something but have little economic leverage over the methods of oil and gas development when they do not purchase these commodities directly from the wells. Next, drafters would consider when and how an information end user[44] might use the data in order to set timing for disclosures, identify substantive requirements, and decide whether to grant limited, conditional access to trade secret information. Finally, drafters would consider how to present and distribute the disclosures, selecting formats and channels familiar and accessible to the target audience—for

44. By "information end users," I mean the audiences for the disclosures. This could be the general public, landowners, public water purveyors, paramedics, state and federal agency officials, insurance companies, lenders, or anyone else who might have an interest in reviewing information related to shale oil and gas extraction. There is a lot of rich academic literature on information users. *See, e.g.*, Holly Doremus, *Adaptive Management as an Information Problem*, 89 N.C.L. Rev. 1455 (2011); George Loewenstein, Cass R. Sunstein, Russell Golman, *Disclosure: Psychology Changes Everything* (Harvard Public Law Working Paper No. 13-30, Aug. 18, 2013), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2312708.

instance, Securities and Exchange Commission (SEC) filings for investors, and Poison Control Centers for first responders—to ensure efficient uptake of the information.

This article has four parts. Part I describes the politics and policy concerns that drove states to issue HFC disclosure requirements. Part II summarizes some of the major characteristics of existing HFC disclosure requirements, and describes their shortcomings when viewed against the policy goals articulated in their support. Part III describes the elements of Goal-Oriented Disclosure Design. Part IV applies Goal-Oriented Disclosure Design to a particular HFC disclosure policy goal of informing first responders and medical professionals as they respond to emergencies and treat patients. The analysis concludes with a suite of practical recommendations for decision-makers designing or re-evaluating existing HFC disclosure requirements.

I. DATA GAPS AND DISCLOSURE POLITICS: THE RISE OF DISCLOSURE REQUIREMENTS

Hydraulic fracturing has been used in the oil and gas industry since the mid-1900s.[45] However, the technology has evolved rapidly in recent years[46] to reach deeper and more impermeable sources of oil and gas. Industry and federal agencies working in partnership to unlock "unconventional" stores of oil and natural gas in the 1970s[47] began referring to the practice as "massive hydraulic fracturing" to distinguish this modern version of fracturing from its more modest beginnings.[48] "Massive hydraulic fracturing" is defined as fracturing requiring at least 50,000 to 500,000 gallons of fracturing or stimulation fluid.[49] As recently as 2004, the U.S. Environmental Protection Agency (EPA) was studying that scale of hydraulic fracturing as applied to coal bed methane production.[50]

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45. Hydraulic fracturing was first used in 1947 on an experimental basis at a well in Kansas. *See* Daniel R. Suchy & K. David Newell, *Hydraulic Fracturing of Oil and Gas Wells in Kansas (2012)*, KANSAS GEOLOGICAL SURVEY, PUBLIC INFORMATION CIRCULAR (PIC) 32, http://www.kgs.ku.edu/Publications/PIC/pic32.html.

46. *See* REVIEW OF EMERGING RESOURCES: U.S. SHALE GAS AND SHALE OIL PLAYS, *supra* note 3.

47. *See, e.g.*, Daniel Soeder, *Shale Gas Development in the United States*, *in* ADVANCES IN NATURAL GAS TECHNOLOGY 3 (Hamid Al-Megren ed., 2012) (describing federal Eastern Gas Shales Project, launched in 1975).

48. *See* S.P. Cremean, S.F. McKetta, G.L. Owens & E.C. Smith, *Massive Hydraulic Fracturing of the Devonian Shale in Lincoln County, West Virginia* 120, 167, 246, 283 (1979).

49. R.G. Agarwal, R.D. Carter & C.B. Pollock, *Evaluation and Performance Prediction of Low-Permeability Gas Wells Stimulated by Massive Hydraulic Fracturing*, 31 J. PETROLEUM TECH. 362 (1979).

50. ENVTL. PROT. AGENCY, EVALUATION OF IMPACTS TO UNDERGROUND SOURCES OF DRINKING WATER BY HYDRAULIC FRACTURING OF COALBED METHANE RESERVOIRS 1–2 (2004)

The practice has grown in scale by another order of magnitude. In 2004, the EPA reported fracturing fluid volumes ranging from 50,000 to 350,000 gallons per well, with a median average injection volume of 57,500 gallons.[51] Today, three to six million gallons of fracturing fluid may be used to fracture a single well in the Marcellus shale, a large shale formation extending 600 miles from the tip of Virginia to the Southern Tier and Finger Lakes regions of New York.[52] The greater volumes are largely driven by the growth in well size. Wells in the Marcellus formation often run 5,000 to 9,000 feet vertically into the ground, then turn horizontally, sending out arms that extend an additional 3,000 to 10,000 feet.[53] A shift in fracking techniques from coal bed methane to shale wells[54] does not correlate automatically to higher risk; shallower coal bed formations can pose a greater risk to underground sources of drinking water due to the coal's proximity to aquifers.[55] However, hydraulic fracturing as applied to shale formations and tight sands is generally more intensive, requiring greater amounts of water and chemicals to stimulate production.[56] That can translate into greater volumes of truck traffic, waste generation, and other drivers.

Although concerns have been raised about all of these additional risk drivers, the chemicals used in fracturing fluid have become a flash point for public concern about shale oil and gas development.[57] One fo-

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[hereinafter EVALUATION IMPACTS] (Coalbed methane production is the process of extracting natural gas from unmined coal seams).

51. *Id.* at 3–11.

52. NAT'L ENERGY TECH. LAB. STRATEGIC CENTER FOR NATURAL GAS AND OIL, MODERN SHALE GAS DEVELOPMENT IN THE UNITED STATES: AN UPDATE 49 (2013).

53. *Id.* at 47. Coal bed methane wells are generally shallower. *Cf.* Oil and Gas Lease Equipment and Operating Cost 1994 through 2009, U.S. Energy Info. Admin., (Sept. 28, 2010) *available at* http://www.eia.gov/pub/oil_gas/natural_gas/data_publications/cost_indices_equipment_production/current/coststudy.html (providing maximum cost numbers for onshore gas wells deeper than 16,000 feet and maximum cost numbers for coal bed methane wells deeper than 3,000 feet).

54. Coalbed methane production held steady from 2008 to 2011; over the same period, shale gas production more than tripled. *See* U.S. ENERGY INFO. ADMIN., U.S. CRUDE OIL, NATURAL GAS, AND NATURAL GAS LIQUIDS PROVED RESERVES 38, 40 (2013).

55. Hannah Wiseman, *Untested Waters: The Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation*, 20 FORDHAM ENVTL. L. REV. 115, 140–41 (2009) (citing a member of the Ground Water Protection Council Board).

56. Hannah Wiseman, *Fracturing Regulation Applied*, 22 DUKE ENVTL. L. & POL'Y F. 361, 362–67 (2012).

57. *See* GEORGE KING, HYDRAULIC FRACTURING 101: WHAT EVERY REPRESENTATIVE, ENVIRONMENTALIST, REGULATOR, REPORTER, INVESTOR, UNIVERSITY RESEARCHER, NEIGHBOR AND ENGINEER SHOULD KNOW ABOUT ESTIMATING FRAC RISK AND IMPROVING FRAC PERFORMANCE IN UNCONVENTIONAL GAS AND OIL WELLS 7 (2012) (noting that "chemicals, or more precisely, the lack of disclosure about chemicals, have probably received and deserved the most vitriolic attacks in the 'anti-frack' literature"); *The Environmental and Occupational*

cus of advocacy around this issue was the lack of transparency about the chemical use. Before 2010, there was virtually no regulatory mechanism for disclosing information about these chemicals to state agencies or the public.[58] When shale oil and gas recovery became commercially viable, state drilling permit applications did not require disclosure of the amount and types of chemicals used in hydraulic fracturing.[59] Moreover, there were no federal requirements to disclose information about all HFC.

Limited chemical disclosure occurred under the federal Occupational Safety and Health Act (OSHA). OSHA requires chemical manufacturers to list information about "hazardous chemicals" on Material Safety Data Sheets (MSDS) for placement on sites where the chemicals are used.[60] OSHA defines "hazardous chemical" broadly;[61] however, the chemicals listed on MSDS are limited in three ways. First, manufacturers are not required to test a new chemical product; only pre-existing studies are consulted to determine if a material is "hazardous."[62] Second, OSHA's requirements are limited to chemicals that were previously "known to be present in the workplace [so] that employees may be exposed under normal conditions of use or in a foreseeable emergency."[63] New applications for chemicals in the oil and gas fields may mean workers are handling, blending, and disposing some chemicals not previously used in a workplace setting. These chemicals will not show up on an MSDS. Third, chemicals constituting less than one percent of the prod-

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Health Impacts of High Volume Hydraulic Fracturing of Unconventional Gas Resources, AMER. PUBLIC HEALTH ASS'N (Oct. 30, 2012), *available at* http://www.apha.org/advocacy/policy/policysearch/default.htm?id=1439 (noting that water contamination by HFC is one "of the most highly publicized environmental impacts"); Edwin Dobb, *The New Oil Landscape*, NAT'L. GEOGRAPHIC (Mar. 2013), http://ngm.nationalgeographic.com/2013/03/bakken-shale-oil/dobb-text#close-modal (noting HFCs are "of special concern").

58. Since at least 2000, Alabama had required coal bed methane producers to file "[p]rograms to hydraulic fracturing" to the state Oil and Gas Supervisor, including information about the "type fluids and materials that are to be utilized." ALA. ADMIN. CODE R. 400-3-8-.03(5) (2000).

59. A few states required limited reporting of fracturing additives to agencies. *See, e.g.*, ALA. ADMIN. CODE R. 400-3-8-.03(5) (2000); IOWA ADMIN. CODE R. 565-51.6(8)(h) (1993).

60. *See* 29 C.F.R § 1910.1200(b)(1) (2013).

61. *See id.* at § 1910.1200(c).

62. *Id.* at § 1910.1200(d)(2); Edwin G. Foulke, Jr., Ass't Sec'y of Labor for Occupational Safety & Health, *Guidance for Hazard Determination - for Compliance with the OSHA Hazard Communication Standard (29 CFR 1910.1200)*, U.S. DEP'T OF LABOR, OCCUPATIONAL SAFETY & HEALTH ADMIN, *available at* http://www.osha.gov/dsg/hazcom/ghd053107.html (last visited Apr. 21, 2014).

63. 29 C.F.R § 1910.1200(b)(2); *see also* Mike Soraghan, *In Fracking Debate, 'Disclosure' is in the Eye of the Beholder*, E&E PUBLISHING, LLC (June 21, 2010), *available at* www.eenews.net [hereinafter *Fracking Debate*] (quoting Amy Mall, Natural Resources Defense Council).

uct[64] (or 0.1-percent, if they are carcinogenic) and chemicals the manufacturer wants to protect as a trade secret[65] are not disclosed.

Several federal statutes would appear to grant the EPA authority to require broader HFC disclosures. However, the Agency has not exercised these authorities. For instance, the EPA has not required oil and gas facilities to report to the Federal Toxics Release Inventory (TRI) system, a public chemical-use database established by the Emergency Planning and Community Right to Know Act.[66] Nor has the EPA required environmental testing or disclosure of HFC under the Toxic Substances Control Act (TSCA), despite considering some action under this statute in 2011.[67]

In 1997, the Eleventh Circuit Court of Appeals ruled that the Federal Safe Drinking Water Act (SDWA) must be used to regulate hydraulic fracturing.[68] The decision meant that oil and gas operators needed to apply for Underground Injection Control permits before they could inject fracturing fluids into an oil or gas well. These applications would require pre-fracturing[69] and post-fracturing[70] disclosures about the volume, concentrations, and an "analysis of the physical and chemical characteristics of the injection fluid."

The EPA balked at this ruling. Instead of launching a SWDA permitting program for oil and gas operators, the EPA launched a study of the risks associated with hydraulic fracturing. In 2004, this study concluded that, "the injection of hydraulic fracturing fluids into [coalbed methane] wells poses little or no threat to [underground sources of drinking water] and does not justify additional study at this time."[71] The EPA reached this conclusion despite reviewing instances of water con-

64. *See, e.g.*, 29 C.F.R. § 1910.1200, App. A, Table A.9.3.

65. *Id.* at § 1910.1200(i).

66. 42 U.S.C. § 11023(b) (2006). EPCRA was enacted in 1986, in the wake of a tragic chemical accident in Bhopal, India that resulted in the death of more than 2,000 people. *What is EPCRA?*, U.S. Envtl. Prot. Agency, *available at* http://www2.epa.gov/epcra-tier-i-and-tier-ii-reporting/what-epcra. Industries covered by EPCRA must file "toxic [chemical] release inventory" forms, so that the public knows what each facility manufactures or uses. Congress required certain industrial facilities to report (Standard Industrial Classification Codes 20 through 39) but oil and gas facilities fall outside of this range of industrial codes. However, Congress authorized EPA to extend coverage. *See* 42 U.S.C. § 11023 (b)(1)(B).

67. *See* Letter from Stephen Owens, U.S. EPA Assistant Administrator, to Deborah Goldberg, EarthJustice, (Nov. 23, 2011).

68. *Legal Envtl. Assistance Found. v. EPA*, 118 F.3d 1467 (11th Cir. 1997).

69. Envtl. Prot. Agency, EPA Form 7520-6,Underground Injection Control Permit Application (2011).

70. Envtl. Prot. Agency, EPA Form 7520-6, Completion Report for Brine Disposal, Hydrocarbon Storage, or Enhanced Recovery (2011).

71. Evaluation Impact, *supra* note 50, at 7-5.

tamination, observing that "water quality (and quantity) problems might be associated with some of the production activities common to coalbed methane extraction."[72]

Following the publication of the EPA study, Congress exempted all hydraulic fracturing from the Safe Drinking Water Act, with one glaring exception; instances where diesel was used as an HFC.[73] In 2003, the EPA had negotiated a voluntary agreement with the three largest oil and gas service companies[74] to eliminate diesel fuel in certain fracturing jobs.[75] In February 2014, EPA issued recommendations for permitting hydraulic fracturing activities using diesel fuel; however, these recommendations are non-binding.[76]

Against this backdrop, the United States witnessed a few high-profile cases of drinking water contamination with possible links to shale oil and gas operations.[77] Scientists began to call for full HFC disclosure in order to ensure effective monitoring of drinking water supplies[78] and inform long-term public health studies.[79] Environmental advocates argued

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72. *Id.* at 6–16.

73. Energy Policy Act of 2005, Pub. L. No. 109-58, § 322, 119 Stat. 694 (Aug. 8, 2005) (amending 42 U.S.C. § 300h(d)).

74. Service companies do not directly produce oil and gas but provide critical field services such as drilling and well stimulation.

75. A Memorandum of Agreement Between the United States Environmental Protection Agency and BJ Services Co., Halliburton Energy Services, Inc., and Schlumberger Techology Corporation (2003). The agreement was limited to coalbed methane fracturing in underground sources of drinking water. The agreement was not enforceable, and did not "constrain[ ] . . . the Companies from taking actions relating to hydraulic fracturing that are authorized or required by law." *Id.* at 3.

76. U.S. Envtl. Prot. Agency, Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuels: Underground Injection Control Program Guidance # 84 1 (2014); EPA Notice, 79 Fed. Reg. 8451, (Feb. 12, 2014).

77. *See, e.g.*, Mouawad & Clifford Krauss, *Dark Side of Natural Gas Boom*, N.Y. Times, Dec. 7, 2009, at B1; Jon Hurdle, *US Test Shows Water Problem Near Nat Gas Drill Site*, Reuters (Sept. 1, 2010), *available at* http://www.reuters.com/article/2010/09/01/us-drilling-water-idUSTRE6807KG20100901 (describing contamination concerns in Pavillion, Wyoming); Laura Legere, *Private Lab Finds Toxic Chemicals in Dimock Water*, Times-Tribune (Sept. 16, 2010), http://thetimes-tribune.com/private-lab-finds-toxic-chemicals-in-dimock-water-1.1014476.

78. Theo Colborn, Carol Kwiatkowski, Kim Schultz & Mary Bachran, *Natural Gas Operations from the Public Health Perspective*, 17 Hum. & Ecological Risk Assessment: An Int'l J. 1039 (2011).

79. Charles W. Schmidt, *Blind Rush? Shale Gas Boom Proceeds Amid Human Health Questions*, 119 Envtl. Health Persp. a348 (2011) (quoting Dr. Bernard Goldstein, University of Pittsburgh).

"[d]isclosure would shine a light and encourage companies to use less toxic chemicals."[80]

By 2009, elected officials responded and began calling for increased HFC disclosures. In June 2009, Rep. Diana DeGette introduced the FRAC Act to repeal the Safe Drinking Water Act exemption.[81] Rep. DeGette argued the legislation was needed to "document contamination cases," forcing the oil and gas industry to follow rules "just like every other industry."[82] Senator Robert Casey introduced a companion bill the same day,[83] arguing that HFC disclosure would "ensure that hydraulic fracturing does not unnecessarily jeopardize our groundwater. There are affordable alternatives that oil and gas companies can use so that they are not risking contaminating drinking water wells with potentially hazardous chemicals."[84] The FRAC Act failed to pass both the 111th Congress and the 112th Congress.[85] In the federal budget for the 2010 fiscal year, Congress directed the EPA to study "the relationship between hydraulic fracturing and drinking water."[86] The EPA released a progress report on this study in December 2012 and is expected to complete the study by 2014.[87]

In 2007, Rep. Henry Waxman, then Chairman of the House Committee on Oversight and Government Reform, sent HFC information request letters to the three companies that had entered into the earlier diesel ban agreement with EPA.[88] A broader investigation was con-

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80. *Fracking Debate*, *supra* note 63 (quoting Amy Mall, Natural Resources Defense Council).

81. H.R. 2766 111th Cong. (2009).

82. David O. Williams, *DeGette, Polis Introduce FRAC Act Aimed at Closing Hydraulic Fracturing* '*Loophole*,' THE COLORADO INDEPENDENT (June 9, 2009), *available at* http://www.coloradoindependent.com/79273/degette-polis-once-again-introduce-frac-act-to-bring-federal-oversight-to-gas-fracking.

83. S. 1215 111th Cong. (2009).

84. Press Release, Casey, House Members Introduce Companion Bills to Protect Drinking Water from Natural Gas Fracking: America Public Deserves to Know Chemicals Used Near Their Water Source (June 9, 2009).

85. S. 587 (112th): FRAC Act, GOVTRACK.US, https://www.govtrack.us/congress/bills/112/s587 (last visited April 21, 2014); H.R. 1084 (112th): Fracturing Responsibilities and Awareness of Chemicals Act of 2011, GOVTRACK.US, https://www.govtrack.us/congress/bills/112/hr1084 (last visited Apr. 21, 2014).

86. H.R. REP. NO. 11-316, at 109 (2009) (Conf. Rep.)

87. *EPA's Study of Hydraulic Fracturing and its Potential Impact on Drinking Water Resources*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/hfstudy/ (last visited Dec. 17, 2012).

88. Letter from Henry A. Waxman, Chairman, Comm. on Oversight and Gov't Reform, to David J. Lesar, Chairman, President, and Chief Executive Officer, Halliburton (Apr. 20, 2007); Letter from Henry A. Waxman, Chairman, Committee on Oversight and Government Reform, and Edward J. Markey, Chairman, Subcommittee on Energy and En-

ducted, and Rep. Waxman, Rep. Edward Markey, and Rep. DeGette reported that from 2005 to 2009, service companies injected 32.7 million gallons of diesel fuel or fracturing fluids containing diesel fuel into wells in 20 states.[89] This revelation further fueled HFC disclosure battles.[90] In August 2010, states began to react. Wyoming became the first state to require public HFC disclosures,[91] responding to public fears about the fracturing fluids and demonstrating that states could protect water supplies without federal regulation.[92] Regulators in Arkansas and Pennsylvania, home to the Haynesville and Marcellus shale plays, soon followed suit.[93]

Under pressure, oil and gas producers began voicing their support for HFC disclosures.[94] These companies and their service contractors moved ahead of many of the states with voluntary disclosures. One month before Wyoming finalized its HFC disclosure rules, natural gas producer Range Resources announced that it would begin disclosing chemicals on a public website.[95] In 2011, the Ground Water Protection Council (GWPC) and the Interstate Oil and Gas Compact Commission (IOGCC) launched a website entitled "FracFocus" for companies to post

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vironment, to Andrew Gould, Chairman and CEO, Schlumberger (Feb. 18–26, 2010); Letter from Henry A. Waxman, Chairman, Comm. on Oversight and Government Reform, to J.W. Stewart, Chairman, President, and CEO, BJ Services (Nov. 26, 2007).

89. Letter from Henry A. Waxman, Ranking Member, Committee on Energy and Commerce, Edward J. Markley, Ranking Member, Committee on Natural Resources, Diana DeGette, Ranking Member, Subcommittee on Oversights and Investigations, to the Honorable Lisa Jackson, Administrator (Oct. 25, 2011); Memorandum from Chairman Henry A. Waxman and Subcommittee Chairman Edward J. Markey on the potential impact of hydraulic fracturing to Members of the Subcommittee on Energy and the Environment.

90. *Toxic Diesel Fuel Used Without Permits in Fracking Operations*, ENVTL. NEWS SERV. (Feb. 4, 2011) *available at* http://www.ens-newswire.com/ens/feb2011/2011-02-04-092.html; Mike Soraghan, *Fracking Companies Inject 32M Gallons of Diesel, House Probe Finds*, E&E PUBLISHING, LLC, Jan. 31, 2011, *available at* www.eenews.net.

91. 3 WY. CODE R. § 45 (2010).

92. *See, e.g.*, Mike Soraghan, *Wyo. Fracking Rules Point the Way for Public Disclosure of Chemical Used*, N.Y. TIMES, Dec. 20, 2010, *available at* http://www.nytimes.com/gwire/2010/12/20/20greenwire-wyo-natural-gas-fracking-rules-for-point-the-w-18753.html?pagewanted=all.

93. ARK. ADMIN. CODE § 178.00.1-B-19 (2011); 25 PA. CODE § 78.122 (2011).

94. *The ExxonMobil-XTO Merger: Impact on U.S. Energy Markets*, HEARING BEFORE THE SUBCOMM. ON ENERGY AND THE ENVIRONMENT OF THE COMMITTEE OF ENERGY & COMMERCE, House of Representatives, 111 Cong. 2 (Jan. 20, 2010), at 53 (comments by Rex Tillerson, Exxon CEO) *available at* http://democrats.energycommerce.house.gov/sites/default/files/documents/Final-Transcript-EE-ExxonMobil-XTO-Merger-2010-1-20.pdf; Christopher Holman, *Gas Industry Faces the Dangers of Fracking*, Forbes (Sept. 28, 2009) (quoting Aubrey McClendon, Chesapeake Energy's CEO at the time).

95. Russell Gold, *Natural-Gas Driller to Disclose Chemical Use*, WALL ST. J., July 14, 2010, http://online.wsj.com/news/articles/SB10001424052748703834604575365360901763540.

voluntary HFC disclosures.[96] Mike Paque, the director of GWPC, explained, "as more and more questions were asked about the hydraulic fracturing process the past couple of years—particularly relating to chemical additives used in the process—we recognized an obstacle to greater disclosure was the lack of a uniform and efficient way to collect, report, and ensure public access."[97] The website states that it was established in order to provide "public access to reported chemicals."[98] In the summer of 2011, Texas and Montana also began to require disclosures, authorizing companies to send disclosures directly to FracFocus.[99] Today, 16 states use FracFocus as a repository for mandatory HFC disclosures.[100] Of those, three states—Pennsylvania, Texas, and Tennessee[101]—require parallel submissions to the state.

Industry has also driven the disclosure discussion in several states. In New Mexico, industry petitioned the state Oil Conservation Commission, asking the Commission to issue an HFC disclosure rule and providing sample draft language for consideration.[102] The President of the New Mexico Oil & Gas Association, a trade group representing industry interests stated, "the proposal before the [Commission] makes a strong statement about the industry's willingness to embrace transparency and accountability."[103] The Commission passed the industry's

96. *Council and Compact Launch FracFocus.org for Chemical Data*, ENVTL. PROTECTION ONLINE, Apr. 13, 2011, http://eponline.com/articles/2011/04/13/council-and-compact-launch-fracfocusorg-for-chemical-data.aspx.

97. *Id.*

98. FracFocus, "About Us," http://fracfocus.org/welcome (last visited Apr. 27, 2014).

99. TEX. NAT. RES. CODE ANN. § 91.851 (West 2011); MONT. ADMIN. R. 36.22.1015(4)(a) (2011).

100. *See* ALA. ADMIN. CODE r. 400-1-9.04(7)(b) (2013); 2 COLO. CODE REGS. § 404-1:205A(b)(2) (2012); KAN. ADMIN. REGS. § 82-3-1401(f) (2013); LA. ADMIN. CODE tit. 43, § 118(c)(4) (2011); MISS. CODE R. 26-2:1.26(10) (2013); MONT. ADMIN. R. 36.22.1015(4) (2011); N. D. ADMIN. CODE 43-02-03-27.1(1)(g), (2)(i) (2012); OHIO REV. CODE ANN. § 1509.10(F)(2) (2011); OKLA. ADMIN. CODE § 165:10-3-10(b) (2013); 58 PA. CONS. STAT. § 3222.1(b)(2) (2012); S.D. ADMIN. R. 74:12:02:19 (2013); TENN. COMP. R. & REGS. 0400-53-01-.03(1)(b) (2013); TEX. NAT. RES. CODE ANN. § 91.851(a)(1)(A) (2011); 16 TEX. ADMIN. CODE § 3.29(c)(2) (2012); UTAH ADMIN. CODE R. 649-3-39(1) (2012); W. VA. CODE R. § 35-8-10.1.b (2013). The sixteenth state, California, enacted a law stating that operators should use FracFocus only until the state establishes a website. *See* CAL. PUB. RES. CODE § 3160(g)(2)(B) (West 2013).

101. *See* 58 PA. CONS. STAT. § 3222(b.2) (2012), § 3222.1(b)(3) (2012); TEX. NAT. RES. CODE ANN. § 91.851(a)(1)(C), (D) (West 2011); TENN. COMP. R. & REGS. § 0400-53-01.03.

102. Press Release, N.M. Oil & Gas Industry, *Hearing on Hydraulic Fracturing Fluid Disclosure Rule*, (Nov. 16, 2011), *available at* http://www.nmoga.org/hearing-on-hydraulic-fracturing-fluid-disclosure-rule.

103. *Id.*

proposed language into law almost verbatim.[104] As of December 31, 2013, 23 states have HFC disclosure requirements in place,[105] and legislatures in at least two more states have directed regulators to draft them.[106]

II. DESCRIPTION OF HYDRAULIC FRACTURING DISCLOSURE RULES

A number of articles and reports have discussed characteristics of state HFC disclosure laws in great detail.[107] The summary that follows is not intended to be comprehensive; it is intended as context for a discussion of Goal-Oriented Disclosure Design that will focus on the goal of informing first responders and medical professionals. The summary is divided into four categories that discuss the timing for the disclosures, the substantive requirements of disclosure, non-disclosure and medical exceptions, and channels of distribution for the disclosed information.

A. Timing of Information Disclosure

All states with hydraulic fracturing have disclosure requirements that include deadlines for disclosure. Six states require "pre-disclosures," where well operators must disclose the HFC that will be used before

104. Rob Nikolewski, *Fracking Rules Adopted in NM – sorry Lamb Chop*, CAPITOL REPORT NEW MEXICO, Nov. 18, 2011, http://www.capitolreportnewmexico.com/2011/11/fracking-rules-adopted-in-nm-sorry-lamb-chop/.

105. ALA. ADMIN. CODE r. 400-1-9.04 (2013); 178 ARK. CODE R. § 1-B-19 (2013); CAL. PUB. RES. CODE § 3160 (2013); 2 COLO. CODE REGS. § 404-1:205A (2012); IDAHO ADMIN. CODE. R. 20.07.02.056 (2012); 225 ILL. COMP. STAT. 732/1-35, 1-75(F) (2013); IND. CODE § 14-37-3-8(B) (2012); IND. EMERGENCY RULE 12-292 (2012); KAN ADMIN. REGS. § 82-3-1401 (2013); LA. ADMIN. CODE TIT. 43, § 118 (2013); MICH. SUPERVISOR OF WELLS INSTRUCTION 1-2011; MISS. CODE ANN. § 26-2:1.26 (2013); MONT. ADMIN. R. 36.22.608 and 1015 (2011); N.M. ADMIN. CODE § 19.15.16.19 (2012); N.D. ADMIN. CODE § 43-02-03-27.1 (2012); OHIO REV. CODE ANN. § 1509.10 (2012); OKLA. ADMIN. CODE § 165:10-3-10 (2012); 58 PA. CONS. STAT. § 3201 ET SEQ. (2012); 25 PA. CODE § 78.122 (2011); S.D. ADMIN. R. 74:12:02:19 (2013); TENN. COMP. R. & REGS 0400-53-01 (2013); TEX. NAT. RES. § 91.851 (2011); 16 TEX. ADMIN. CODE § 3.29 (2012); UTAH ADMIN. CODE § 649-3-39 (2012); W. VA. CODE R. § 35-8 (2013); 3 WY. CODE R. § 45 (2010).

106. *See* 2012 N.C. Sess. Laws 143 (S.B. 820); 2013 NEV. REV. STAT. 390.

107. *See, e.g.*, Terence J. Centner, *Oversight of Shale Gas Production in the United States and the Disclosure of Toxic Substances*, 38 RESOURCES POL'Y 233 (2013); Chris Boling, *Hydraulic Fracturing and Chemical Disclosures: What You Do Not Know Could Hurt You!*, 46 LOY. L.A. L. REV. 257 (2012); Matthew McFeeley, *State Hydraulic Fracturing Disclosure Rules and Enforcement: A Comparison*, NRDC ISSUE BRIEF, IB-12-06-A (July 2012), *available at* http://www.nrdc.org/energy/files/Fracking-Disclosure-IB.pdf; BRANDON J. MURRILL & ADAM VAN, CONG. RESEARCH SERV., R42461 HYDRAULIC FRACTURING: CHEMICAL DISCLOSURE REQUIREMENTS (June 19, 2012) *available at* http://www.fas.org/sgp/crs/misc/R42461.pdf.

they fracture a well.[108] Arkansas requires service companies to submit master lists of all fracturing fluid additives and constituent chemicals that will be used in the state, as opposed to providing well-specific pre-disclosures.[109] Five of the states requiring pre-disclosures do not include a policy rationale for the timing in the law. However, three of the pre-disclosure states prohibit the use of certain additives in some or all fracturing jobs, as well as requiring state approval to use these additives.[110] In these cases, pre-disclosures are necessary to ensure compliance with separate provisions in the law. The remaining 16 states require HFC disclosures later in the process, typically a number of days following the start[111] or the completion[112] of a fracturing job. Five states—California, Colorado, Pennsylvania, Tennessee, and Texas—set deadlines for chemical suppliers and service companies to provide chemical information to well operators.[113] In every case, the deadlines for the suppliers and service companies to provide the information are set after the start date for fracturing. Arkansas and Michigan direct service companies to provide HFC information to the permit holder, but set no timeline for this information transfer.[114] Sixteen states do not address the transfer of information from the chemical suppliers or service companies to the operators.[115]

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108. *See* ALA. ADMIN. CODE R. 400-1-9-.04(3)(C) (2013) (requiring applications to include "consideration of the type fluids and materials that are to be utilized"); CAL. PUB. RES. CODE § 3160(d)(1)(D); IDAHO ADMIN. CODE R. 20.07.02.056(01)(b) (2012); 225 IL. COMP. STAT. 732/1-35(b)(8) (2013); MONT. ADMIN. R. 36.22.608; WYO. ADMIN. CODE OIL GEN CH. 3. § 45(d) (LexisNexis 2010).

109. 178 ARK. CODE R. § 1-B-19(m)(3).

110. *See* ALA. ADMIN. CODE R. 400-1-9-.04(4) (2013) (prohibiting diesel oil or fuel in any fracturing fluid); IDAHO ADMIN. CODE R. 20.07.02.056.02 (2012) (prohibiting VOCs or petroleum distillates when injecting into groundwater and otherwise require prior approval); *see also* 3 WYO. CODE. R. § 45(g) (LexisNexis 2010).

111. *See, e.g.*, OKLA. ADMIN. CODE § 165:10-3-10(b) (2013) (requiring disclosures within 60 days of the conclusion of fracturing).

112. *See, e.g.*, 2 COLO. CODE REGS. § 404-1:205A(b)(2)(A) (LexisNexis 2014) (requiring disclosures within 60 days of completion, and not more than 120 days from the start of fracturing); N.D. ADMIN. CODE 43-02-03-27.1(1)(g), (2)(i) (2012) (within 60 days of completion of the well); N.M. ADMIN. CODE 19.15.16.19B (2012) (within 45 days of well completion); 58 PA. CONS. STAT. § 3222(b)(3) (2012) (within 30 days of completion of the well).

113. CAL. PUB. RES. CODE § 3160(f) (Deering 2014); 2 COLO. CODE REGS. § 404-1:205A(b)(1) (LexisNexis 2014); 58 PA. CONS. STAT. § 3222.1(b)(1) (2012); TENN. COMP. R. & REGS. § 0400-53-01.03(1) (2013); 16 TEX. ADMIN. CODE § 3.29(c)(1) (2012).

114. 178 ARK. CODE. R. § 1-B-19(m)(4) (LexisNexis 2014); MICH. SUPERVISOR OF WELLS INSTRUCTION 1-2011, Permitting Instructions #1, *available at* https://www.michigan.gov/documents/deq/Supervisor_of_Wells_Insruction_1-2011_428260_7.pdf.

115. Some of these state requirements indicate disclosures may be made to the state, or to FracFocus, directly from the operator or service companies. *See, e.g.*, W. VA. CODE. R. 35-8-10.1.a (2014). Most of the states place the legal burden of disclosure on the operator. *See, e.g.*, OKLA. ADMIN. CODE § 165:10-3-10(b) (2010).

B. Substance of Disclosed Information

Chemicals are used in at least two stages of well development: the drilling of the well, and the hydraulic fracturing of the well to stimulate production. Nearly every state has focused on HFC and has excluded drilling chemicals from the disclosure requirements.[116] Ohio is singular in requiring disclosure of chemicals from both stages.

Of the states that require disclosure of HFC, several states, including Louisiana, Michigan, and New Mexico, limit disclosure to chemicals regulated under OSHA.[117] This eases compliance for well operators who can submit the MSDS they already have at the well. However, as discussed, disclosure laws limited by reference to OSHA result in underdisclosure of HFCs, by excluding chemicals which are newly developed or are being newly applied to oil and gas work.[118]

For each HFC that must be disclosed, most states require the following information: Chemical Abstract Service numbers, the supplier name, and the purpose of the chemical or the additive that contains the chemical.[119] Most states also require reporting of chemical concentrations, although these requirements vary from state to state. In some cases, companies must report the actual concentrations of chemicals used in each chemical product, and in the fracturing fluid.[120] Other times, companies need only report maximum concentrations in each product and in the fracturing fluid.[121] Some states fall into a still narrower category, only requiring reporting of maximum concentrations as a percentage of the fracturing fluid (and not requiring this information for each product used in the fluid).[122] Very few states share any toxicological information with the public about the chemicals being used; the exception

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116. *See, e.g.*, ALA. ADMIN. CODE R. 400-1-9-.04(7)(a)(ii) (2013); 178 ARK CODE R. § 1-B-19(l)(5); IDAHO ADMIN. CODE 20.07.02.056.01(b)(iv); 225 ILL. COMP. STAT. 732/1-35(b)(8)(B) (2013); MONT. ADMIN. R. 36.22.1015(2) (2011); OHIO REV. CODE ANN. § 1509.10(A)(10)(b) (2013); OKLA. ADMIN. CODE § 165:10-3-10(b)(1)(H) (2010); 58 PA. CONS. STAT. § 3222(b.1)(1)(iii) (2012); W. VA. CODE R. § 35-8-10.1.a (2014); 3 WY. CODE R. § 45(d)(ii), (h)(ii) (2010).

116 2 COLO. CODE REGS. § 404-1:205A(b)(2)(A)(xi); OKLA. ADMIN. CODE § 165:10-3-10(b)(1)(H).

117. LA. ADMIN. CODE TIT. 43, § 118(C)(1)(d) (2011); MICH. SUPERVISOR OF WELLS INSTRUCTION 1-2011; N.M. ADMIN. CODE § 19.15.16.19(B) (LexisNexis 2008). In addition, a few state rules are unclear about the scope of their disclosure requirements. *See generally*, N. DAK. ADMIN. CODE § 43-02-03-27.1 (2012); UTAH ADMIN. CODE § 649-3-39-1.1.

118. *See* text accompanying notes 61–65.

119. *See, e.g.*, N.M. ADMIN. CODE § 19.15.16.19(B) (LexisNexis 2008); OHIO REV. CODE ANN. § 1509.10(A)(10)(b) (2013); *see also*, www.fracfocus.com.

120. MONT. ADMIN. R. 36.22.1015(2) (2011).

121. *See, e.g.*, N. M. ADMIN CODE § 19.15.16.19(B) (LexisNexis 2008).

122. 2 COLO. CODE REGS. § 404-1:205A(b)(2)(A)(xi) (LexisNexis (2012); OKLA. ADMIN. CODE § 165:10-3-10(b)(1)(H).

is those states that require and disclose MSDS.[123] This type of information is not often provided to the public on a well-specific basis.[124]

C. Non-disclosures and Medical Exceptions

Several state HFC disclosure requirements exempt trade secrets or confidential information from disclosure. Three of the four states that do not mention trade secrets—Indiana, Michigan, and New Mexico—only require submission of MSDS or information available on MSDS, thereby implicitly approving trade secret assertions made in the OSHA forms.[125] Where the regulations specifically address trade secrets, state HFC requirements usually allow companies to withhold confidential or trade secret information.[126] Only in four states—Arkansas, Illinois, Pennsylvania, and Wyoming—does the law call for the submission of confidential information to the state.[127]

At times, industry has opposed turning over confidential HFC information, stating a concern that confidential information might be shared with competitors. North Carolina's Mining & Energy Commission proposed a nonbinding recommendation that the legislature require the submission of trade secrets to the state for use in emergency situations. However, objections from the oil and gas service company Halliburton have delayed a vote on the measure for nearly a year.[128] Public agencies are often reluctant to receive trade secrets, given that inadvertent disclosures could result in criminal prosecution[129] or a civil Fifth

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123. *See, e.g.*, IND. EMERGENCY RULE 12-292(E); Indiana Dep't of Nat. Res., *available at* http://www.in.gov/legislative/iac/20120627-IR-312120292ERA.xml.pdf.

124. *But see* 225 ILL. COMP. STAT. 732/1-75 (3)(f)(9)(B) (2014); *see, e.g.*, Michigan Dep't of Envtl. Quality, *Hydraulic Fracturing in Michigan*, http://www.michigan.gov/deq/0,4561,7-135-3311_4111_4231-262172—,00.html.

125. IND. EMERGENCY R. 12-292(E) § 3(b)(3) (2014); MICH. SUPERVISOR OF WELLS INSTRUCTION 1-2011, Reporting Instructions (2011); N.M. ADMIN. CODE § 19.15.16.19(B). The fourth state, Idaho, does not appear to make disclosures public. IDAHO ADMIN. CODE R. 20.07.02.056 (Effective through July 10, 2013).

126. *See, e.g.*, 2 COLO. CODE REGS. § 404-1:205A(d)(2) (LexisNexis 2012); MONT. ADMIN. R. 36.22.1016(1) (2011); MISS. CODE ANN. § 26-2:1.26(7).

127. *See* 178 ARK. CODE R. § 1-B-19(L)(8) (LexisNexis 2013); 58 PA. CONS. STAT. § 3222(b.2) (2012); 225 ILL. COMP. STAT. 732/1-77(f) (2014); 3 WY. CODE R. § 45(f) (2010).

128. John Murawski, *Fracking Giant Halliburton Nixes North Carolina's Chemical Disclosure Rule*, CHARLOTTE OBSERVER, May 3, 2013, *available at* http://www.charlotteobserver.com/2013/05/03/4019479/fracking-giant-halliburton-nixes.html#.U1V0euZdUSo; John Murawski, *North Carolina Mining Panel Delays Vote on Fracking Chemical Disclosure*, CHARLOTTE OBSERVER, Nov. 22, 2013, *available at* http://www.charlotteobserver.com/2013/11/22/4489367/nc-energy-and-mining-commission.html#.U1V3n-ZdUSo.

129. *See, e.g.*, Mark D. Seltzer, Angela A. Burns, *Criminal Consequences of Trade Secret Misappropriation: Does the Economic Espionage Act Insulate Trade Secrets from Theft and Render*

Amendment takings claim seeking government compensation for a company's lost competitive advantage.[130]

Eight states specify that companies must provide confidential HFC information to state officials in the event of a spill or emergency upon request by the state.[131] This is because medical treatment may depend on understanding exactly what chemicals have been released into the environment. In addition, thirteen states facilitate disclosure of confidential HFC information to first responders and medical professionals who request the information. Arkansas directs that all HFC information, confidential or otherwise, "shall be supplied, immediately upon request . . . directly to the requesting health care professional, doctor, or nurse."[132] Ohio's HFC disclosure law requires medical professionals in receipt of trade secret HFC information to keep it confidential, but the law does not require the submission of a confidentiality agreement.[133] Other states require medical professionals to sign a confidentiality agreement before receiving the requested information.[134] In addition, in at least six states, the medical professional must submit a written statement of medical need in order to obtain the confidential information.[135] Some laws waive or postpone these requirements in the event of an emergency situation.[136] In rare cases, companies are required to share HFC information "immediately" upon request by medical professionals.[137] Kansas requires companies to disclose confidential HFC information to the state within two days of notice of a spill or alleged contamination, and imme-

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Civil Remedies Obselete?, 1999 B.C. INTELL. PROP. & TECH. F. 052501, *available at* http://www.bc.edu/bc_org/avp/law/st_org/iptf/articles/.

130. *See* Tri-Bio Labs, Inc. v. United States, 836 F.2d 135 (3d Cir. 1987); *see also* Ruckelshaus v. Monsanto Co., 467 U.S. 986 (1984).

131. *See* CAL. PUB. RES. CODE § 3160(j)(10)(A) (Deering 2014); COLO. CODE REGS. §404-1:205(d) (LexisNexis 2009); KAN. ADMIN. REGS. § 82-3-1402(a)(1) (2013). MONT. ADMIN. R. 36.22.1016(2) (2011); OHIO REV. CODE ANN. § 1509.10(J)(2) (LexisNexis 2010); PA. CONS. STAT. §3222.1(d)(2)(ii) (2012); TENN. COMP. R. & REGS 0400-53-01-.03(3)(a) (2013); W. VA. CODE R. § 35-8-10.1.d-10.1.e (2014).

132. 178 ARK. CODE R. § 1-B-19(l)(9) (2013).

133. OHIO REV. CODE ANN. § 1509.10(H) (LexisNexis 2012).

134. *See, e.g.*, 58 PA. CONS. STAT. § 3222.1(b)(10) (2012); TENN. COMP. R. & REGS 0400-53-01-.03(1)(f) (2013).

135. *See* CAL. PUB. RES. CODE § 3160(j)(10)(C) (Deering 2014); 2 COLO. CODE REGS. 404-1:205A(5) (LexisNexis 2009); 225 ILL. COMP. STAT. 732/1-77(l) (2014); MONT. ADMIN. R. 36.22.1016(3) (2011); 58 PA. CONS. STAT. § 3222.1(b)(10) (2014), (11); TENN. COMP. R. & REGS 0400-53-01-.03(1)(f) (2013; 16 TEX. ADMIN. CODE § 3.29(c)(4) (2012).

136. *See, e.g.*, 2 COLO. CODE REGS. 404-1:205A (LexisNexis 2009); MONT. ADMIN. R. 36.22.1016(4) (2011).

137. *See* 178.00.1-B-19 ARK. CODE R. § l(9); 16 TEX. ADMIN. CODE § 3.29(c)(4).

diately upon notice of an emergency.[138] The state is then authorized to share the information with first responders.[139] Illinois has proposed to establish specific deadlines for medical disclosures.[140]

D. Distribution Channels for Disclosed Information

In certain states, HFC information is submitted directly to a state agency.[141] Other states post HFC information on public websites.[142] Even in states that do not affirmatively post the information, the data collected by public agencies generally becomes part of the public record, unless the information is deemed privileged or confidential.[143] Members of the public may request information under the federal Freedom of Information Act[144] or similar state laws,[145] and can challenge assertions of confidentiality. Most state HFC disclosure requirements track this general rule, although some states have narrowed applicability of the general public information laws.[146]

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138. KAN. ADMIN. REGS. § 82-3-1402(a)(1)(A), (B). The rules do not define "emergency" but indicate that the Director of the Oil and Gas Conservation Division may determine when an emergency exists.

139. *See* KAN. ADMIN. REGS. § 82-3-1402(a)(2).

140. Illinois Hydraulic Fracturing Regulatory Act Draft Regulations § 245.730(c)(2) (proposing to require companies to share proprietary information the same business day that a request is made); *id.* at § 245.730(b)(2) (proposing to shorten this timeline to two hours in the event of an emergency).

141. *See, e.g.*, 178.00.1-B-19 ARK. CODE R. § l(2)-(8); IDAHO ADMIN. CODE R. 20.07.02.056(01)(b)(i)-(ii), (iv); N.M. ADMIN. CODE § 19.15.16.19(B); W. VA. CODE § 22-6A-7(a)-(b), (e)(5); 055-000-003 WYO. CODE R. § 45(d), (h); MICHIGAN DEP'T OF ENVTL. QUALITY, SUPERVISOR OF WELLS INSTRUCTION 1-2011, HIGH VOLUME HYDRAULIC FRACTURING WELL COMPLETIONS 3 (2011).

142. *See* State of Arkansas Oil and Gas Comm'n, Well Fracture Information, http://www.aogc.state.ar.us/Well_Fracture_Companies.htm (providing well-specific HFC information); 225 ILL. COMP. STAT. 732/1-75(f) (requiring the Department of Natural Resources to post completion reports on its website); IND. EMERGENCY RULE, SLA DOCUMENT #12-292(E), SECTION 4 (2012)); (disclosing the MSDS of each additive used in the state).

143. *See, e.g.*, 65 PA. CONS. STAT. § 67.305(a)(1)–(3) (2008).

144. 5 U.S.C. § 552 (1966).

145. *See, e.g.*, California Public Records Act, CAL. GOV'T. CODE § 6250 *et seq.* (West 1968 as amended through 1970); Colorado Open Records Act, COLO. REV. STAT. § 24-72-200.1 *et seq.* (2009); N.D. CENT. CODE § 44-04-18 (1957 as amended through 2009); New Mexico Inspection of Public Records Act, N.M. STAT. ANN. § 14-2-1 (West 1947 as amended through 2011); Pennsylvania Right-to-Know Law, 65 PA. CONS. STAT. § 67.101 *et seq.* (2008); TEX GOV'T CODE ANN. § 552.001 *et seq.* (West 2008).

146. *See, e.g.*, OHIO REV. CODE ANN. § 1509.10(I)(2) (2013) (limiting persons who can challenge trade secret assertions to the owner of the property where the fractured well is located, adjacent property owners, and any interested person or state agency that may be negatively impacted by fracturing chemicals).

Sixteen states instruct or allow companies to send HFC disclosures directly to FracFocus, a public website administered by the IOGCC and the Groundwater Protection Council (GWPC).[147] The BLM has also proposed adopting FracFocus as the distribution channel for HFC information on unconventional wells located on federal and tribal lands.[148] However, some quality control concerns have been raised with information submitted to FracFocus.[149] Moreover, researchers express frustration with the website's format, which prohibits aggregation of search results or "scraping" of data for use in searchable databases offline.[150] Finally, where state laws direct companies to disclose directly to FracFocus, it is not clear to the public if and when the state "possesses" the information, which would trigger state public information laws and the right to challenge trade secret assertions.[151]

E. Summary

Regulators and the general public are more knowledgeable about the chemicals used in hydraulic fracturing fluid than they were five years ago, and states have moved quickly to respond to the public's demand for more information. In addition, when issuing HFC disclosure requirements, states have invoked at least some of the policy rationales

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147. *See* FracFocus, Chemical Disclosure Registry, www.fracfocus.org. The FracFocus states are: Alabama; Colorado; Kansas; Louisiana; Mississippi; Montana; North Dakota; Ohio; Oklahoma; Pennsylvania; South Dakota; Tennessee; Texas; Utah; and West Virginia. In addition, California will use FracFocus until the state develops its own site. *See* Cal. Pub. Res. Code § 3160(g)(2)(B) (West 2013).

148. Oil and Gas; Hydraulic Fracturing on Federal and Indian Lands, 78 Fed. Reg. 31636 (Proposed May 24, 2013) (to be codified at 43 C.F.R. pt. 3160).

149. *See, e.g.*, Scott Anderson, *A Red Flag on Disclosure of Hydraulic Fracturing Chemicals*, EDF, Energy Exchange Blog (Dec. 12, 2012) (noting that in a selected review of FracFocus forms, 29 percent of reported Chemical Abstract Service numbers were wrong), http://blogs.edf.org/energyexchange/2012/12/12/a-red-flag-on-disclosure-of-hydraulic-fracturing-chemicals/; Kate Konschnik et al., Harvard Law School, Envtl. Law Program, Policy Initiative, Legal Fractures in Chemical Disclosure Laws: Why the Voluntary Chemical Disclosure Registry FracFocus Fails as a Regulatory Compliance Tool (Apr. 23, 2013), http://blogs.law.harvard.edu/environmentallawprogram/files/2013/04/4-23-2013-LEGAL-FRACTURES.pdf (*cited in* Matthew Daly, *Interior Issues New Drilling Rule on Public Land*, Associated Press (May 16, 2013, 6:30PM EDT), http://bigstory.ap.org/article/interior-issues-new-drilling-rule-public-land).

150. *See* Mike Soraghan, *Hydraulic Fracturing: FracFocus Can't Replace Full, Public Disclosure, Groups Say*, EnergyWire (May 21, 2012), http://www.eenews.net/stories/1059964669.

151. *See, e.g.*, N.D. Cent. Code § 44-04-17.1 (1997 as amended through 2011) (defining a public record as information "in the possession or custody of a public entity or its agent and which has been received or prepared for use in connection with public business").

for disclosure that had been voiced by disclosure advocates.[152] Whether the requirements as drafted achieve these goals, however, remains to be seen. The lack of access for public health researchers to confidential HFC information has posed significant obstacles to epidemiological studies.[153] In ongoing litigation over water contamination potentially caused by HFC-laden wastewater, Range Resources stated to the court that it could not identify all of the HFCs in chemical fracturing additives used at the wells in the area, even though these products and their ingredients have been described on submissions to FracFocus.[154] The EPA did not have complete lists of HFCs used in the United States for its drinking water study as of late 2012. The agency sought HFC information directly from nine service companies, and successfully negotiated the release of some of the HFCs initially protected as confidential. Despite this process, the "EPA does not have precise names for many chemicals, and cannot rule out the possibility that other chemicals have been or are being used that EPA does not know about."[155] These gaps in knowledge raised questions about the efficacy of HFC disclosure laws as drafted and their ability to achieve important policy goals.

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152. *See, e.g.*, *DEQ Proposes New Michigan 'Fracking' Regulation*, HOLLAND SENTINEL (Oct. 22, 2013, 12:01AM) (quoting DEQ Director Dan Wyant as saying the rules are "intended to protect the state's fresh water supplies while giving the public more information about fracking operations"), *available at* http://www.hollandsentinel.com/x919096124/DEQ-proposes-new-Michigan-fracking-regulations.

153. *See* Lisa Song, *Tiny Doses of Gas Drilling Chemicals May Have Big Health Effects*, INSIDECLIMATE NEWS (Mar. 21, 2012) (citing Sonya Lunder, Environmental Working Group), http://insideclimatenews.org/news/20120321/endocrine-disrupting-chemicals-fracking-natural-gas-low-dose-environmental-health. State medical exceptions to nondisclosure often specify that the information must be needed to "diagnose or treat *an individual*." *See, e.g.*, 58 PA. CONS. STAT. § 3222.1(b)(10), (11).

154. *See* Motion for Adverse Inference, at ¶ 23, Kiskadden v. Penn. Dep't of Envtl. Prot., Pa. Envtl. Hrg. Bd. No. 2011-149-R, *available at* http://www.scribd.com/doc/170399029/Motion-for-Adverse-Inference-w-exhibits-Kiskadden-v-PA-DEP-and-Range-Resources (Aug. 20, 2013); *see also* FracFocus, Hydraulic Fracturing Fluid Product Component Information Disclosure Form for well # 42-013-1702 (identifying ingredient of FRW-200 as "petroleum distillate hydrotreated light"); FracFocus, Hydraulic Fracturing Fluid Product Component Information Disclosure Form for well #42-501-34387 (identifying ingredients of HVG-1 as guar gum, petroleum distillate, and clay), http://www.fracfocusdata.org/DisclosureSearch/SearchResults.aspx. However, other forms listing the same ingredients assert trade secret protection. *See, e.g.*, FracFocus Hydraulic Fracturing Fluid Product Component Information Disclosure Form for well # 42-311-34739 (HVG-1), http://www.fracfocusdata.org/DisclosureSearch/SearchResults.aspx and well # 42-283-32905 (FRW-200), http://www.fracfocusdata.org/DisclosureSearch/SearchResults.aspx.

155. U.S. ENVTL. PROT. AGENCY, SUMMARY OF TECH. ROUNDTABLES ON EPA'S STUDY OF THE POTENTIAL IMPACTS OF HYDRAULIC FRACTURING ON DRINKING WATER RESOURCES, Nov. 14-16, 2012, at 8 (Feb. 2013).

III. A NEW APPROACH: GOAL-ORIENTED DISCLOSURE DESIGN

Reliable, timely, and accessible data about the chemicals used at an unconventional oil or gas well can serve a number of useful purposes. Quality information about chemicals can inform regulation and reduce risk. For instance, Alabama, Idaho, and Wyoming use disclosures to ensure that diesel, petroleum distillates, and VOCs are used in fracturing projects only where they are pre-approved by a state agency.[156]

HFC disclosures are also useful to third parties. Epidemiologists use the data to conduct long-term public health studies of workers and communities exposed to oil and gas development and HFC disposal sites. Adjacent landowners can compare lists of chemicals being stored, blended, and used in their community with drinking water tests they conduct, or agency air monitoring results, if the landowners are concerned about chemical exposure. The results of these comparisons may provide some assurance to the landowner, or may alert them to a possible health risk from local oil and gas activity. Insurers, investors, and lenders might also use HFC data to identify patterns and weigh the relative risks posed by different actors or activities in the industry.[157] Comprehensive risk analysis could then inform investment and pricing decisions, thereby incentivizing safer practices in the industry.

Conversely, disclosures cost money, time, and resources. As three financial market experts cautioned in a paper about disclosure in that context, "[w]hile effective disclosure allocates resources and produces other benefits that probably justify such expenditures, ineffective disclosure produces little to justify its costs, and may even misallocate resources."[158] Disclosure that generates unreliable, irrelevant, or obscure data becomes a paper exercise, frustrating the industry and feeding public cynicism. Therefore, it is important to know precisely *why* disclosure

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156. *See* ALA. ADMIN. CODE R. 400-1-9-.04(4) (prohibiting diesel oil or fuel in any fracturing fluid); IDAHO ADMIN. CODE R. 20.07.02.056.02 (prohibiting VOCs or petroleum distillates when injecting into groundwater and otherwise requiring prior approval); 3 WY. CODE. R. § 45(g) (prohibiting injection of volatile organic compounds into ground water, but allowing use of such compounds for well stimulation with prior authorization).

157. *See, e.g.*, INVESTOR ENVTL. HEALTH NETWORK & INTERFAITH CENTER ON CORP. RESPONSIBILITY, EXTRACTING THE FACTS: AN INVESTOR GUIDE TO DISCLOSING RISKS FROM HYDRAULIC FRACTURING OPERATIONS, *available at* http://www.iehn.org/documents/frackguidance.pdf; Roger Drouin, *How the Fracking Boom Could Lead to a Housing Bust*, THE ATLANTIC CITIES (Aug. 19, 2013), http://www.theatlanticcities.com/politics/2013/08/how-fracking-boom-could-lead-housing-bust/6588/.

158. Griffith L. Garwood et al., *Consumer Disclosure in the 1990s*, 9 GA. ST. U. L. REV. 777, 784 (1993).

is sought, rather than to base a reporting regime on an "amorphous goal" or "an unsubstantiated faith in the efficacy of requiring disclosures."[159]

Goal-Oriented Disclosure Design can improve the effectiveness of HFC disclosure requirements.[160] Similar frameworks have been developed and suggested prior to Goal-Oriented Disclosure Design. Paula J. Dalley suggested that disclosure programs "must have an articulated purpose, an identified mechanism through which it can accomplish that purpose, a design that takes into account the operation of that mechanism, and a careful analysis showing that the benefits of the system outweigh its costs."[161] In many cases, small changes to existing HFC disclosure regimes could allow these disclosures to work for the states by considering the stakeholders that the disclosures could inform and engage.

Under a goal-oriented approach to disclosure design, drafters would begin by specifying one or more desired policy goals. The process should be iterative, so that the requirements are reviewed and developed one goal at a time. There are instances where a disclosure regime may meet multiple goals; however, it is important to recognize when "goals are not the same and may not even be purely complementary." Some information "conflict" may be situational; spills of fracturing fluid might require knowledge of all chemicals in the fluid. A spill of one product stored at a well site before it is blended into the fracturing fluid requires knowledge of the ingredients of the chemicals in that one product. Information end users might create another conflict. A landowner wants to see information about one well, while public health researchers want to be able to aggregate searches about chemical use across wells in a region or shale formation. In such cases, the state will need to determine which goal should trump in driving disclosure design, or whether both needs may be accommodated.[162]

Drafters would then identify the target audience of the information for each goal. In some cases, the goal may be achieved directly by providing information to the target audience; for instance, where the goal is fully informing first responders and medical professionals. In other cases, the goal may be achieved indirectly, after an intermediate group receives the requisite information. If the goal is to reduce the use

159. Michael D. Guttentag, *An Argument for Imposing Disclosure Requirements on Public Companies*, 32 FLA. ST. U. L. REV. 123, 124–25 (2004).

160. The requirements also need to be enforced to maintain integrity in the process and to build public trust. This is a critical component of effective disclosure regimes, but is beyond the scope of this article.

161. Paula J. Dalley, *The Use and Misuse of Disclosure as a Regulatory System*, 34 FLA. ST. U. L. REV. 1089, 1131 (2007).

162. *See id*. at 1094–95.

of carcinogenic chemicals in fracturing fluid, regulators need to think about what intermediate groups could use information about current chemical use to influence the industry decision-making around HFC formulations. These groups might include insurance companies and investors, who could use HFC information to assess risk and use their market power to drive change.[163] In another scenario, consumers might be the targeted information end users if they can drive change in the marketplace by making informed purchasing decisions.

Next, drafters should consider the response mechanisms or feedback loops that can be used by these target audiences. A feedback loop is the way the intermediate group will use the information to achieve the policy goal. To take the above examples, insurance companies are a target audience; to the extent that higher premiums are based on the use of a particular chemical, this is an effective feedback loop. Also, the general public is a target audience if its political or purchasing power is an effective feedback loop. Thinking through these mechanisms is a good way to pare down potential targets for the information, or to identify how disclosures should be made so that they are incorporated more effectively into the feedback mechanism. For example, financial institutions and equity firms that underwrite fossil fuel exploration and production activities can directly influence companies that seek financing to drill a well.[164] Large oil and gas companies do not need outside financing. Thus, the feedback mechanism from financial institutions to large oil and gas companies is more tenuous, and sending information through that pathway may prove less efficient. These different feedback loops may direct designers to focus on particular types of lenders and investors, and to require different types of disclosures to feed these different feedback loops.

Despite the variety of policy rationales articulated by HFC disclosure advocates and states that have issued disclosure requirements, state debates over disclosures have turned on how comprehensive a list of fracturing fluid additives and their chemical ingredients may be shared with the public without violating trade secret protection. Industry and states often compare the formula of "Coca-Cola" to their HFC formula-

163. This is the rationale behind U.S. securities laws. *See, e.g.*, Christian J. Meier-Schatz, *Objectives of Financial Disclosure Regulations*, 8 J. COMP. BUS. & CAP. MKT. L. 219 (1986); Dalley, *supra* note 161, 1089–1131.

164. *See* Peter C. Reiss, *Economic and Financial Determinants of Oil and Gas Exploration Activity in* ASYMMETRIC INFORMATION, CORPORATE FINANCE AND INVESTMENT (R. Glenn Hubbard ed., 1990); Conway Irwin, *In U.S. Oil and Gas, Everyone's Money is Welcome*, BREAKING ENERGY (Oct. 21, 2013, 10:00AM) (noting that investment in smaller firms has shifted from large oil and gas companies to banks and equity firms in five years), http://breakingenergy.com/2013/10/21/in-us-oil-gas-everyones-money-is-welcome/.

tions in debates over HFC disclosure laws, as if these laws are regulating a simple consumer product.[165]

Public disclosure is a worthy goal in its own right.[166] In other contexts, consumer-oriented disclosure laws have driven substantive changes in industry through economic forces. Sara Gosman makes the case that the federal TRI disclosure requirements "significantly reduced the amount of chemicals that industrial facilities released into the environment."[167] Since 1986, California's Safe Drinking Water and Toxic Enforcement Act has required businesses to provide "clear and reasonable warning" of chemicals known by the state to cause cancer or reproductive toxicity.[168] In response to this law, companies and vendors have reformulated their products to avoid or phase out the warning label requirements.[169] A few states banned the use of BPA, an endocrine disruptor and possible carcinogen in plastic baby bottles and "sippy" cups[170]

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165. R.R. Comm'n of Tex. News Release, *R.R. Comm'rs Adopt One of Nation's Most Comprehensive Hydraulic Fracturing Chemical Disclosure Requirements* (Dec. 13. 2011) (quoting Chairman Jones saying, "[T]he Railroad Commission is taking a lead in helping the public understand the safety of hydraulic fracturing with this rule's adoption. In fact, with this new rule, Texans will know more about what is going in the ground for energy production than about the ingredients that go into their sodas"), *available at* http://www.rrc.state.tx.us/pressreleases/2011/121311.php; Susan Greene, *Oil and Water Don't Mix, so Lose Loophole*, THE DENVER POST (June 9, 2009, 1:00AM MDT) (quoting a Halliburton executive using the same metaphor), http://www.denverpost.com/greene/ci_12549550.

166. WENDY GINSBERG ET AL., CONG. RESEARCH SERV., GOVERNMENT TRANSPARENCY AND SECRECY: AN EXAMINATION OF MEANING AND ITS USE IN THE EXECUTIVE BRANCH (Nov. 14, 2012) ("From the beginnings of American federal government . . . [s]ome scholars and statesmen, including James Madison, thought access to information—commonly referred to in contemporary vernacular as 'transparency'—was an essential cornerstone of democratic government").

167. Sara Gosman, *Reflecting Risk: Chemical Disclosure and Hydraulic Fracturing*, 48 GA. L. REV. 83 (2013); *see also id.* at 17, n. 122–23.

168. CAL. HEALTH & SAFETY § 25249.6 (West 1986).

169. *See, e.g.*, *Gateway's Support of Prop 65*, GATEWAY, http://us.gateway.com/gw/en/US/content/proposition-65 (describing the computer company's phase-out of lead in its keyboards and noting that "[a]s a result of this reformulation, the Proposition 65 warning will no longer be required") (last visited Apr. 21, 2014); HOME SHOPPING NETWORK, CALIFORNIA PROPOSITION 65 COMPLIANCE REQUIREMENTS, https://view.hsn.net/WebDocuments/documents/01_Prop65Guide.pdf (notifying jewelry manufacturers that all items submitted to the Home Shopping Network "must include a declaration of compliance with California law") (last updated Jan. 24, 2013); *Strengthening Public Health Protections by Addressing Toxic Chemical Threats: Hearing Before the Senate Environment and Public Works Committee*, 113th Cong. (July 31, 2013) (statement of Michael A. Troncoso, Senior Counsel to the Attorney General of California), http://www.epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=952b7db0-fbf3-4559-b111-610799224269.

170. *See* Nat'l Conference of State Legislatures, NCSL Policy Update: State Restrictions on Bisphenol A (BPA) in Consumer Products, http://www.ncsl.org/research/environment-and-natural-resources/policy-update-on-state-restrictions-on-bisphenol-a.aspx (not-

and required labeling.[171] Within three years, the American Chemical Society announced that BPA was no longer being used in these products anywhere in the United States.[172] At the time of the announcement, most states did not require BPA labeling; however, consumers were informed about BPA and took steps to avoid products containing this chemical. The FDA then instituted a federal ban to lock in these public health benefits.[173]

The same feedback loops available to the average consumer when considering the purchase of computers, costume jewelry, or baby bottles are not available in the shale oil and gas context. Americans consume natural gas and oil to meet basic, everyday needs such as heating, electricity, and transportation. Most Americans do not purchase these fossil fuels from a particular well or supplier; most fossil fuel supplies are often commingled in interstate pipelines.[174] American consumers can choose to purchase baby bottles that do not contain BPA, but when these same consumers flick a light switch, turn up the thermostat, or fill up their car, they cannot choose to purchase fossil fuels developed using only non-toxic chemicals. There is no direct feedback loop between the average person as a consumer of oil and natural gas products and the companies who develop shale oil and gas plays. As a result, even an HFC disclosure regime that provided ideal disclosure levels may not provide "actionable information" to the average consumer. The public still has a political feedback loop—people may call on elected officials to do something—but this is not a direct feedback loop either, as it depends on government action. While public disclosure is critical, HFC disclosures may prove more effective if designed with other target audiences in mind, including consumer "informational and financial in-

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ing that California, Connecticut, Delaware, Maryland, Massachusetts, Minnesota, New York, Vermont, Washington, and Wisconsin banned BPA from sippy cups and baby bottles).

171. *See id.* (noting that Maine had BPA labeling requirements and that New York authorized manufacturers to use "BPA free" labeling).

172. Jeremy P. Jacobs, *Chemical Industry Shifts on BPA After Spending Millions to Fight Legislation*, N.Y. TIMES (Oct. 12, 2011), http://www.nytimes.com/gwire/2011/10/12/12greenwire-chemical-industry-shifts-on-bpa-after-spending-94235.html.

173. *See* Sabrina Tavernise, *F.D.A. Makes it Official: BPA Can't be Used in Baby Bottles and Cups*, N.Y. TIMES (July 17, 2012), *available at* http://www.nytimes.com/2012/07/18/science/fda-bans-bpa-from-baby-bottles-and-sippy-cups.html?_r=0&adxnnl=1&adxnnlx=1398115637-N3kUANolBYfI3ZBz/3NZ5w.

174. Some of the larger producers do make direct sales to electricity distribution companies, but not usually to residential or commercial consumers. *See* CHARLES AUGUSTINE ET AL., AM. PETROLEUM INST., UNDERSTANDING NATURAL GAS MARKETS, 19 (2006), *available at* http://www.api.org/aboutoilgas/upload/understanding_natural_gas_markets.pdf.

termediaries;"[175] in this context, insurers, lenders, and perhaps the electric utilities that purchase natural gas to run power plants.

The stated goal, target audiences, and feedback loops need not be referenced in the HFC disclosure requirements, however, with these factors in mind, drafters could identify the disclosure requirements that would be most useful. For instance, timing of disclosure may be more or less relevant to different audiences. Landowners may need to be the first to know what HFCs are being contemplated for development on their property in order to determine what to test for in baseline water quality tests. Their mortgage holder or insurer may also want this information before hydraulic fracturing begins to determine whether they are willing to cover the potential liabilities this activity creates.[176] First responders may also need to know about the HFCs on a case-by-case basis when they arrive at a well site. Conversely, public health researchers might not need certain information about a well site until after the HFCs have been used.

Drafters can also identify substantive requirements for the disclosures in order to make them more relevant to target audiences. The disclosure of a chemical's identity may not be enough where the policy goal is to reduce the use of toxic chemicals or reduce exposure to particular chemicals. Additional information may be needed to educate target audiences about the health and environmental effects and risks of each particular chemical. Disclosure under California's Proposition 65, for instance, indicates why certain chemicals are of concern.[177] The EPA's TRI database employs a color-coding system to track a facility's compliance with environmental laws over time.[178] Using a similar system for HFC disclosures could quickly translate long lists of chemicals into a more comprehensible risk guide for the reader.

Many HFC disclosure goals can be achieved with a publicly available master list of HFCs used at the well, as opposed to a recitation of HFCs as they appear in each fracturing fluid product. A landowner may only require a master list of all chemicals being used at the site to determine which chemicals to test for in his or her water well. In addition, if insurers, lenders, investors, or community members are concerned about

175. *See* Dalley, *supra* note 161, at 1101–02.

176. *See, e.g.*, Nationwide Press Release, *Nationwide Statement Regarding Concerns About Hydraulic Fracturing* (July 13, 2012), *available at* http://www.nationwide.com/about-us/071312-nw-statement-on-fracking.jsp (announcing, "we do not have a comfort level with the unique risks associated with the fracking process to provide coverage at a reasonable price").

177. CAL. HEALTH & SAFETY § 25249.6.

178. *See* U.S. ENVTL. PROT. AGENCY, TOXIC RELEASE INVENTORY (TRI) PROGRAM, www2.epa.gov/toxics-release-inventory-tri-program.

a particular HFC (petroleum distillates, perhaps), they may not need to know what percentage of each additive is contained in these HFCs. They may just need to know if the HFCs were used at the site and in what amounts. Conversely, in the event of employee exposure to a particular additive, a paramedic or emergency room doctor would need to know the particular formulation of that additive to assess whether or not the exposure reached toxic levels in order to determine the appropriate treatment response.[179]

The listing of HFCs by product name is the most common format directed by states.[180] The policy rationale is not clear; however, this format appears to be what drives industry concerns about trade secret disclosure. If lists of chemicals may be provided without reference to each chemical product, this might reduce the rate of nondisclosures by industry. Drafters could then determine the need for writing exceptions to the remaining non-disclosures.

As discussed above, many states allow agency personnel, first responders, and medical professionals to access proprietary information in the event of a spill, emergency, or other medical situation. This is a promising start; however, broader exceptions might be warranted. For instance, the medical professional exceptions are drafted in such as way as to preclude confidential data transfer to public health researchers who are conducting population-wide studies.[181] Finally, disclosures would be distributed through channels that are familiar and accessible to the target audience to ensure efficient uptake of the information. States have moved quickly to provide certain well-specific information online.[182] Yet disclosures remain scattered, and FracFocus, the repository that is most

179. Therefore, it may make sense to have operators report HFCs by fracturing fluid product, so that this information is available should a medical professional need product-specific information. Reporting by product might make it easier for the regulators, or an automatic form on fracfocus.org, to detect when inconsistent ingredients have been reported for the same product. This could be an important quality control check. Then, however, the public interface would display a master list of HFCs for each well.

180. 2 COLO. CODE REGS. § 404-1:205A(b)(2)(A)(xi); OKLA. ADMIN. CODE § 165:10-3-10(b)(1)(H).

181. CAL. PUB. RES. CODE § 3160(j)(10)(A) (Deering 2014); COLO. CODE REGS. §404-1:205(d) (LexisNexis 2009); KAN. ADMIN. REGS. § 82-3-1402(a)(1) (2013). MONT. ADMIN. R. 36.22.1016(2) (2011); OHIO REV. CODE ANN. § 1509.10(J)(2) (LexisNexis 2010); PA. CONS. STAT. §3222.1(d)(2)(ii) (2012); TENN. COMP. R. & REGS. 0400-53-01-.03(3)(a) (2013); W. VA. CODE R. § 35-8-10.1.d-10.1.e (2014). Each of the states with a statement of need require that the statement describe why the information is needed to diagnose or treat *an individual*. *See also* 225 ILL. COMP. STAT. 732/1-5 (defining "health professional" as someone "licensed or registered to provide health care services").

182. *See, e.g.*, RR COMM'N OF TEX., *available at* webapps.rrc.state.tx.us. However, this site does not include chemical information.

national in scope, remains an inefficient research tool.[183] Futhermore, target audiences may not know where to go to find this information. Learning more about where these potential targets go for information, and using this knowledge to effectively deliver HFC disclosures could greatly increase the value of this information.[184] First responders, public health researchers, banks, insurance companies, electric utilities, and other potential end users each look to different sources for their information because they are familiar with those sources and trust them.[185] If a state wanted to engage the investor community to reduce the use of diesel compounds in fracturing fluid, the state could flag these HFCs as "high risk" or require significantly more expensive wastewater storage and disposal based on disclosures revealing use of these HFCs, perhaps triggering a discussion of these HFCs as "material effects" or "significant risk factors" in a company's SEC filings.[186] To take another example, emergency situations make it necessary to use pre-existing, reliable channels of information to reach target audiences quickly. Proprietary HFC information is sometimes needed quickly, and in these occasions HFC disclosure requirements place the practical burden on the state and the first responders to track down the information.

If HFC requirements were drafted to achieve specified outcomes, their design would become less of an ideological debate over the content of information shared, and more of a focused discussion about how targeted audiences could make best use of the information provided to achieve specified goals. The resulting disclosure requirements could build public trust by directing progress towards policy goals embraced by the public.

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183. *See* THE SECRETARY OF ENERGY ADVISORY BOARD SHALE GAS PRODUCTION SUBCOMMITTEE, NINETY-DAY REPORT (Aug. 11, 2011), at 23–24.

184. *Cf.*, Emily Badger, *How Yelp Might Clean Up the Restaurant Industry*, THE ATLANTIC, June 19, 2013, http://www.theatlantic.com/magazine/archive/2013/07/youll-never-throw-up-in-this-town-again/309383/ (describing a San Francisco initiative to include city health inspection results on Yelp!, the restaurant review website.)

185. *See* Holly Doremus, *Adaptive Management as an Information Problem*, 89 N.C. L. REV. 1455, 1493.

186. *See* 17 C.F.R. § 229.503(c) ("Risk disclosures"); *see also* E. Lynn Grayson & Patricia L. Boye-Williams, Jenner & Block, *SEC Disclosure Obligations: Increasing Scrutiny on Environmental Liabilities and Climate Change Impacts*, *in* ENVIRONMENTAL ISSUES IN BUSINESS TRANSACTIONS, at 447–69. It is beyond the scope of this article to evaluate the merits of this idea, or to determine whether such measures would trigger the "materiality" threshold of SEC reporting rules.

IV. APPLICATION OF GOAL-ORIENTED DISCLOSURE DESIGN TO FIRST RESPONDER GOAL

The remainder of this article will apply the Goal-Oriented Disclosure Design approach to one goal of state HFC disclosure laws: ensuring a prompt, safe response to fires, explosions, and uncontrolled HFC releases. Emergencies can and have occurred at well sites,[187] and states have a strong interest in responding quickly and effectively. After an emergency room nurse became violently ill upon exposure to undisclosed HFCs on a worker seeking treatment, Colorado responded by drafting a narrow reporting law in 2009 to expedite the transmission of HFC information to first responders.[188] When Colorado issued a more comprehensive disclosure rule for hydraulic fracturing activities in 2011, the state observed that disclosure to medical personnel had been adopted in the interim by several other states and was now "generally well accepted."[189] Furthermore,

> [a] major justification for mandating greater disclosure is to provide sufficient information to emergency first responders. The responders would benefit from specific information on chemicals to enable them to prepare for emergencies and to take immediate action to limit damage arising from exposure to toxic substances. Likewise, medical personnel treating individuals experiencing health problems would benefit from earlier information on chemicals that may adversely affect people.[190]

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187. *See, e.g.*, Ken Ward, Jr., *Company Cited in Fatal Taylor Gas Well Explosion*, WVGAZETTE.COM, Aug. 16, 2013, http://www.wvgazette.com/News/201308160106 (describing a February 15, 2013 explosion at a well site as an employee transferred wastewater from an onsite truck to a disposal truck); David Gutman, *Doddridge County Gas Fracking Explosion Injures at Least 7*, WVGAZETTE, July 7, 2013, http://www.wvgazette.com/News/201307070002 (describing how tanks receiving flowback and produced water exploded during a fracturing job); Gayathri Vaidyanathan, *Hydraulic Fracturing: When 2 Wells Meet, Spills Can Often Follow*, E&E NEWS, Aug. 5, 2013, http://www.eenews.net/stories/1059985587 (documenting more than 10 instances where one well has intercepted another during a fracturing job, spilling oil and fracturing fluids); Laura Legere, *Wyoming County Well Malfunction Causes Spill, Evaluation*, THE TIMES-TRIBUNE.COM, Mar. 15, 2013, http://thetimes-tribune.com/news/wyoming-county-well-malfunction-causes-spill-evacuation-1.1458575 (describing how a well spewed out 227,000 gallons of fracturing fluid during the fracturing stage).

188. COLO. CODE REGS. § 404-1:205 (2013); *see also* Eric Frankowski, *Gas Industry Secrets and a Nurse's Story*, HIGH COUNTRY NEWS, July 28, 2008, http://www.hcn.org/wotr/gas-industry-secrets-and-a-nurses-story.

189. COLO. CODE REGS. 404-1: Appendix I, Statement of Basis, Specific Statutory Authority, and Purpose (Jan. 30, 2012) (describing rationale for Rule 205A).

190. Terence J. Centner, *Oversight of Shale Gas Production in the United States and the Disclosure of Toxic Substances*, RESOURCES POL'Y 38, Sept. 1, 2013, at 233, 237.

Some states have underscored this policy goal in the text of the law. Texas law states that "a supplier, service company or operator must provide directly to a health professional or emergency responder, all information in the person's possession that is required by the health professional or emergency responder, whether or not the information may qualify for trade secret protection . . . ."[191]

States usually intend HFC disclosure laws to permit full disclosure to first responders and medical professionals. By pointing out where the provisions fall short of this goal, this article seeks to spark a deeper analysis of all HFC disclosure provisions. As noted above, the shift of perspective from disclosure as an end to disclosure as a means can empower legislators and regulators to rethink HFC requirements and ask the critical questions that will result in more effective disclosures.

The federal government and states may wish to craft HFC disclosure requirements to achieve multiple goals. The timing, substance, and channels of distribution that are most useful for first responders and medical professionals may not prove optimal for other goals and target audiences. Therefore, additional measures may need to be added onto any disclosure requirement to meet these other needs. Alternatively, one goal may have to take precedence over another if two goals or their design needs conflict.

A. Facilitating Prompt, Safe Emergency and Medical Responses

To facilitate prompt, safe responses to fires, explosions, and uncontrolled HFC releases, HFC disclosure laws must ensure the rapid and effective transmittal of HFC information to first responders and medical professionals. Identifying the needs of first responders and medical professionals can help states determine how to best design HFC disclosure regimes. In addition, states cannot assume that every paramedic will be "highly trained and exquisitely equipped" for the job. Many rural settings rely on volunteer fire departments and paramedic teams for support.[192] While brave and well-intentioned, these personnel cannot be expected to have extensive toxicological training.[193]

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191. 16 Tex. Admin. Code § 3.29(c)(4) (2014).

192. Dr. Edward Boyer, Presentation at Harvard Law School (Oct. 16, 2013); U.S. Dep't of Health & Human Servs., Office of Rural Health Policy, Rural Communities and Emergency Preparedness (April 2002), *available at* ftp://ftp.hrsa.gov/ruralhealth/ruralpreparedness.pdf.

193. U.S. Dep't of Health & Human Servs., Office of Rural Health Policy, Rural Communities and Emergency Preparedness (April 2002), *available at* ftp://ftp.hrsa.gov/ruralhealth/ruralpreparedness.pdf, at 3 (noting that "[m]any rural communities lack access

First responders have a direct feedback mechanism; they can use helpful, accessible, and reliable HFC information in real time to inform response decisions, diagnosis, and treatment, thereby making their communities safer. An informed emergency response team and medical community can improve public health through a number of indirect feedback loops as well. First, if the medical community has full knowledge of the chemicals used at a site where an exposure has occurred, they may begin to document symptoms that are not explained by known health studies and trace those symptoms back to a particular HFC chemical or chemical family. Many HFCs have not previously been used in an occupational environment and so have not been studied for health effects.[194] Therefore, informed medical observations may trigger new health and environmental studies, and enhance our understanding of the relative risks posed by one ingredient over another. Second, first responders can share best practices with more confidence[195] if they know a particular type of chemical fire extinguisher or protective gear that worked at a site where similar HFCs were present.

As discussed in Part II, many state HFC disclosure requirements include provisions authorizing first responders and medical professional to receive the HFC information they need to respond to an emergency at a shale oil or gas site.[196] However, "these [emergency] provisions may not be optimal as they may cause a delay in securing the identity of the chemical, and the delay may preclude immediate treatment."[197] In other words, authorizing receipt of information is not the same thing as guaranteeing delivery of that information in short order. Changes in the timing of the disclosures, their substance, the process for sharing trade secret HFC information, and distribution methods may be necessary to improve effectiveness.

B. Timing

HazMat protocols across the United States commonly emphasize that the most vital piece of information to secure is the identity of any

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to hazardous materials units, . . . lack sufficient HAZMAT recognition capability and decontamination training").

194. *See supra* text accompanying notes 16–17.

195. This type of information sharing takes place at first responder trainings around the country. *See, e.g.*, Response Wyoming First Responder Training Conference (Mar. 23–25, 2013), *available at* https://www.eventbrite.com/e/respond-wyoming-first-responder-training-conference-23-25-march-2013-please-read-all-information-registration-4478037932.

196. *See supra* text accompanying notes 17–19.

197. Terence J. Centner, *Oversight of Shale Gas Production in the United States and the Disclosure of Toxic Substances*, RESOURCES POL'Y 38, Sept. 1, 2013, at 233, 238.

chemicals present at the emergency.[198] Yet under current law, most states do not require a well operator to collect all of the information about the HFCs until some months after a well has been fractured and production has begun.[199] Moreover, most laws do not require service companies and vendors to share information about the various HFCs with the well operator until just before the operator's disclosures are due.[200] If a fire, explosion, blowout, accidental spill, or release of fracturing fluids occurs before disclosure is required, fire fighters, paramedics, and emergency room personnel are forced to respond based on incomplete chemical information.

Without access to full HFC disclosures, medical providers could find some information in the Material Safety Data Sheets (MSDS) required at the work site under OSHA[201] and state emergency planning requirements.[202] However, MSDS do not cover all HFCs,[203] and MSDS "may be inadequate" for first responders from a toxicological perspective.[204] MSDS for chemical products do not list all of the ingredients and are not always found in toxicological databases. For instance, the MSDS for "Be-9," a Halliburton product, identifies one ingredient: tributyl tetradecyl phosphonum chloride, which comprises 5 to 10 percent of the overall product. The remaining chemical ingredients may be inert carrier fluids, or they may be HFCs that pose risks and confound medical responses. Attempts to access additional toxicological information about the product from several toxicological databases were unsuccessful because the trade name is not registered.[205] Therefore, HFC disclosure laws should require pre-fracturing disclosures to ensure that first responders have complete information of a site's chemical profile in the event of an emergency. The disclosures need not be public to achieve this particular goal, but the HFC information needs to be in one place and ready to submit to first responders.

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198. *See, e.g.*, AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY, U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, MANAGING HAZARDOUS MATERIALS INCIDENTS: A PLANNING GUIDE FOR THE MANAGEMENT OF CONTAMINATED PATIENTS, at 4 (Mar. 2001) (observing that "[a]ccess to chemical identities assists health professionals, physicians, and nurses in obtaining further information for diagnostic and treatment recommendations during emergencies, and for prevention and treatment measures during nonemergencies").

199. *See supra* text accompanying notes 108–115.

200. *See supra* text accompanying notes 113–115.

201. 29 C.F.R. § 1910.1200 (2013).

202. *See, e.g.*, 25 PA. CODE §§ 78.55, 91.34.

203. *See supra* text accompanying notes 59–65.

204. Interview with Dr. Edward Boyer, Professor of Emergency Med. and Dir. of Toxicology, at Univ. of Mass. Med. Sch. (Sept. 4, 2013); Dr. Edward Boyer, Dr. Boyer Presentation, *supra* note 192.

205. Alex Gast performed these searches in August 2013.

C. Substance

Emergencies have occurred during the drilling stage of oil and gas development.[206] If chemicals are used in the drilling muds, their identity should be easily accessible to emergency personnel. However, Ohio is the only state that currently requires disclosure of drilling chemicals.[207] Similarly, in states that only require disclosure of OSHA-regulated HFCs,[208] first responders and medical personnel are entering emergency scenes with incomplete information. This could be remedied by requiring that all HFCs at a well site be reported. Important decisions, such as nature of protective gear and whether medical oxygen can be safely provided on site without risk of explosion, turn on a full understanding of the HFCs present.[209]

When treating patients, emergency room personnel commonly consult toxicological references, including the EPA Integrated Risk Information System (IRIS), the U.S. Department of Health & Human Services' Medical Management Guidelines (MMGs) for Acute Chemical Exposures, and the National Library of Medicine's TOXNET.[210] These references may be searched using a Chemical Abstract Service number or a common chemical name. These two pieces of information are critical; every state HFC requirement calls for these pieces of information. However, as discussed above, some quality control concerns have been raised with the submitted information.[211]

Conversely, other pieces of HFC information required by states[212] are less critical to inform first responders and medical personnel. Unless the fracturing additive is a registered trade name, it is of no use for toxicological research. Meanwhile, while HFC concentrations may be useful to first responders in certain situations, HFC concentration is a moving target on well sites. HFCs are blended together to fracture a well, com-

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206. *See, e.g.*, Jennifer A. Dlouhy, *Drilling Fluids Spill from Shell Site in Gulf of Mexico*, FUELFIX.COM, Dec. 19, 2011, http://fuelfix.com/blog/2011/12/19/drilling-fluids-spill-from-shell-site-in-gulf-of-mexico/; *Drilling Mud Spill in Harrison County, OH - ATEX Express Pipeline*, MARCELLUS DRILLING NEWS, Oct. 3, 2013, http://marcellusdrilling.com/2013/10/drilling-mud-spill-in-harrison-county-oh-atex-express-pipeline/.

207. *See supra* notes 116–117 and accompanying text.

208. *See supra* text and accompanying notes 117–118.

209. Email from Dr. Eike Blohm, Resident at Univ. of Mass. Med. Sch. (Sept. 29, 2013) (on file with author); Interview with Dr. Edward Boyer, *supra* note 204.

210. Dr. Rose Goldman, *Information and Educational Resources for Occupational and Environmental Health Resources*, UPTODATE.COM (Mar. 2014), http://www.uptodate.com/contents/information-and-educational-resources-for-occupational-and-environmental-health-issues-in-the-united-states (listing commonly used toxicological databases).

211. *See supra* text and accompanying note 149.

212. *See supra* text and accompanying notes 119–124.

bined with produced water from the well in waste impoundments, treated with biocides, and recycled for use at new wells sites.[213] Seeking the precise concentrations of an HFC at the time of an emergency may be impractical and ineffective.

D. Non-disclosure and Medical Exceptions

Many state laws express a clear intent that first responders and medical professionals should receive information about HFCs, including information claimed as confidential. For instance, Arkansas' law states that nothing in its trade secret provisions:

> [s]hall authorize any person to withhold information which is required by state or federal law to be provided to a health care professional, a doctor, or a nurse. All information required by a health care professional, a doctor, or a nurse shall be supplied, immediately upon request, by the person performing the Hydraulic Fracturing Treatment, directly to the requesting health care professional, doctor, or nurse, including the percent by volume of the Chemical Constituents (and associated CAS numbers) of the total Hydraulic Fracturing Fluids and Additives.[214]

However, in nearly every state, the practical burden of tracking down this information is placed firmly on paramedics, firemen, and medical personnel. Provision of information for medical purposes, even in an emergency situation, is provided "upon request."[215] EMTs and medical personnel must know the HFC disclosure laws in the states where they provide services to know where to go to request the trade secret information.

More often than not, the information is scattered across multiple sources. Although the well operator will receive non-confidential HFC information from its service company and chemical vendors,[216] it will not receive the trade secrets. Four state laws suggest that trade secret HFC information from the service company and vendors should be submitted to the state as a matter of course. In the event of an emergency, another eight states require the companies to provide this information to the state

213. Discussion between Dr. John Deutch and Cal Cooper, Manager of Special Projects, Apache Corp., U.S. Dep't of Energy, Secretary of Energy Advisory Board FracFocus 2.0 Task Force Meeting, in Washington, DC (Jan. 6, 2014).

214. 178 Ark. Code R. § 1-B-19(l)(9), (m)(5) (LexisNexis 2014).

215. *See supra* text and accompanying notes 131–140.

216. *See supra* notes 113–115 and accompanying text.

upon request.[217] Only a handful of laws then authorize the state to share the trade secret information with medical personnel.[218] Thirteen states also authorize first responders and medical professionals to ask for proprietary HFC information directly.[219] But in each case, the first responder must collect this information from the service company, and sometimes multiple chemical suppliers, to access confidential HFC information for a single well site.

Some states require information about proprietary HFCs that can help first responders and hospital personnel in this search. Most states require companies to list the manufacturer or vendor of each proprietary chemical.[220] However, even with this information in hand, it is not clear where a call requesting confidential information should be directed. Texas alone requires companies to list emergency contact names, numbers, and addresses on the FracFocus form next to any chemical protected as a trade secret.[221] However, the FracFocus form provides no field to specifically address this disclosure requirement, and operators rarely comply. In a random sampling of 91 disclosures made at Texas wells subject to the state's 2012 rule (because these wells received initial drilling permits on June 1, 2012),[222] 85 disclosures contained proprietary chemicals. Of those, only three provided emergency contact information for those HFCs.[223] Once medical personnel have located an individual with knowledge about each of the proprietary chemicals, they must often write out a statement of need and sign a confidentiality agreement before receiving the information.[224] Then, few states set deadlines for companies to provide the requested information.

First responders and emergency room teams do not have the time to track down the origin of each trade secret HFC or locate a contact person with knowledge of the trade secret and authority to share it. Valuable time is lost in this process. Instead, HFC disclosure requirements must shift the legal burden to the well operator or the service company to affirmatively provide confidential and non-confidential HFC information with the state and a pre-identified emergency medical facility within a set time period.

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217. *See supra* note 131 and accompanying text.

218. *See, e.g.*, vol. 32 no. 56 Kan. Reg. 1355 (Nov. 14, 2013) (to be codified at KAN. ADMIN. REGS. § 82-3-1402(a)(2)).

219. *See supra* notes 131–132 and accompanying text.

220. *See supra* note 119 and accompanying text.

221. 16 TEX. ADMIN. CODE § 3.29(c)(2)(C).

222. The Texas disclosure requirements apply to any well that received an initial drilling permit on or after February 1, 2012. *See* 16 TEX. ADMIN. CODE § 3.29(b).

223. Analysis on file with the author.

224. *See supra* note 134 and accompanying text.

E. Channels of Distribution

Timely disclosure requirements will ensure that necessary data is available if an emergency or medical situation arises. Strengthening substantive requirements will provide first responders with a complete picture of a site's chemical profile. In addition, improving quality control of HFC disclosures will ensure data reliability. Requiring oil and gas companies to provide a comprehensive HFC list for a site upon notification of an emergency removes a huge research burden from the first responder's shoulders. However, in an emergency situation, states may also need to think about ways to get time-sensitive information in the hands of first responders through well-worn channels of distribution.

First responders are likely to jump in response vehicles with at least one cell phone. Therefore, Saudi Aramco has considered geo-coding chemical information on cell phone towers in oil fields.[225] First responders can access the password-protected information, download it onto their phones, and read it en route to the emergency. The information need not be comprehensive; instead, it could note what type of protective gear the responders should wear, whether oxygen can be administered, or how to safely fight a fire.[226]

When oil and gas workers are exposed to chemicals on the job,[227] first responders and medical professionals may consult with local poison control centers to determine treatment.[228] Providing master lists of the HFCs being used in an area, along with available toxicological data for those chemicals, would be an effective way to distribute information needed for treatment and diagnosis. Poison control centers could be funded and trained with oil and gas impact fees to ensure uptake of the information.

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225. Interview with Dr. Edward Boyer, *supra* note 204 (discussing his meetings with Saudi Aramco on this proposal); Dr. Edward Boyer Presentation, *supra* note 192.

226. Interview with Dr. Edward Boyer, *supra* note 204; Dr. Boyer Presentation, *supra* note 192.

227. Yang Wang & Lise Olsen, *Workplace Deaths Drop, but not in the Oil Industry*, HOUSTON CHRON., Feb. 21, 2013, http://www.houstonchronicle.com/news/houston-texas/houston/article/Workplace-deaths-drop-but-not-in-the-oil-4266141.php#/0 (noting some workers have died "inhaling poisonous gases"); *Gas Extraction*, OCCUPATIONAL HEALTH & SAFETY ADMIN., OIL, www.osha.gov/SLTC/oilgaswelldrilling/ (listing "chemical exposures" as a hazard of the profession).

228. Interview with Dr. Edward Boyer, *supra* note 204; Dr. Boyer Presentation, *supra* note 192.

CONCLUSION

States have acted quickly in response to the public's demand for information on the chemicals used in hydraulic fracturing. However, the resulting HFC disclosure requirements may not be achieving the policy goals legislators and regulators had in mind when drafting them. Ineffective disclosure risks undermining public confidence in the disclosure process and wastes an important opportunity to put these disclosures to work. Under the Goal-Oriented Disclosure Design approach to HFC disclosure that has been proposed by this article, drafters would begin by specifying one or more policy goals they seek to achieve through disclosure. The drafters would then identify the information end users that the disclosures would target. In some cases, the policy goal may be achieved directly by providing information to the target audience; for instance, where the goal is fully informing first responders and medical professionals. In other cases, the goal may be achieved indirectly, after an intermediate group, such as insurers, lenders, electric utilities, receives the requisite information. In these indirect circumstances, drafters will then have to think about the feedback loops that the intermediate groups can use to achieve the policy goal. With the goals, targeted information end users, and feedback loops in mind, the drafters can then decide on the basic elements of disclosure: timing, substance, distribution channels, and when confidential information should be shared and with whom. By applying the Goal-Oriented Disclosure Design, states and federal agencies may identify places where even modest changes to disclosure requirements may greatly enhance their effectiveness.