

PLANNING FOR FRACKING ON THE BARNETT SHALE: SOIL  
AND WATER CONTAMINATION CONCERNS, AND THE ROLE  
OF LOCAL GOVERNMENT

BY

RACHAEL RAWLINS\*

*In the last decade, hydraulic fracturing for natural gas has exploded on the Barnett Shale in Texas, now home to the most intensive hydraulic fracturing and gas production activities ever undertaken in a densely urbanized area. Yet, the debate is ongoing as to whether the explosive growth of gas industry operations poses a serious risk to public health and the environment. Concerns include the possibility that chemicals injected, naturally occurring substances disrupted, or toxins spilled at the surface may contaminate soil or make their way into drinking water supplies. Particularly problematic are the endocrine-disrupting chemicals, which are known to cause latent abnormalities at infinitesimally small levels of exposure. Health effects may not surface for decades and could affect future generations.*

*Although the gas industry is quick to claim that there are no proven cases of groundwater contamination related to hydraulic fracturing, local concerns are far more complicated. Leaks, spills, illegal dumping, and the attendant risk of soil contamination, ground and surface water pollution cannot be denied. Yet, a close review of federal and state regulatory provisions related to chemical reporting, monitoring, disclosure, tracking, and cleanup reveal a fundamental problem: quality monitoring data is scarce. Moreover, information is not available on the hazards, or even the identity of all the potentially problematic chemicals associated with gas industry operations.*

*Texas has adopted chemical disclosure requirements, but they are very limited, and unless trade secret claims are challenged, they are largely optional. There are exceptions requiring disclosure of trade secrets to emergency medical personnel, but not to toxicologists or epidemiologists. There are no exceptions for incidents where hydraulic fracturing chemicals are spilled on property that have not (yet) resulted*

---

\* Faculty, Community and Regional Planning, extended faculty, School of Law, University of Texas at Austin, faculty fellow, Center for Sustainable Development. I would like to thank Dr. Robert Paterson and John Laycock, MSCRP, for their research support. Research for this article was funded in part by a grant from the Energy Institute at the University of Texas at Austin.

*in identifiable health effects. There are no provisions allowing disclosure of trade secrets for the purpose of conducting sampling, assessing hazards, designing protective measures or engineering controls, or conducting studies to determine health effects.*

*Even where chemicals associated with gas industry operations have been disclosed, they may still slip by undetected given limited surface and drinking water quality monitoring systems that focus narrowly on short and dated chemical lists. There is no comprehensive or systematic monitoring for industrial chemicals in groundwater. Given the difficult burden of proof, common law is also unlikely to serve as a reliable vehicle to identify contamination and hold industry accountable. The difficulty of toxic tort litigation, the ad hoc nature of litigation, and the veil of secrecy following settlement agreements requiring confidentiality all argue in favor of strong regulations governing gas industry operations.*

*Gas-industry exemptions from federal regulation and a weak state regulatory system that relies on vague standards reminiscent of the early days of environmental law leave Texas cities at the forefront of the regulatory effort. After evaluating the federal and state regulatory framework, this Article reviews local regulatory efforts and concludes by discussing reasonable regulatory approaches to further strengthen and address soil and water contamination concerns. These approaches include adopting significant setbacks from the floodplain, a manifest system for tracking waste, monitoring, and reporting requirements, and clear standards to govern cleanup operations based on planned and restricted future land use. This Article also explores the possibility that local governments could adopt additional chemical disclosure requirements and share in the cost of any subsequent trade-secret litigation. Finally, this Article discusses constitutional takings issues and concludes that public health concerns may outweigh the burden on property rights.*

I. INTRODUCTION .....	137
II. TEXAS DISCLOSURE RULES AND TRADE SECRET EXCEPTIONS.....	147
III. MOVING BEYOND PROPERTY RIGHTS CLAIMS.....	152
IV. WATER QUALITY ANALYSIS AND EVOLVING STANDARDS .....	157
V. THE COMMON LAW AND THE DIFFICULT BURDEN OF PROOF .....	161
VI. LEAKS, SPILLS, AND ILLEGAL DUMPING: STATUTORY AND REGULATORY CONTROL AT THE FEDERAL LEVEL .....	164
VII. ALTERNATE STATE REGULATION: VAGUE REGULATORY STANDARDS AND A CLIMATE OF RELAXED REGULATORY ENFORCEMENT.....	170
VIII. MUNICIPAL LAWS: WATER AND SOIL .....	184
IX. CONCLUSION .....	194

## I. INTRODUCTION

The debate is ongoing as to whether the explosive growth of gas industry operations involving hydraulic fracking poses a serious risk to public health and the environment. Concerns include the possibility that chemicals injected, naturally occurring substances disrupted, or toxins spilled at the surface may contaminate soil or make their way into drinking water supplies.<sup>1</sup> Chemicals used in drilling and fracking include carcinogens and endocrine-disrupting chemicals that may have latent long-term health effects, including chemicals that can affect the skin, eyes, other sensory organs, the respiratory and gastrointestinal systems, the brain and nervous system, immune and cardiovascular systems, or the kidneys.<sup>2</sup> Particularly problematic are endocrine-disrupting chemicals, which are known to cause latent abnormalities at infinitesimally small levels of exposure, create predispositions for disease that only become apparent later in life, and cause transgenerational effects.<sup>3</sup> Health effects may not surface for decades and could affect future generations.<sup>4</sup>

Drawing lessons for planning practice, this Article explores the legal and regulatory framework at the federal, state, and local level focusing on soil contamination and water quality concerns related to fracking on the Barnett Shale. The Barnett Shale, an area which underlies 5,000 square miles over twenty-three counties including the Dallas-Fort Worth area of Texas,<sup>5</sup> is the most active shale gas production area in the United States, and the home of one of the largest drilling programs ever undertaken in an urban area.<sup>6</sup> The Barnett Shale accounted for 25% of the gas production in Texas in 2009,

---

<sup>1</sup> Earthworks, *Hydraulic Fracking 101*, [http://www.earthworksaction.org/issues/detail/hydraulic\\_fracturing\\_101](http://www.earthworksaction.org/issues/detail/hydraulic_fracturing_101) (last visited Feb. 22, 2014).

<sup>2</sup> Theo Colborn et al., *Natural Gas Operations from a Public Health Perspective*, 17 HUMAN & ECOLOGICAL RISK ASSESSMENT 1039, 1049 (2011). This study identified 944 products used in gas industry operations. *Id.* at 1045. Many of the ingredients used in these products were not available. *Id.* Using the 632 chemicals that were reported in these products, this study completed a health effects analysis on 353 of these chemicals for which an American Chemical Society's Chemical Abstract Service (CAS) classification system number was available. *Id.* at 1039.

<sup>3</sup> Evanthia Diamanti-Kandarakis et al., *Endocrine-Disrupting Chemicals: An Endocrine Society Scientific Statement*, 30 ENDOCRINE REVS. 293, 296-97 (2009); cf. Ana M. Soto et al., *Does Cancer Start in the Womb? Altered Mammary Gland Development and Predisposition to Breast Cancer Due to in Utero Exposure to Endocrine Disruptors*, 18 J. OF MAMMARY GLAND BIOLOGY & NEOPLASIA 199, 200, 206 (2013) (presenting evidence of cancerous effects of endocrine-disrupting chemicals during fetal development).

<sup>4</sup> Colborn et al., *supra* note 2, at 1049.

<sup>5</sup> MILES T. WHITTEN, TCEQ, EMISSIONS INVENTORY PROCESSES, RECENT RESEARCH AND IMPROVEMENTS AND THE BARNETT SHALE SPECIAL INVENTORY (2010), *available at* <http://www.tceq.texas.gov/assets/public/implementation/air/ie/pseiforms/10162010arlington.pdf>.

<sup>6</sup> SCHLUMBERGER, SHALE GAS: WHEN YOUR GAS RESERVOIR IS UNCONVENTIONAL, SO IS OUR SOLUTION 2 (2005), *available at* [http://www.pe.tamu.edu/wattenbarger/public\\_html/Selected\\_papers/-Shale%20Gas/shale\\_gas-%20schlumberger.pdf](http://www.pe.tamu.edu/wattenbarger/public_html/Selected_papers/-Shale%20Gas/shale_gas-%20schlumberger.pdf). See also Thomas Kurth et al., *Shaking Up Established Case Law and Regulation: The Impacts of Hydraulic Fracturing*, ADVOC. TEX., Winter 2011, at 18, 25.

with 13,902 existing gas wells and another 3,333 permitted.<sup>7</sup> Gas production in this area increased over 3,000% from 1998 to 2007.<sup>8</sup> Since 2001, over 1,000 permits have been issued for drilling and production of gas within the city limits of the City of Fort Worth alone.<sup>9</sup>

Gas industry operations risk leaks and spills of fracking fluid chemicals and wastewater from many sources including flow lines, trucks, tanks, and holding pits.<sup>10</sup> In fracking, water, sand, and chemicals are injected into the shale layer at extremely high pressures to create fractures and release the trapped natural gas.<sup>11</sup> Although additives represent less than 0.5% of the total volume of hydraulic fracking fluid,<sup>12</sup> the U.S. Geological Survey estimates that about 15,000 gallons of chemical additives of waste are returned to the surface in a three million gallon frac job.<sup>13</sup> Additives are used to reduce friction, to prevent bacterial growth, to prevent mineral scale formation, to prevent corrosion, to prevent swelling of expandable clay minerals, as gelling agents to support proppants, as surfactants to promote fracturing, and as cleaners to dissolve contaminants in the casing and minerals in the shale.<sup>14</sup> Most of the injected fluids, 60–80%, are returned to the surface as “flowback” water<sup>15</sup> during a period of about two weeks before the well begins natural production, following which wastewater, now called “produced water,” will still flow back out of the well, typically at a rate of 84–420 gallons per day.<sup>16</sup> The well may continue in production for decades.<sup>17</sup>

Chemicals are also added to ‘muds’ used to drill the bore hole to increase the density and weight of the fluids, reduce friction, facilitate the return of drilling detritus to the surface, shorten drilling time, and reduce

---

<sup>7</sup> WHITTEN, *supra* note 5.

<sup>8</sup> *Id.* (showing chart of Barnett Shale production increasing from 34 billion cubic feet per year in 1998 to 103 trillion cubic feet per year in 2007).

<sup>9</sup> Fort Worth, Tex., Ordinance No. 18449-02-2009 at 1 (Feb. 3, 2009), *available at* [http://fortworthtexas.gov/uploadedFiles/City\\_Secretary/City\\_Council/Official\\_Documents/2009\\_Ordinances/18449-02-2009.pdf](http://fortworthtexas.gov/uploadedFiles/City_Secretary/City_Council/Official_Documents/2009_Ordinances/18449-02-2009.pdf) (including the fact that more than 1,000 drilling permits had been issued since 2001 among the reasons to revise the existing ordinance regulating noise, distance, and gas pipelines, including providing a penalty clause).

<sup>10</sup> Earthworks, *supra* note 1.

<sup>11</sup> ANTHONY ANDREWS ET AL., CONG. RESEARCH SERV., R40894, UNCONVENTIONAL GAS SHALES: DEVELOPMENT, TECHNOLOGY, AND POLICY ISSUES 33 (2009).

<sup>12</sup> R.R. Comm’n of Tex., *Hydraulic Fracturing Frequently Asked Questions*, <http://www.rrc.state.tx.us/about/faqs/hydraulicfracturing.php> (last visited Feb. 22, 2014).

<sup>13</sup> ANDREWS, *supra* note 11, at 34 (citing DANIEL J. SOEDER & WILLIAM M. KAPPEL, U.S. GEOLOGICAL SURVEY, WATER RESOURCES AND NATURAL GAS PRODUCTION FROM THE MARCELLUS SHALE 4 (2009), *available at* <http://pubs.usgs.gov/fs/2009/3032/pdf/FS2009-3032.pdf>).

<sup>14</sup> RICK MCCURDY, HIGH RATE HYDRAULIC FRACTURING ADDITIVES IN NON-MARCELLUS UNCONVENTIONAL SHALES 7–9, 11–12, 14–15, 18 (2011), *available at* <http://www2.epa.gov/sites/production/files/documents/highratehfinnon-marcellusunconventionals shale.pdf>.

<sup>15</sup> *Id.* at 33.

<sup>16</sup> REBECCA HAMMER & JEANNE VANBRIESEN, IN FRACKING’S WAKE: NEW RULES ARE NEEDED TO PROTECT OUR HEALTH AND ENVIRONMENT FROM CONTAMINATED WASTEWATER 11 (2012).

<sup>17</sup> Jim Fuquay, *Report Questions Long-Term Productivity of Gas Wells in Barnett Shale*, STAR-TELEGRAM, Feb. 12, 2013, <http://www.star-telegram.com/2013/02/12/4617558/report-questions-long-term-productivity.html> (last visited Feb. 22, 2014).

accidents.”<sup>18</sup> “The drilling fluid is circulated through a pit or tank, where the cuttings settle out,” and drilling mud may be stored for reinjection.<sup>19</sup> Temporary pits may be used during drilling to separate and hold the cuttings, the used drilling mud, and the contaminated water that comes to the surface during drilling.<sup>20</sup>

In addition to concerns about surface contamination, controversy is ongoing as to whether chemicals injected deep underground (in the Barnett, the fracking is done at about 6,000–7,500 feet underground) can make their way back up into drinking water aquifers (which reach surface depths of only 2,000 feet in the Barnett Shale).<sup>21</sup> The Texas Railroad Commission (RRC), the State agency with jurisdiction over oil and gas activities, states that Commission rules protect groundwater by requiring that surface casing in the well be set below the depth of usable quality water.<sup>22</sup> According to the RRC, its “records do not indicate a single documented water contamination case associated with the process of hydraulic fracturing.”<sup>23</sup> However, identifying contaminants associated with gas industry operations and tracking their source can be difficult pursuant to the current regulatory regime. It may take time for contaminants left deep in the earth to reach the surface and health effects may be latent. According to some current and former EPA officials, confidential settlement agreements are also interfering with risk assessment.<sup>24</sup>

The New York Times compiled documents from the mid-1980’s of a case where EPA concluded that hydraulic fracturing at depths of 4,216–4,363 feet led to contamination of a water well drilled to a depth of 400 feet.<sup>25</sup> The contaminant was described by the EPA as a fracturing fluid or gel.<sup>26</sup> There were reportedly no signs of surface contamination, and the gas well had

---

<sup>18</sup> Colborn et al., *supra* note 2, at 1040.

<sup>19</sup> John McFarland, *Landfarming—What is It and Should I Allow It On My Land?*, OIL & GAS LAW BLOG, Feb. 4, 2013, <http://www.oilandgaslawyerblog.com/2013/02/landfarming—what-is-it-and-s.html> (last visited Feb. 22, 2014).

<sup>20</sup> Colborn et al., *supra* note 2, at 1042.

<sup>21</sup> See Brief for Respondent at 6, *Range Resources Co. v. EPA*, No. 11-60040 (5th Cir. May 9, 2011); *see also* R.R. Comm’n of Tex., *supra* note 12.

<sup>22</sup> R.R. Comm’n of Tex., *supra* note 12.

<sup>23</sup> *Id.*

<sup>24</sup> Ian Urbina, *A Tainted Water Well, and Concern There May Be More*, N.Y. TIMES, Aug. 3, 2011, at A13 [hereinafter *A Tainted Water Well*].

<sup>25</sup> N.Y. TIMES, *Documents: A Case of Fracking Related Contamination*, <http://www.nytimes.com/interactive/us/drilling-down-documents-7.html#document/p1/a27935> (last visited Feb. 22, 2014); U.S. ENVTL. PROT. AGENCY, EPA/530-SW-88-003, REPORT TO CONGRESS: MANAGEMENT OF WASTES FROM THE EXPLORATION, DEVELOPMENT, AND PRODUCTION OF CRUDE OIL, NATURAL GAS, AND GEOTHERMAL ENERGY IV-22 (1987), *available at* <http://www.epa.gov/osw/nonhaz/industrial/special/oil/530sw88003a.pdf>; WEST VIRGINIA DEP’T OF ENERGY, OIL & GAS, INSPECTION REPORT (1985); STATE OF WEST VIRGINIA, WELL OPERATORS REPORT OF DRILLING, FRACTURING AND/OR STIMULATING, OR PHYSICAL CHANGE (1982); DAMAGE CASE REPORT FORM AND SUMMARY (1987).

<sup>26</sup> Urbina, *supra* note 24, at 377; EPA, EPA/530-SW-88-003, REPORT TO CONGRESS: MANAGEMENT OF WASTES FROM THE EXPLORATION, DEVELOPMENT, AND PRODUCTION OF CRUDE OIL, NATURAL GAS, AND GEOTHERMAL ENERGY 369 (1987).

strong casing to a depth that exceeded that of the aquifer.<sup>27</sup> EPA filed another report of ground water contamination linked to hydraulic fracking in December 2011.<sup>28</sup> EPA detected synthetic chemicals consistent with gas production and hydraulic fracturing fluids, high benzene concentrations and high methane levels in deep monitoring wells in Pavillion, Wyoming.<sup>29</sup> EPA cautiously noted that the conditions may be unique in that the fracturing is taking place “in close proximity to drinking water wells” and that production conditions are different than in many other areas.<sup>30</sup> Appearing wary of political ramifications, in March of 2012, EPA committed to additional investigation together with “a group of stakeholders and experts.”<sup>31</sup> The report was issued only in draft form for public comment and submission to an independent scientific panel.<sup>32</sup> The results are contested, with industry arguing that EPA’s study did not “adequately distinguish between potential natural impacts and those from gas drilling activities.”<sup>33</sup> On June 20, 2013, EPA announced that, although it “stands behind its work and data,” it does not plan to finalize or seek peer review of its draft groundwater report.<sup>34</sup> EPA plans instead to support the State of Wyoming in its continued investigation.<sup>35</sup>

In late 2010, EPA investigated a claim against Range Resources in Parker County on the Barnett Shale that a homeowner’s tap water became bubbling and flammable after nearby drilling and fracking operations.<sup>36</sup> Water samples showed elevated levels of benzene, toluene, ethane, and a

---

<sup>27</sup> Urbina, *supra* note 24, at 374; EPA, *supra* note 25, at 374.

<sup>28</sup> DOMINIC C. DIGIULIO ET AL., DRAFT INVESTIGATION OF GROUNDWATER CONTAMINATION NEAR PAVILLION, WYOMING xi (2011).

<sup>29</sup> *Id.*

<sup>30</sup> Press Release, EPA, EPA Releases Draft Findings of Pavillion, Wyoming Ground Water Investigation for Public Comment and Independent Scientific Review, Dec. 8, 2011, *available at* <http://yosemite.epa.gov/opa/admpress.nsf/20ed1dfa1751192c8525735900400c30/ef35bd26a80d6ce3852579600065c94e!OpenDocument>.

<sup>31</sup> Press Release, EPA, Statement on Pavillion, Wyoming Groundwater Investigation, Mar. 8, 2012, [hereinafter EPA Statement on Pavillion Investigation] *available at* <http://yosemite.epa.gov/opa/admpress.nsf/0/EF35BD26A80D6CE3852579600065C94E> (“Together with the Tribes, the EPA and the State will convene a group of stakeholders and experts to develop and carry out a plan for further investigation of the Pavillion gas field to identify potential risks to drinking water, including possible sources and pathways for the migration of contaminants.”).

<sup>32</sup> PETER FOLGER ET AL., CONG. RESEARCH SERV., R42327, EPA DRAFT REPORT OF GROUNDWATER CONTAMINATION NEAR PAVILLION, WYOMING: MAIN FINDINGS AND STAKEHOLDER RESPONSES 12 (2012).

<sup>33</sup> Letter from Comm. on Energy and Commerce, U.S. House of Representatives, to Gina McCarthy, Adm’r, EPA (July 30, 2013), *available at* <http://energycommerce.house.gov/sites/republicans.energycommerce.house.gov/files/letters/20130730EPA.pdf>.

<sup>34</sup> EPA Statement on Pavillion Investigation, *supra* note 31.

<sup>35</sup> *Id.*

<sup>36</sup> EPA, *Range Resources Imminent and Substantial Endangerment Order, Parker County, TX*, <http://www.epa.gov/region6/region-6/tx/tx005.html> (last visited Feb. 22, 2014); United States’ Memorandum in Opposition to Defendants’ Motion to Dismiss at 3, United States v. Range Prod. Co., 793 F. Supp. 2d 814 (N.D.Tex. 2011) (No. 3:11-CV-00116-F).

high level of methane.<sup>37</sup> EPA sampled the production gas from the gas well, and performed compositional and isotopic fingerprinting analyses.<sup>38</sup> Based on the results of its investigation, EPA determined that the presence of gas in the well was likely to be due to impacts from gas development and production activities in the area.<sup>39</sup> EPA concluded that the methane levels were potentially flammable and explosive, that benzene, if ingested or inhaled, could cause cancer, anemia, neurological impairment and other adverse health impacts, and that the contaminants “may present an imminent and substantial endangerment to the health of persons.”<sup>40</sup> EPA issued an emergency order that included requirements for providing potable water, surveying, sampling, and submitting plans to identify, eliminate, and remediate gas flow pathways into the Trinity Aquifer.<sup>41</sup>

After legal challenges to their regulatory authority, and amidst significant political controversy,<sup>42</sup> EPA ultimately dropped the case without a full explanation.<sup>43</sup> The Texas RRC held an independent hearing and concluded that the hydraulic fracking operations had not and were not causing or contributing to contamination of any domestic water wells.<sup>44</sup> Given an imbalance in representation, however, the Texas RRC may not have received a complete and balanced presentation of the facts.<sup>45</sup> While

---

<sup>37</sup> United States’ Memorandum in Opposition to Defendants’ Motion to Dismiss, *supra* note 36, at 3.

<sup>38</sup> *Id.* at 4 (“Isotopic fingerprinting is a method for determining the ratio of different isotopes of a particular element in a material such as gas.”).

<sup>39</sup> *Id.*

<sup>40</sup> *Id.* at 3–4.

<sup>41</sup> *Id.* at 15 (noting that EPA “ordered Range: (i) to notify EPA whether it intended to comply, (ii) to provide potable water to two residences, (iii) to install explosivity meters in two residences, (iv) to conduct a survey and limited sampling of water supply wells in the area, (v) to submit plans for additional soil gas surveys and indoor air concentration analyses of two residences, and (vi) to submit plans to identify gas flow pathways, plans to eliminate gas flow if possible, and plans to remediate impacted areas.”). *See also* Emergency Order from EPA, to Mike Middlebrook, Vice President, Range Res. Corp. & Range Prod. Co. (Dec. 10, 2010), available at <http://www.rrc.state.tx.us/meetings/ogpfd/7B-68629RangePFD-AttachA-commcalledepa.pdf>.

<sup>42</sup> Brantley Hargrove, *State and EPA Battle Over Fracking, Flaming Well Water*, HOUSTON PRESS NEWS, Apr. 25, 2012, <http://www.houstonpress.com/2012-04-26/news/texas-epa-fracking-well-water/full/> (last visited Feb. 22, 2014).

<sup>43</sup> *See* Mike Soraghan, *EPA Officials Ignored Engineer’s Theory in Range Resources Water Contamination Case*, INSIDE CLIMATE NEWS, Feb. 20, 2013, <http://insideclimatenews.org/todaynews/20130221/epa-officials-ignored-engineers-theory-range-resources-water-contamination-case> (last visited Feb. 22, 2014); Notice of Withdrawal of Imminent and Substantial Endangerment Order, from EPA, to David Poole, Gen. Counsel, Range Res. Corp. (Mar. 29, 2012), available at <http://www.rangeresources.com/rangeresources/files/4b/4bdd072d-a0fc-4084-8a22-77defab10da7.pdf>. The case was not entirely concluded as of May 9, 2011. *See* Brief of Respondent, Range Res. Corp. v. EPA, No. 11-60040 (5th Cir. May 9, 2011), available at [http://www.epa.gov/region6/6xa/pdf/range\\_5th\\_circuit\\_brief.pdf](http://www.epa.gov/region6/6xa/pdf/range_5th_circuit_brief.pdf).

<sup>44</sup> BRENDA CLAYTON, THE FUTURE OF REGULATION IN HYDRAULIC FRACTURING 11 (2012).

<sup>45</sup> *Id.* (“Neither the EPA nor the owners of the Parker County domestic water wells showed up at the RRC hearing.”).

Range Resources reportedly spent \$3 million on its defense,<sup>46</sup> EPA chose not to participate in the hearings.<sup>47</sup> The incestuous relationship in Texas between politics and the oil and gas industry also cast a pale over the integrity of the process.<sup>48</sup> Politics and process aside, however, there was testimony as to a possible natural cause of the contamination from another gas formation, the Strawn, which is located above the Barnett Shale.<sup>49</sup> Another nearby well, allegedly drilled at around the same time, hit gas immediately (before gas drilling), and there was testimony that a nearby public water system had signs since 1995 on its water storage tanks that read “No Open Flame.”<sup>50</sup> The water well at issue was drilled to a depth of only 200 feet, whereas the wellbore of the gas well was 5,000 feet deeper.<sup>51</sup> There was testimony that the greatest fracture identified in that county was 400 feet, or 4,500 feet below the surface.<sup>52</sup> There was also testimony that tests of the casing and cement lining in the wells proved there were no leaks;<sup>53</sup> however, there have been allegations to the contrary.<sup>54</sup>

The Houston Press noted that there was evidence that from about 400 feet below the surface to more than 4,000 feet, the gas well created a potential conduit, uncemented, and exposed to gas-bearing earth.<sup>55</sup> However, the question is unresolved as to whether natural fissures, faults, and wells may create conduits that will allow gas to travel from deep below the surface up into more shallow ground water supplies.<sup>56</sup> Federal researchers with the U.S. Department of Energy are currently conducting testing in the Marcellus Shale to evaluate whether hydraulic fracturing fluids can travel through geologic faults thousands of feet “into drinking water aquifers close to the surface.”<sup>57</sup> Richard Hammack, a spokesman for the U.S. Department of Energy explained that, although “[s]ome faults can be easily seen and avoided, [others] are not easily detected and could extend from the Marcellus Shale formation into other formations close to the surface.”<sup>58</sup> He

---

<sup>46</sup> Hargrove, *supra* note 42.

<sup>47</sup> The RRC held hearings on January 19 through 20, 2011, and issued the final order on March 22, 2011. Clayton, *supra* note 44, at 11–12.

<sup>48</sup> Hargrove, *supra* note 42.

<sup>49</sup> *Id.*

<sup>50</sup> *Id.*

<sup>51</sup> R.R. COMM’N OF TEX. OIL AND GAS, OIL AND GAS DOCKET NO. 7B-0268629, REVISED EXAMINERS REPORT AND PROPOSAL FOR DECISION, 15 (2008), *available at* <http://www.rrc.state.tx.us/meetings/ogpfd/RangePFD>.

<sup>52</sup> *Id.* at 8.

<sup>53</sup> Hargrove, *supra* note 42.

<sup>54</sup> See Soraghan, *supra* note 43; *EPA Officials Ignored Engineer’s Theory in Range Resources Water Contamination Case*, INSIDE CLIMATE NEWS, February 21, 2013, *available at* <http://insideclimatenews.org/todaynews/20130221/epa-officials-ignored-engineers-theory-range-resources-water-contamination-case>.

<sup>55</sup> Hargrove, *supra* note 42.

<sup>56</sup> See Rodney White, *US DOE Testing for Links Between Faults, Groundwater Pollution*, PLATTS MCGRAW HILL FINANCIAL, <http://www.platts.com/latest-news/natural-gas/Washington/US-DOE-testing-for-links-between-faults-groundwater-6370255> (last visited Feb. 22, 2014).

<sup>57</sup> *Id.*

<sup>58</sup> *Id.*

also expressed concern about the possibility that the thousands of oil and gas wells drilled before the state required drillers to map their locations could also provide pathways for fracking fluids to travel to the surface.<sup>59</sup> Similar concerns have been voiced in Texas.<sup>60</sup> Although Texas created a program to plug wells, resources have historically been limited in comparison to the magnitude of the task, and the number of wells that still need to be plugged is in the tens of thousands.<sup>61</sup>

Further complicating matters are earthquakes associated with gas industry options. There have been a series of small earthquakes on the Barnett Shale in areas that had not previously experienced seismic activity coinciding with natural gas production.<sup>62</sup> Other gas drilling regions have also experienced an increase in seismic activity. There has been an increase in earthquakes in western New York, central Oklahoma, and West Virginia since drilling began.<sup>63</sup> In 2011, Central Oklahoma experienced an earthquake at a magnitude of 5.6, the second strongest in the state's history.<sup>64</sup> U.S. Geological Survey researchers reported drastic increases in seismic events in the nation's midsection stretching from Alabama to New Mexico and north-south along the Great Plains.<sup>65</sup> Earthquake averages jumped from an average of twenty-one per year in the three decades prior to 2000, to fifty in 2009, eighty-seven in 2010 and 134 in 2011.<sup>66</sup> The researchers report "[a] naturally-occurring rate change of this magnitude is unprecedented outside

---

<sup>59</sup> *Id.*

<sup>60</sup> Kate Galbraith, *In Texas, Abandoned Oil Equipment Spurs Pollution Fears*, TEX. TRIBUNE, June 9, 2013, <http://www.texastribune.org/2013/06/09/texas-abandoned-oil-equipment-spurs-pollution-fear/> (last visited Feb. 22, 2014).

<sup>61</sup> TEX. DEP'T OF AGRIC., AGRICULTURAL LAND AND WATER CONTAMINATION FROM INJECTION WELLS, DISPOSAL PITS, AND ABANDONED WELLS USED IN OIL AND GAS PRODUCTION 3, 9 (1985), available at <http://www.nytimes.com/interactive/us/drilling-down-documents-7.html#document/p1/a27935> (concluding that abandoned wells can serve as conduits for injected oil and gas drilling waste fluids to migrate from underground to an area near the surface where they can break out and cause both groundwater and land contamination); U.S. GEN. ACCOUNTING OFFICE, GAO/RCED-89-97, DRINKING WATER: SAFEGUARDS ARE NOT PREVENTING CONTAMINATION FROM INJECTED OIL AND GAS WASTES 5 (1989); Kate Galbraith, *In Texas, Abandoned Oil Equipment Spurs Pollution Fears*, TEXAS TRIBUNE, June 9, 2013, <http://www.texastribune.org/2013/06/09/texas-abandoned-oil-equipment-spurs-pollution-fear/> (last visited Feb. 22, 2014).

<sup>62</sup> Cliff Frolich, *Environmental and Related Impacts of Shale Gas Development: Case Study of the Barnett Shale* (Nov. 26, 2012) (unpublished draft white paper, prepared for the Energy Inst.) (on file with author).

<sup>63</sup> Joyce Nelson, *Shake, Rattle and Drill: Earthquake Swarms, Fault Lines, and Fracking for Natural Gas*, WATERSHED SENTINEL, Mar.–Apr. 2011, at 8, 10.

<sup>64</sup> CNN Wire Staff, *Oklahoma's Largest Quake in Decades Buckles Highway; Rattles Residents*, Nov. 7, 2011, [http://articles.cnn.com/2011-11-06/us/us\\_oklahoma-earthquake\\_1\\_47-magnitude-quake-largest-quake-56-magnitude-quake?\\_s=PM:US](http://articles.cnn.com/2011-11-06/us/us_oklahoma-earthquake_1_47-magnitude-quake-largest-quake-56-magnitude-quake?_s=PM:US) (last visited Feb. 22, 2014).

<sup>65</sup> Bill Callahan & Mark Drajen, *Fracking Wastewater Tied by Scientists to Earthquakes*, BLOOMBERG, Apr. 18, 2012, <http://www.bloomberg.com/news/2012-04-19/fracking-wastewater-tied-by-scientists-to-earthquakes.html> (last visited Feb. 22, 2014) (discussing W.L. Ellsworth et al., U.S. Geological Survey, *Are Seismicity Rate Changes in the Midcontinent Natural or Manmade?*, 83 SEISMOLOGICAL RESEARCH LETTERS 403, 403 (2012) [hereinafter SSA 2012 Abstract]).

<sup>66</sup> Callahan & Drajen, *supra* note 65.

of volcanic settings or in the absence of a main shock, of which there were neither in this region.”<sup>67</sup>

On the Barnett Shale and in other regions, researchers have drawn a link between earthquakes and deep injection waste disposal wells.<sup>68</sup> Ohio recently tightened its rules regarding disposal wells after researchers at Colombia University linked several Ohio earthquakes in 2011 to a disposal well for injecting wastewater used in the fracking process.<sup>69</sup> At least for some smaller earthquakes, the finger has also been pointed at hydraulic fracturing.<sup>70</sup> However, fracking-induced quakes appear to be less common and smaller than injection-triggered quakes.<sup>71</sup> The Oklahoma Geological Survey (OGS) reviewed data from a series of about fifty earthquakes (ranging in magnitude from 1.0 to 2.8 millidarcy (mD)), most within a twenty-four hour period, forty-three of which were large enough to be located and identified as shallow and unique.<sup>72</sup> The study concluded that “[t]he strong correlation in time and space as well as a reasonable fit to a physical model, suggested that there is a possibility that these earthquakes were caused by hydraulic fracturing.”<sup>73</sup>

Although the question as to whether underground injection poses a risk to groundwater supplies is complicated, the potential hazards of surface contamination are more difficult to dismiss. Spills, leaks, malfunctions, and illegal dumping have been reported in shale gas regions across the county.<sup>74</sup> In Pavillion, Wyoming, EPA identified at least thirty-three surface pits used for disposal of drilling cuttings, hydraulic fracturing flowback, and water

<sup>67</sup> SSA 2012 Abstract, *supra* note 65.

<sup>68</sup> Callahan & Drajem, *supra* note 65; C. Frolich et al., *Dallas-Fort Worth Earthquakes Coincident with Activity Associated with Natural Gas Production*, 29 LEADING EDGE 270, 270, 274 (2010), available at <http://smu.edu/newsinfo/pdf-files/earthquake-study-10march2010.pdf>; Julie Carr Smyth, *Ohio: Fracking Waste Tied to Earthquakes*, USA TODAY, Mar. 9, 2012, <http://usatoday30.usatoday.com/money/story/2012-03-09/fracking-gas-drilling-earthquakes/53435232/1> (last visited Feb. 22, 2014). See also R.R. Comm’n of Tex., *supra* note 12 (injection waste disposal wells are the primary method of disposal for gas industry wastes on the Barnett Shale).

<sup>69</sup> Smyth, *supra* note 68; Lamont-Doherty Earth Observatory, Columbia Univ., *Ohio Quakes Probably Triggered by Waste Disposal Well Say Seismologists*, <http://www.ldeo.columbia.edu/news-events/seismologists-link-ohio-earthquakes-waste-disposal-wells> (last visited Feb. 22, 2014).

<sup>70</sup> Michael McCarthy, *Fracking for Gas Allowed in UK Despite Earthquakes*, INDEPENDENT, Apr. 17, 2012, <http://www.independent.co.uk/news/uk/home-news/fracking-for-gas-allowed-in-uk-despite-earthquakes-7648265.html> (last visited Feb. 22, 2014). See also CUADRILLA RESOURCES, GEOMECHANICAL STUDY OF BOWLAND SHALE SEISMICITY iii (2011), available at [http://www.cuadrillaresources.com/wp-content/uploads/2012/02/Geomechanical-Study-of-Bowl-and-Shale-Seismicity\\_02-11-11.pdf](http://www.cuadrillaresources.com/wp-content/uploads/2012/02/Geomechanical-Study-of-Bowl-and-Shale-Seismicity_02-11-11.pdf).

<sup>71</sup> Mike Soraghan, *Earthquakes: Disconnects in Public Disclosure Around “Fracking” Cloud Earthquake Issue*, ENERGYWIRE, Apr. 23, 2012, <http://www.eenews.net/public/energywire/2012/04/23/3> (last visited Feb. 22, 2014).

<sup>72</sup> OKLAHOMA GEOLOGICAL SURVEY, OPEN-FILE REPORT 1 (2011), available at [http://www.ogs.ou.edu/pubsscanned/openfile/OF1\\_2011.pdf](http://www.ogs.ou.edu/pubsscanned/openfile/OF1_2011.pdf).

<sup>73</sup> *Id.*

<sup>74</sup> Hannah Wiseman, *Risk and Response in Fracking Policy*, 84 U. COLO. L. REV. 729, 766–68 (2013).

produced, as likely sources of contamination in the shallow portion of the aquifer.<sup>75</sup> In June 2011, EPA identified seven locations for prospective and retrospective case studies to evaluate the potential impacts of hydraulic fracturing on drinking water resources, including one in Wise County on the Barnett Shale in Texas where there may be contamination from leaks, spills, and runoff.<sup>76</sup>

Information is not available on the hazards, or even the identity, of all the potentially problematic chemicals associated with gas industry operations.<sup>77</sup> Aside from some new rules that concern only drilling on public and Indian lands,<sup>78</sup> there are no federal laws requiring disclosure of the chemical composition of the fracking fluid.<sup>79</sup> Although many states have adopted disclosure laws, trade secret claims continue to interfere with full disclosure.<sup>80</sup> According to one count, two out of three times companies have publicly disclosed the chemicals in their hydraulic fracturing fluid they have claimed trade secrets, and 65% of fracking disclosures withhold at least one chemical as confidential business information.<sup>81</sup> A 2012 study of weekly air quality sampling for one year near a well pad in rural western Colorado where sixteen vertical gas wells had been drilled, hydraulically fractured and put into production, detected methylene chloride—a toxic solvent not reported in products used in drilling or hydraulic fracturing—73% of the time, including several times in high concentrations.<sup>82</sup> This chemical has many health effects, including endocrine-disrupting effects.<sup>83</sup>

Recent experience around the country following the contamination of water supplies with MTBE suggests caution in the regulatory approach to

---

<sup>75</sup> FOLGER ET AL., *supra* note 32, at 4.

<sup>76</sup> EPA, *Case Studies*, <http://www.epa.gov/hfstudy/casestudies.html#criteria> (last visited Feb. 22, 2014); EPA, *Key Issues to be Investigated at Case Study Locations*, <http://www.epa.gov/hfstudy/keyissues.html> (last visited Feb. 22, 2014); EPA, *News Releases Issued By the Office of Water*, <http://yosemite.epa.gov/opa/admpress.nsf/ec5b6cb1c087a2308525735900404445/41888687a8e96fdb85257c36005830d4!opendocument> (last visited Feb. 22, 2014).

<sup>77</sup> Mark Jaffe, *Drillers Claim "Trade Secrets" When They Don't Reveal Chemicals in Fracking Fluid*, DENVER POST, Dec. 4, 2011, [http://www.denverpost.com/ci\\_19461782](http://www.denverpost.com/ci_19461782) (last visited Feb. 22, 2014). See also Jeff Tollefson, *Secrets of Fracking Fluids Pave Way for Cleaner Recipe*, NATURE, Sep. 12, 2013, at 146, available at <http://www.nature.com/news/secrets-of-fracking-fluids-pave-way-for-cleaner-recipe-1.13719> (last visited Feb. 22, 2014).

<sup>78</sup> Matthew Daly, *Fracking Chemical Disclosure Rules Proposed*, HUFFINGTON POST, May 4, 2012, [http://www.huffingtonpost.com/2012/05/04/fracking-chemical-disclos\\_n\\_1477436.html](http://www.huffingtonpost.com/2012/05/04/fracking-chemical-disclos_n_1477436.html) (last visited Feb. 22, 2014).

<sup>79</sup> See, e.g., BRANDON MURRILL & ADAM VANN, CONG. RESEARCH SERV., R42461, HYDRAULIC FRACTURING: CHEMICAL DISCLOSURE REQUIREMENTS, at summary (2012).

<sup>80</sup> See ProPublica, *Fracking Chemical Disclosure Rules*, <http://www.propublica.org/special/fracking-chemical-disclosure-rules> (last visited Feb. 22, 2014).

<sup>81</sup> Mike Soraghan, *Hydraulic Fracturing: Two-Thirds of Frack Disclosures Omit 'Secrets,'* ENERGYWIRE, Sept. 26, 2012, <http://www.eenews.net/stories/1059970474> (last visited Feb. 22, 2014).

<sup>82</sup> Theo Colborn et al., *An Exploratory Study of Air Quality Near Natural Gas Operations*, HUMAN AND ECOLOGICAL RISK ASSESSMENT, Nov. 9, 2012, <http://www.endocrinedisruption.org/chemicals-in-natural-gas-operations/air-pollution> (last visited Feb. 22, 2014).

<sup>83</sup> *Id.*

hydraulic fracking and related gas industry operations. Leaking underground storage tanks, pipelines, and spills have caused extensive contamination with MTBE, an oxygenate previously used to reduce carbon monoxide and ozone levels caused by automobile emissions.<sup>84</sup> According to one recent report, MTBE may be used in fracking operations.<sup>85</sup> MTBE dissolves easily in water, does not “cling” well to soil, and migrates faster and farther in the ground than other gasoline components.<sup>86</sup> MTBE does not degrade easily and is difficult and costly to remove from ground water.<sup>87</sup> Starting in 1998, water providers across the county began filing suits against oil companies.<sup>88</sup> MTBE is responsible for the closure of thirteen of the South Tahoe Public Utility District’s drinking water wells and prompted a lawsuit with settlements in 2002 of over \$69 million.<sup>89</sup> New York State banned MTBE in 2004, because the chemical had polluted groundwater drinking water supplies throughout the State.<sup>90</sup> Approximately twenty other states have also banned MTBE.<sup>91</sup> In 2008, a multi-district litigation involving 153 public water providers, including municipalities, water agencies, and private water companies from seventeen states reached a \$422 million settlement.<sup>92</sup>

It may prove hazardous to health and costly in the long run for both public water supply entities and industry if hazardous chemicals like MTBE

---

<sup>84</sup> EPA, *Water Unregulated*, <http://water.epa.gov/drink/contaminants/index.cfm> (last visited Feb. 22, 2014).

<sup>85</sup> Email from Sharon Wilson to author (Feb. 1, 2013, 18:08 CST) (on file with author) (reporting a series of alleged leaks, spills, illegal dumping and cover up operations). See generally *Ruggiero Timeline*, <https://docs.google.com/document/d/1fkhd2RuyQDj1O6AWir9gYDZX410yNPsVgcfzrfo-7A/edit> (last visited Feb. 22, 2014) (tracking fracking events between Sept. 4, 2009, and Aug. 24, 2010, and including two well water testing reports at the same location before and after fracking operations). Compare STEVENS ECOLOGY, WATER ANALYSIS REPORT, *PROJECT NO. 2761* (2009) [hereinafter *STEVENS ANALYSIS REPORT NO. ONE*] (on file with author) (showing clean report with MTBE sample of 0.0), with STEVENS ECOLOGY, WATER ANALYSIS REPORT, *PROJECT NO. 3112* (2010) [hereinafter *STEVENS ANALYSIS REPORT NO. TWO*] (on file with author) (showing report with MTBE sample of 169.5 ppb and identifying as higher than upper recommended limit of 20).

<sup>86</sup> EPA, *Methyl Tertiary Butyl Ether (MTBE): Drinking Water*, <http://www.epa.gov/mtbe/water.htm> (last visited Feb. 22, 2014). See Colborn et al., *supra* note 2.

<sup>87</sup> *Id.*

<sup>88</sup> *MTBE Litigation - Background*, <http://www.mtbelitigationinfo.com/external/?fuseaction=external.docview&cid=942&documentID=72912> (last visited Feb. 22, 2014).

<sup>89</sup> South Tahoe Public Utility District, *MTBE FAQ's*, <http://www.stpud.us/mtbe-faqs.html> (last visited Feb. 22, 2014).

<sup>90</sup> Press Release, New York City Law Dep’t, Appeals Upholds \$105 Million Verdict Against ExxonMobil for Contaminating New York City’s Groundwater (July 26, 2013), available at <http://www.scribd.com/doc/156212396/MTBE-Appeals-Decision>.

<sup>91</sup> *Id.*

<sup>92</sup> Press Release Baron & Budd, Partial Settlement Requires Oil Companies to Pay Substantial Settlement and Treats Wells for MTBE Over the Next 30 Years (May 7, 2008), available at <http://baronandbudd.com/areas-of-practice/water-contamination/mtbe-settlement-press-kit/mtbe-settlement-press-release/> (last visited Feb. 22, 2014). See also Blank Rome LLP, *Public Nuisance in MTBE Litigation: An Attempt to Expand Tort Law Beyond Its Historical Parameters*, <http://www.blankrome.com/index.cfm?contentID=37&itemID=1526> (last visited Feb. 22, 2014).

are associated with gas industry operations. MTBE has not been the only costly surprise in recent years. Makers of the herbicide Atrazine, an endocrine-disrupting herbicide effectively banned in Europe,<sup>93</sup> recently settled a class action lawsuit with forty-three water systems in six states for \$105 million.<sup>94</sup> The lawsuit alleged that Atrazine entered the water supplies and forced them to incur costs associated with testing, monitoring, and filtering.<sup>95</sup> According to the lead attorney representing sixteen cities in 2010, the plaintiffs had spent more than \$350 million trying to filter Atrazine from their drinking water.<sup>96</sup> Over a thousand class members have now filed claims seeking a portion of the \$105 million settlement fund.<sup>97</sup>

This article will consider the extent to which state and federal regulatory programs are addressing soil and water contamination concerns related to gas industry operations on the Barnett Shale and the role of local government. This Article seeks to both assist local governments and share their experience for the benefit of other communities. Part I provides a close look at the Texas fracking chemical disclosure rules and their exemptions for trade secrets. Part II explores the possibility for increased chemical disclosure requirements in the face of inevitable property rights challenges. Part III reviews the scope and adequacy of testing to evaluate surface and ground water quality pursuant to state and federal regulations. Part IV discusses the difficult burden of holding the gas industry accountable under the common law in Texas. Part V reviews the federal regulatory framework and exemptions for gas industry operations. Part VI reviews the alternate state regulatory framework. Part VII reviews local efforts to fill regulatory gaps. The concluding section discusses reasonable approaches to strengthen and extend local regulation.

## II. TEXAS DISCLOSURE RULES AND TRADE SECRET EXCEPTIONS

The Texas RRC has recently adopted a limited disclosure rule that applies to fracking treatments of new wells. “New wells” are those wells for which the Commission has issued an initial drilling permit on or after

---

<sup>93</sup> Charles Duhigg, *Debating How Much Weed Killer is Safe in Your Water Glass*, N.Y. TIMES, Aug. 22, 2009, <http://www.nytimes.com/2009/08/23/us/23water.html?pagewanted=all> (last visited Feb. 22, 2014); Tyrone Hayes, *What is Atrazine and Why Do We Love It*, <http://www.atrazine-lovers.com/m1.html> (last visited Feb. 22, 2014).

<sup>94</sup> Duhigg, *supra* note 93; Bethany Karjelis, *Gilbert Approves \$105 Million Settlement in Atrazine Lawsuit*, MADISON-ST. CLAIR RECORD, Oct. 22, 2012, <http://madisonrecord.com/news/247257-gilbert-approves-105-million-settlement-in-atrazine-lawsuit> (last visited Feb. 22, 2014).

<sup>95</sup> Karjelis, *supra* note 94.

<sup>96</sup> Jason Hancock, *Iowa Community Sues Atrazine Maker for Contaminated Water*, IOWA INDEP., Mar. 9, 2010, <http://iowaindependent.com/29518/iowa-community-sues-atrazine-maker-for-contaminated-drinking-water> (last visited Feb. 22, 2014).

<sup>97</sup> *City of Greenville v. Syngenta Crop Prot., Inc.*, No. 3:10-CV-188-JPG-PMF, 2012 WL 1948153 (S.D. Ill. 2012). *Accord Atrazine Class Action Settlement Checks Are Being Sent to Community Water System Claimants*, <http://www.atrazinesettlement.com/> (last visited Feb. 22, 2014).

February 1, 2012.<sup>98</sup> The rules require that both the suppliers of fracking additives and the service company that performs fracking treatments provide the well operator with the identity, function, and Chemical Abstracts Service Registry Number (CAS number)<sup>99</sup> of each chemical ingredient intentionally added to the fracking fluid and the actual or maximum concentration of any chemicals for which a Material Safety Data Sheet (MSDS) is available.<sup>100</sup> The operator must then complete and upload a Chemical Disclosure Registry to FracFocus, a publicly accessible national fracking chemical registry website.<sup>101</sup>

The new Texas rule is limited both in the scope of activities and the scope of chemicals for which full disclosure is required.<sup>102</sup> Although operators often perform numerous treatments on a well over its lifespan,<sup>103</sup> the rule exempts tens of thousands of existing wells, including the 18,175 wells permitted on the Barnett Shale between January 2004 and December 2011.<sup>104</sup> Even as to new wells, there is uncertainty as to whether the disclosure requirements apply to subsequent treatments.<sup>105</sup> The rule concerns only chemicals related to the “hydraulic fracturing treatment.”<sup>106</sup> There are no requirements for the disclosure of drilling chemicals or other chemicals that may be employed onsite.<sup>107</sup>

There are also many exceptions to full disclosure for hydraulic fracturing chemicals. Disclosure of the actual or maximum concentration of each chemical is required only for those chemicals for which an MSDS has been prepared pursuant to the Occupational Safety and Health Administration (OSHA) hazard communication rules.<sup>108</sup> However, MSDS are not available for

---

<sup>98</sup> 16 TEX. ADMIN. CODE § 3.29(b) (2013).

<sup>99</sup> *See id.* § 3.29(c)(1)(A)(i)–(B)(ii) (requiring the assignment of a unique identification number by a globally recognized authority on chemical substances: the Chemical Abstracts Service, a division of the American Chemical Society).

<sup>100</sup> *See id.* § 3.29(c) (making each chemical ingredient used in the hydraulic fracturing treatment(s) of the well subject to the requirements of Title 29 of the Code of Federal Regulations at § 1910.1200(g)(2). *Accord* 29 C.F.R. § 1910.1200(g)(7)(i) (“Distributors shall ensure that material data sheets, and updated information, are provided to other distributors and employers with their initial shipment and with the first shipment after a safety data sheet is updated.”).

<sup>101</sup> *See, e.g.*, 16 TEX. ADMIN. CODE § 3.29(c)(2)(A) (2013) (providing that disclosures are not required for ingredients not disclosed by the manufacturer, supplier or service company and ingredients that were not intentionally added to the hydraulic fracturing treatment).

<sup>102</sup> *See id.* § 3.29(d)(1)–(4).

<sup>103</sup> John D. Furlow & John R. Hays, *Disclosure with Protection of Trade Secrets Comes to the Hydraulic Fracturing Revolution*, 7 TEX. J. OF OIL, GAS, & ENERGY L. 289, 325 (2012).

<sup>104</sup> *Id.* at 324. *See* R.R. COMM’N OF TEX., NEWARK, EAST BARNETT SHALE FIELD DATA (2012), available at <http://www.rrc.state.tx.us/data/fielddata/barnettshale.pdf>.

<sup>105</sup> Furlow & Hays, *supra* note 103, at 325.

<sup>106</sup> 16 TEX. ADMIN. CODE § 3.29(b) (2013) (limiting applicability of hydraulic fracturing treatment).

<sup>107</sup> *See* Furlow & Hayes, *supra* note 103, at 343 (noting the absence of any rule to this effect).

<sup>108</sup> 16 TEX. ADMIN. CODE § 3.29(c)(1)(A)(ii) (2013).

all potentially toxic chemicals.<sup>109</sup> Although MSDS are required for all “hazardous chemicals,”<sup>110</sup> classification of chemicals is limited by available information.<sup>111</sup> OSHA does not require chemical testing<sup>112</sup> and existing information on health effects of chemical exposure is limited, particularly in the area of chronic health effects where injury may be latent, and difficult to separate from illnesses that may be related to other causes.<sup>113</sup> Moreover, the scope of OSHA review for chronic effects often includes only carcinogenicity, teratogenicity, and mutagenicity, categories which do not adequately cover the area of chronic effects, excluding, for example, blood dyscrasias (such as anemia), chronic bronchitis, and liver atrophy.<sup>114</sup> Even where information is available, it is often not fully disclosed on the MSDS. In 1991, an OSHA-commissioned study of 150 MSDS found that only 37% accurately identified health effects data.<sup>115</sup> Further complicating matters, there are exceptions to disclosure requirements for trade secrets.<sup>116</sup>

OSHA has acknowledged that most chemicals have not been adequately tested to determine their health hazard potential.<sup>117</sup> Our primary regulatory program for assessing chemical risk, the Toxic Substance Control Act, has not proven effective.<sup>118</sup> EPA does not routinely assess the risks of the tens of thousands of chemicals already on the market.<sup>119</sup> Companies are not required to test the approximately 700 new chemicals introduced into commerce each year, and generally choose not to voluntarily perform testing.<sup>120</sup> EPA conducts assessments for some toxic chemicals under its Integrated Risk Information System (IRIS) program.<sup>121</sup> However, this program has historically been unable to keep pace with evolving science and has not completed assessments on many chemicals of concern.<sup>122</sup> There are no other federal agencies that assess cancer and noncancer risks of

---

<sup>109</sup> See OCCUPATIONAL SAFETY & HEALTH ADMIN., U.S. DEPT. OF LABOR, HAZARD COMMUNICATION IN THE 21ST CENTURY WORKPLACE (2004), available at <https://www.osha.gov/dsg/hazcom/finalmsdsreport.html> (noting that some MSDSs may be incomplete or contain erroneous or out-of-date information).

<sup>110</sup> OCCUPATIONAL SAFETY & HEALTH ADMIN., U.S. DEPT. OF LABOR, OSHA 3111, HAZARD COMMUNICATION GUIDELINES FOR COMPLIANCE 2–3 (2000).

<sup>111</sup> OSHA, *Hazard Communication in the 21st Century Workplace*, <http://www.osha.gov/dsg/hazcom/finalmsdsreport.html#msds> (last visited Feb. 22, 2014).

<sup>112</sup> 29 C.F.R. § 1910.1200, app. A § A.0.2.1 (2013).

<sup>113</sup> See *id.*

<sup>114</sup> *Id.* § 1910.1200(c) (2013).

<sup>115</sup> OSHA *supra* note 111.

<sup>116</sup> 29 C.F.R. § 1910.1200(i) (2013).

<sup>117</sup> See *id.* § 1910.1200, app. A (2013) (stating that testing is not required and outlining scientific methods for characterization when chemicals have not been adequately tested).

<sup>118</sup> U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-10-292T, CHEMICAL REGULATION OBSERVATIONS ON IMPROVING THE TOXIC SUBSTANCES CONTROL ACT 1 (2009), available at <http://www.gao.gov/assets/130/123792.pdf>.

<sup>119</sup> *Id.* at Introduction.

<sup>120</sup> *Id.*

<sup>121</sup> *Id.* at 1.

<sup>122</sup> *Id.* at 6.

exposure to chemicals.<sup>123</sup> EPA has reported that “insufficient scientific data are available on most of the estimated 87,000 chemicals produced today to allow for an evaluation of endocrine associated risks.”<sup>124</sup> Moreover, most products are mixtures of chemicals and information about potential synergistic effects of chemical mixtures is even more limited.<sup>125</sup>

In addition to the difficulty of evaluating the chemicals that are disclosed, the Texas fracking disclosure rules include exceptions to disclosure. A supplier, service company, or operator that claims trade secret protection will not be required to publicly disclose detailed information on fracking chemicals unless its claim is challenged and the Texas Attorney General or a court determines that the information is not entitled to protection.<sup>126</sup> If it claims a trade secret, an entity may withhold the chemical ingredient name or CAS number and must disclose only limited information to the Commission on the chemical family, properties, and effects of the chemical.<sup>127</sup> Even this limited chemical information might itself be considered a trade secret and excluded from public disclosure.<sup>128</sup> Moreover, it is unclear how the RRC would use the limited information that may be provided. The RRC is not generally in the business of analyzing, studying, and classifying chemicals. Moreover, without the CAS number, accurate investigation for health effects is not possible.<sup>129</sup> The CAS system uses unique number sequences to identify chemical elements, compounds, isomers of chemicals, polymers, biological sequences, or mixture, and provides a universal identity to substances that can otherwise be known by different names.<sup>130</sup>

Only landowners on or adjacent to the property where a wellhead is located, or a department or agency of the state,<sup>131</sup> may challenge a claim of trade secret protection. The City of Dallas unsuccessfully requested changes that would also allow municipalities to appeal a claim of trade secrets.<sup>132</sup>

---

<sup>123</sup> *Id.* at 3.

<sup>124</sup> EPA, *Endocrine Primer*, <http://www.epa.gov/endo/pubs/edspoverview/primer.htm> (last visited Feb. 22, 2014).

<sup>125</sup> See EPA, *ARCHITECTURE OF PRIORITY SETTING DATABASE*, <http://www.epa.gov/endo/pubs/prioritysetting/finalarch.htm> (last visited Feb. 22, 2014) (setting mixtures as a “specially targeted” priority in its 2001 priority database).

<sup>126</sup> 16 TEX. ADMIN. CODE § 3.29(c)(2)(C) (2013); TEX. GOV'T CODE ANN. §§ 552.110, 552.305 (West 2012).

<sup>127</sup> 16 TEX. ADMIN. CODE § 3.29(c)(2)(C) (2013).

<sup>128</sup> *Id.* § 3.29(2)(D) (“Unless the information is entitled to protection as a trade secret under Texas Government Code, Chapter 552, information submitted to the Commission or uploaded on the Chemical Disclosure Registry is public information.”).

<sup>129</sup> TEDX, THE ENDOCRINE DISRUPTION EXCHANGE, MULTISTATE SUMMARY 1 (2011), available at <http://endocrinedisruption.org/assets/media/documents/Multistatesummary1-27-11Final.pdf> (providing a summary of the potential health effects of products and chemicals used during natural gas operations).

<sup>130</sup> *Id.* See also Chemical Abstracts Service, *CAS Registry and CAS Registry Number FAQs*, <http://www.cas.org/content/chemical-substances/faqs> (last visited Feb. 22, 2014).

<sup>131</sup> 16 TEX. ADMIN. CODE § 3.29(f)(1) (2012).

<sup>132</sup> Letter from Jill A. Jordan, Assistant City Manager, City of Dallas, to the Rules Coordinator, Office of Gen. Counsel, and R.R. Comm'n of Tex. (Oct. 10, 2011), available at

Public health professionals and academics seeking to study these chemicals are also denied the right to challenge trade secret claims.<sup>133</sup>

There is a limited exception requiring the disclosure of trade secrets to a health professional or emergency responder, but the professional is specifically defined as someone needing information in order to provide medical or other health services to a person exposed to a chemical ingredient,<sup>134</sup> who must then keep the information confidential.<sup>135</sup> There are no exceptions whatsoever for incidents where hydraulic fracturing chemicals are spilled on property that have not (yet) resulted in identifiable health effects.<sup>136</sup> In contrast to the OSHA trade secret rules, there are no exceptions allowing disclosure to toxicologists or epidemiologists to conduct studies to assess hazards, to assess sampling, to design or assess appropriate protective measures or engineering controls, for medical surveillance, or to conduct studies to determine health effects of disclosure.<sup>137</sup>

In the event of a challenge to a trade secret claim, any assessment as to the need for protection is based only on consideration of industry concerns, with no weighing of the public interest.<sup>138</sup> “Trade secret” is defined as “[a]ny formula, pattern, device, or compilation of information that is used in a person’s business, and that gives the person an opportunity to obtain an advantage over competitors who do not know or use it.”<sup>139</sup> The following six factors are considered in determining whether information qualifies as “trade secret”: 1) the extent to which the information is known outside the company; 2) the extent to which it is known by employees and others involved in the company’s business; 3) the extent of measures taken by the company to guard the secrecy of the information; 4) the value of the information to the company and its competitors; 5) the amount of effort or money expended by the company in developing the information, and; 6) the ease or difficulty with which the information could be properly acquired or duplicated by others.<sup>140</sup>

In sum, given inadequate information on chemical toxicity and trade secret protection, public disclosure requirements are of limited effectiveness in advancing the state of knowledge and informing the regulatory process

---

<http://www.rrc.state.tx.us/rules/3-29-City-Of-Dallas.PDF> (noting, however, that municipalities may in many cases fall under the category of “adjacent land owner” in light of adjoining public rights of way).

<sup>133</sup> 16 TEX. ADMIN. CODE § 3.29(f)(1) (2012).

<sup>134</sup> *Id.* § 3.29(c)(4) (providing limited exceptions for diagnostic or treatment purposes).

<sup>135</sup> *Id.* § 3.29(g) (establishing confidentiality requirement for health professionals or emergency responders).

<sup>136</sup> *See* 16 TEX. ADMIN. CODE § 3.29 (2012).

<sup>137</sup> *See* 29 C.F.R. § 1910.1200(i)(3) (2006) (providing various exceptions to trade secret privilege under OSHA regulation); 16 TEX. ADMIN. CODE § 3.29 (2012) (providing none of the enumerated exceptions set forth under OSHA regulation).

<sup>138</sup> *See id.* § 3.29(a)(26).

<sup>139</sup> *Id.*

<sup>140</sup> *Id.*

governing gas industry operations to minimize potential hazards to public health and the environment. The rule is also not an effective tool for dealing with incidents that occur during the hydraulic fracturing process as notice is only required after the hydraulic fracturing process has been completed.<sup>141</sup>

### III. MOVING BEYOND PROPERTY RIGHTS CLAIMS

The City of Southlake has boldly required MSDS for all hazardous material located or used on the site, and information on “all types, quantities, volumes and concentration of all additives used in the drilling, completion and fracturing (or similar programs).”<sup>142</sup> No exceptions are apparent for trade secrets, however, the ordinance has not yet been applied in practice.<sup>143</sup> Local regulations that may require the disclosure of trade secrets could face takings challenges. Trade secrets can be considered property rights and thus subject to the Takings Clause of the Fifth Amendment of the U.S. Constitution.<sup>144</sup> However, state law defines and creates property interests.<sup>145</sup> Texas courts have not clearly classified trade secrets as property for the purposes of the takings clause.<sup>146</sup> Even where trade secrets are subject to the takings clause, however, it is not clear that takings challenges to trade secret disclosure requirements for chemicals associated with gas industry operations would prevail.

Case law applying the Takings Clause to trade secrets, and takings law developed in the context of real property does not necessarily apply in the context of personal property.<sup>147</sup> In *Lucas v. South Carolina Coastal Council*, the Supreme Court established a categorical takings rule for cases where a regulation eliminates all economically beneficial or productive use of real property,<sup>148</sup> but noted that “in the case of personal property, by reason of the State’s traditionally high degree of control over commercial dealings, [the owner] ought to be aware of the possibility that new regulation might even

---

<sup>141</sup> *Id.* § 3.29(c). See also letter from Jill Jordan, Assistant City Manager, to the Rules Coordinator (Oct. 10, 2011).

<sup>142</sup> SOUTHLAKE, TEX., CODE OF ORDINANCES ch. 9.5, art. IV, div. 2, § 234(25) (2011).

<sup>143</sup> Interview with Ken Baker, Planning Dir., City of Southlake, in Southlake, Tex. (Aug. 21, 2012).

<sup>144</sup> *Ruckelshaus v. Monsanto Co.*, 467 U.S. 986, 1003–04 (1984).

<sup>145</sup> *Id.* at 1001.

<sup>146</sup> *Garcia v. Peeples*, 734 S.W.2d 343, 348 n.4 (Tex. 1987); Loyd Doggett & Michael J. Mucchetti, *Public Access to Public Courts: Discouraging Secrecy in the Public Interest*, 69 TEX. L. REV. 643, 674–75 (1991); Gen. Tire v. Kepple, 917 S.W.2d 444, 454 (Tex. App. 1996) (“While Texas law treats trade secrets as property in some contexts, they have not been classified as property for the purposes of the taking clause.”), *rev’d and remanded on other grounds*, 970 S.W.2d 520, 529 (Tex. 1998).

<sup>147</sup> David H. Isaacs, *Not all Property is Created Equal: Why Modern Courts Resist Applying the Taking Clause to Patents and Why They are Right to Do So*, 15 GEO. MASON L. REV. 1 (2007).

<sup>148</sup> *Lucas v. S.C. Coastal Council*, 505 U.S. 1003, 1019, 1028–29 (1992) (“[R]egulations that prohibit all economically beneficial use of land . . . cannot be newly legislated or decreed (without compensation), but must inhere in the title itself, in the restrictions that background principles of the State’s law of property and nuisance already place upon land ownership.”).

render his property economically worthless (at least if the property's only economically productive use is sale or manufacture for sale)."<sup>149</sup>

*Philip Morris, Inc. v. Reilly*, a First Circuit en banc opinion, addressed property rights in the context of trade secrets. Reversing a previous decision, the court struck down a Massachusetts law requiring disclosure of cigarette ingredient lists.<sup>150</sup> The court declined to apply the categorical rule announced in *Lucas*,<sup>151</sup> and chose instead to apply the *Penn Central Transportation Co. v. New York City (Penn Central)* balancing test the Supreme Court applied in *Ruckelshaus v. Monsanto Co.*, an earlier case involving trade secrets.<sup>152</sup> The *Penn Central* rule is an "ad hoc, factual inquiry" that balances the importance of the public interest<sup>153</sup> while considering the economic impact of the regulation; the extent to which the government action interferes with reasonable investment-backed expectations; and the character of the government action.<sup>154</sup>

In *Philip Morris*, the court objected to the permissive language in the Disclosure Act that allowed Massachusetts to disclose trade secrets where doing so "could" further public health.<sup>155</sup> The law required disclosure to the State, and then allowed the State to disclose the information to the public if "there is a reasonable scientific basis for concluding that the availability of such information could reduce risks to public health."<sup>156</sup> The court reasoned that "[t]he tremendous individual loss is simply not justified by such a speculative public gain."<sup>157</sup> The court concluded that the character of the government action weighs heavily against sustaining the Act.<sup>158</sup>

The court cited to language in *Corn Products Refining Co. v. Eddy (Cord Products II)*, an early Supreme Court decision upholding a Kansas food labeling law against a takings challenge.<sup>159</sup> In that case, the Court stated:

[I]t is too plain for argument that a manufacturer or vendor has no constitutional right to sell goods without giving to the purchaser fair information of what it is that is being sold. The right of a manufacturer to maintain secrecy as to his compounds and processes must be held subject to

---

<sup>149</sup> *Id.* at 1027–28 (citing *Andrus v. Allard*, 444 U.S. 51, 66–67 (1979)) (prohibiting the sale of birds lawfully killed prior to the enactment of the Eagle Protection Act and Migratory Bird Treaty Act).

<sup>150</sup> *Philip Morris, Inc. v. Reilly*, 312 F.3d 24, 47 (1st Cir. 2002) (citing Massachusetts Disclosure Act, MASS. GEN. LAWS ch. 94, § 307B (2002)).

<sup>151</sup> *Lucas*, 505 U.S. at 1029.

<sup>152</sup> *Philip Morris*, 312 F.3d at 30–31 (citing *Ruckelshaus v. Monsanto Co.*, 467 U.S. 986, 1007 (1984)).

<sup>153</sup> *Id.* at 33 (citing *Penn Cent. Transp. Co. v City of N.Y.*, 438 U.S. 104, 124 (1978) (discussing a three part test)).

<sup>154</sup> *Id.*

<sup>155</sup> *Id.* at 42, n.13.

<sup>156</sup> *Id.* at 29 (citing the Massachusetts Disclosure Act, Mass. Gen. Laws ch. 904, § 307B (repealed therein)).

<sup>157</sup> *Id.* at 44.

<sup>158</sup> *Id.* at 45.

<sup>159</sup> 249 U.S. 427 (1919).

the right of the state, in the exercise of its police power and in promotion of fair dealing, to require that the nature of the product be fairly set forth.<sup>160</sup>

The First Circuit reasoned that this language refers only to “fair information,” which it surmised could be something short of complete disclosure of all additives in the context of cigarettes.<sup>161</sup> Consistent with this reasoning, the en banc opinion’s summary of the facts noted “most of the added ingredients are approved for consumption in food or ‘Generally Recognized as Safe’ by the Food and Drug Administration.”<sup>162</sup> The court reasoned that other states have required confidential disclosure to a state agency with explicit guarantees for protection of trade secrets and concluded that the “right to publish, under the minimal standard set forth, has not been shown to further the stated goal of promoting public health in such a way as to counterbalance the tremendous private loss involved.”<sup>163</sup>

With little deference to the legislative scheme, the court was not convinced that this regulation was tailored to promote health and was the best strategy to do so.<sup>164</sup> However, there is no discussion in the case as to the capacity of the State of Massachusetts to perform the necessary testing and analysis.<sup>165</sup> The State legislature may have believed that public disclosure was necessary to enable and encourage further outside research. In contrast to the en banc opinion’s summary of facts, the initial opinion specifically noted a letter submitted during the legislative process from the Director of Centers for Disease Control to Congress that identified the harmful potential of the chemical additives and possible interactive effects, stating: “We do not know what potentially harmful byproducts may be produced when tobacco additives are burned alone or in combination, as they are in cigarettes.”<sup>166</sup> The summary of facts in the initial opinion noted that manufacturers report using approximately 700 additives, many of which serve chemical functions, including solvents that process and modify pH and which present public health concerns.<sup>167</sup>

The degree of scrutiny employed in *Philip Morris* is inconsistent with the rationale of previous Supreme Court opinions discussing the application of heightened scrutiny in takings cases and ignores the theoretical underpinnings of takings law. Takings law seeks to identify regulations “whose effects are functionally comparable to government appropriation or

---

<sup>160</sup> *Philip Morris*, 312 F.3d at 39–40 (citing *Corn Prods. Ref. Co. v. Eddy*, 249 U.S. 427, 431–32 (1919) (upholding required disclosure of ingredient lists to prevent consumer fraud)).

<sup>161</sup> *Id.* at 40.

<sup>162</sup> *Id.* at 27.

<sup>163</sup> *Id.* at 45.

<sup>164</sup> *Id.* at 44.

<sup>165</sup> *See id.* at 42, n.13.

<sup>166</sup> *Philip Morris, Inc. v. Reilly*, No. 00-2425, 2001 U.S. App. LEXIS 22348, at \*5 (1st Cir. 2001), *withdrawn*.

<sup>167</sup> *Id.* at \*4.

invasion of private property.”<sup>168</sup> In *Nolan v. California Coastal Commission*, the Supreme Court applied heightened scrutiny in the context of a bargain between property owners and the regulatory body where the government conditioned permit approval on the surrender of a property interest.<sup>169</sup> The Court required a “substantial advancing” of a legitimate state interest, reasoning:

We are inclined to be particularly careful about the adjective where the actual conveyance of property is made a condition to the lifting of a land-use restriction, since in that context there is a heightened risk that the purpose is avoidance of the compensation requirement, rather than the stated Police Power objective.<sup>170</sup>

In the context of public health laws requiring disclosure of chemical ingredient lists, however, there is no reason to suspect that the government may be trying to weasel a free property interest while evading payment of just compensation. Although industry may lose the trade secret at the moment of disclosure, there is nothing for the government to acquire.

In *Lingle v. Chevron*, the Supreme Court made clear that heightened scrutiny of the public purpose is not generally an appropriate inquiry in the context of takings law. In that case, the Court explained that applying the “substantially advancing” test, “a means-ends test asking, in essence, whether a regulation of private property is *effective* in achieving some legitimate public purpose”<sup>171</sup> requires courts to “scrutinize the efficacy” of regulations, “a task for which courts are not well suited.”<sup>172</sup> The Court explained that such a test “would empower—and might often require—courts to substitute their predictive judgments for those of elected legislatures and expert agencies.”<sup>173</sup>

Where complex questions of chemical toxicity and interactive effects are at issue, decisions about the level of public disclosure necessary may be best left to legislative bodies. The Court has long recognized that the “Fifth Amendment’s guarantee . . . [is] designed to bar Government from forcing some people alone to bear public burdens which, in all fairness and justice, should be borne by the public as a whole.”<sup>174</sup> In all fairness and justice, the government may conclude that it is the gas industry, not the children in its

---

<sup>168</sup> *Lingle v. Chevron U.S.A., Inc.*, 544 U.S. 528, 529 (2005). *See also* *Lucas v. S.C. Coastal Council*, 505 U.S. 1003, 1018 (1992) (noting that regulations leaving the owner of land without economically beneficial or productive options “carry with them a heightened risk that private property is being pressed into some form of public service under the guise of mitigating serious public harm.”).

<sup>169</sup> *See Nolan v. Cal. Coastal Comm’n*, 483 U.S. 825, 828, 838 (1987).

<sup>170</sup> *Id.* at 841.

<sup>171</sup> *Lingle*, 544 U.S. at 529.

<sup>172</sup> *Id.*

<sup>173</sup> *Id.*

<sup>174</sup> *Penn. Cent. Transp. Co. v. City of N.Y.*, 438 U.S. 104, 123 (1978) (citations omitted).

path, that should absorb the cost of addressing uncertainty as to public health and safety.

Even if the courts were to apply heightened scrutiny, a full disclosure requirement for fracking and drilling fluids may still be upheld. In *Philip Morris*, the initial opinion made note of the fact that the Disclosure Act would enable the state to study additives and the potential synergistic effects of certain ingredients.<sup>175</sup> In the context of fracking in Texas, however, there is no indication that the State plans to undertake such study and analysis. The Texas Sunset Commission recently concluded that the RRC is ill equipped, understaffed, and underfunded, to complete the tasks that it has already been delegated.<sup>176</sup> It is not equipped for the enormous task of evaluating the uncertain risk of the many chemicals on the market. Nor would any other state agency appear to be equipped for the task. As reported by the Texas Environmental Health Institute (TEHI or the Institute) in 2007:

[N]o system exists in Texas at the State level to track many of the exposures and health effects that may be related to environmental hazards. While Texas does maintain various environmental, exposure, and disease tracking systems it lacks the ability to link these systems together. Because existing systems are not linked, it is difficult to study and monitor relationships among hazards, exposures, and health effects.<sup>177</sup>

In response to citizen concerns about the potential health impacts of environmental pollutants, the Texas Legislature created the TEHI in 2001 as a joint venture between the Texas Department of Health and the Texas Natural Resources Conservation Commission.<sup>178</sup> Yet, a 2013 Progress Report explains that the Institute was established only as a “virtual entity” with its functions assigned to existing staff.<sup>179</sup> The report does not identify any significant progress in creating a coordinated systematic approach to

---

<sup>175</sup> *Philip Morris, Inc. v. Reilly*, No. 00-2425, 2001 U.S. App. LEXIS 22348, at \*9 (1st Cir. 2001), *withdrawn*.

<sup>176</sup> See SUNSET ADVISORY COMM’N, STAFF REPORT 33 (2010), *available at* [http://images.bimedia.net/documents/rct\\_sr.pdf](http://images.bimedia.net/documents/rct_sr.pdf); see discussion *infra* pp. 2–5.

<sup>177</sup> TEX. ENVTL. HEALTH INST., PROGRESS REPORT AND FUTURE DIRECTIONS 23 (2007), *available at* [http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CCQFjAA&url=http%3A%2F%2Fwww.dshs.state.tx.us%2Fepitox%2Freports%2Ftehi\\_accomplishments.pdf&ei=Tr7\\_UpWVC8LmoATDoIHABw&usg=AFQjCNH36Amldv9uOEngFSIxtohcgjdcAA&bvm=bv.61535280,d.cGU](http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CCQFjAA&url=http%3A%2F%2Fwww.dshs.state.tx.us%2Fepitox%2Freports%2Ftehi_accomplishments.pdf&ei=Tr7_UpWVC8LmoATDoIHABw&usg=AFQjCNH36Amldv9uOEngFSIxtohcgjdcAA&bvm=bv.61535280,d.cGU).

<sup>178</sup> Tex. Dep’t of State Health Servs., *Texas Environmental Health Institute: Establishment of the Institute*, <http://www.dshs.state.tx.us/epitox/tehi.shtm> (last visited Feb. 22, 2014).

<sup>179</sup> TEX. ENVTL. HEALTH INST., PROGRESS REPORT 2 (2013), *available at* [http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0CDAQFjAB&url=http%3A%2F%2Fwww.dshs.state.tx.us%2Fepitox%2Freports%2F2013TEHIPProgressReportFINAL011513.pdf&ei=E\\_J6UppyIB8egiALdyoCgBA&usg=AFQjCNHQ9kclDuKqKlwwja6onjSgELQutA&bvm=bv.56146854,d.cGE](http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0CDAQFjAB&url=http%3A%2F%2Fwww.dshs.state.tx.us%2Fepitox%2Freports%2F2013TEHIPProgressReportFINAL011513.pdf&ei=E_J6UppyIB8egiALdyoCgBA&usg=AFQjCNHQ9kclDuKqKlwwja6onjSgELQutA&bvm=bv.56146854,d.cGE).

tracking public health in relation to toxic exposure.<sup>180</sup>

#### IV. WATER QUALITY ANALYSIS AND EVOLVING STANDARDS

Even where chemicals associated with gas industry operations have been disclosed, they may still slip by undetected into ground and surface water supplies. Carrying out its responsibilities pursuant to the federal Clean Water Act (CWA), the TCEQ evaluates water bodies<sup>181</sup>, including those that supply drinking water.<sup>182</sup> However, the evaluation is far from comprehensive. The relatively short list of toxic chemicals identified for regulation under the CWA has remained essentially unchanged since 1976. Pursuant to a 1976 settlement agreement, EPA was required to regulate sixty-five chemicals and classes of chemicals.<sup>183</sup> The list was then subdivided into 129 distinct substances (later reduced to 126 substances)<sup>184</sup> now commonly referred to as “priority pollutants.”<sup>185</sup> The 1976 agreement required EPA to develop water quality criteria for each of the priority pollutants that could then be incorporated into legally binding State water quality standards.<sup>186</sup> The TCEQ currently has numerical criteria in its water quality standards for only seventy-one toxic substances for freshwater bodies that are designated as public water supplies.<sup>187</sup> A comparison of this list to chemicals that have been associated with drilling and fracking fluid reveals many hazardous chemicals that are not subject to monitoring and regulation by the TCEQ regulatory program.<sup>188</sup>

---

<sup>180</sup> *See id.*

<sup>181</sup> WATER QUALITY PLANNING DIV., DRAFT GUIDANCE FOR ASSESSING AND REPORTING SURFACE WATER QUALITY IN TEXAS 1-1, 2-1 (2012), *available at* [http://www.tceq.texas.gov/assets/public/waterquality/swqm/assess/12twqi/2012\\_guidance.pdf](http://www.tceq.texas.gov/assets/public/waterquality/swqm/assess/12twqi/2012_guidance.pdf).

<sup>182</sup> *Id.*

<sup>183</sup> EPA, *Toxic and Priority Pollutants*, <http://water.epa.gov/scitech/methods/cwa/pollutants-background.cfm> (last visited Feb. 22, 2014).

<sup>184</sup> *Id.*

<sup>185</sup> CLAUDIA COPELAND, CONG. RESEARCH SERV., 93-849 ENR, TOXIC POLLUTANTS AND THE CLEAN WATER ACT: CURRENT ISSUES (1993), <http://digital.library.unt.edu/ark:/67531/metacrs89/> (last visited Feb. 22, 2014).

<sup>186</sup> *Id.*

<sup>187</sup> WATER QUALITY PLANNING DIV., 2010 GUIDANCE FOR ASSESSING AND REPORTING SURFACE WATER QUALITY IN TEXAS 3-37 (2010), *available at* [http://www.tceq.texas.gov/assets/public/compliance/monops/water/10twqi/2010\\_guidance.pdf](http://www.tceq.texas.gov/assets/public/compliance/monops/water/10twqi/2010_guidance.pdf) (failing to include the 15 or so different forms of dioxin listed and summarized to calculate total dioxin); E-mail from Jim Davenport, Leader of the Water Quality Standards Team of the TCEQ (Jan. 29, 2012) (on file with the author) (The TCEQ has gradually expanded the number of toxic criteria it uses to evaluate drinking water resources, depending on the level of confidence in EPA’s criteria and toxicity estimates and whether EPA has identified the specific toxic pollutant in surface waters).

<sup>188</sup> *See* Colborn et al., *supra* note 2, at 1039, 1052–53 (identifying 46 of the more commonly used chemicals used in drilling and fracking operations). *Compare* TEDX, *supra* note 129 (identifying which of the forty-six chemicals are water soluble chemicals used in drilling and fracking fluids), *with* 30 TAC §307.6(d)(1), Hol., *available at* <http://info.sos.state.tx.us/fids/201003720-3.pdf>.

Chemicals associated with gas industry operations may also bypass limited testing and reporting related to groundwater resources. The Texas Groundwater Protection Committee (TGPC) tracks groundwater contamination, but only contamination in documented cases compiled from information provided by disparate state agencies.<sup>189</sup> The State has not developed a comprehensive assessment program or standards for pollutant discharges to groundwater.<sup>190</sup> The Texas Water Development Board maintains a groundwater database to support water planning that includes some data on water quality, but only for a few constituents (regularly reporting on only silica, calcium/magnesium, sodium, potassium, fluoride, nitrate, strontium, carbonate/bicarbonate, and sulfate/chloride).<sup>191</sup> The database includes less than 10% of the wells in Texas and only about half of the public water–supply wells.<sup>192</sup>

The State has created Groundwater Conservation Districts, but the focus is on supply and demand, not water quality.<sup>193</sup> The district water management plans covering core counties on the Barnett Shale (Denton, Johnson, Tarrant, and Wise) do not discuss water quality monitoring efforts.<sup>194</sup> No monitoring is reported in plans for the Northern Trinity (Tarrant County), or the Upper Trinity (Montague, Parker, Wise, and Hood Counties) and Middle Trinity (Comanche, Erath, Bosque, and Coryell Counties).<sup>195</sup> Among these three groundwater conservation districts, only the Middle Trinity District management plan, which does not include the core

---

<sup>189</sup> TEX. GROUNDWATER PROT. COMM., SFR-047/12, ACTIVITIES AND RECOMMENDATIONS OF THE TEXAS GROUNDWATER PROTECTION COMMITTEE: A REPORT TO THE 83RD LEGISLATURE 15–17 (2013), available at [http://www.tceq.texas.gov/assets/public/comm\\_exec/pubs/sfr/047\\_12.pdf](http://www.tceq.texas.gov/assets/public/comm_exec/pubs/sfr/047_12.pdf). See also TEX. WATER CODE ANN. § 26.405–406 (West 2013).

<sup>190</sup> TEX. GROUNDWATER PROT. COMM., *supra* note 189, at 12. See also TEX. WATER CODE ANN. § 26.405–406 (West 2013).

<sup>191</sup> See Tex. Water Dev. Bd., *Explanation of Groundwater Well Data*, <http://www.twdb.texas.gov/groundwater/faq/faqgwdb.asp> (last visited Feb. 22, 2014).

<sup>192</sup> *Id.*

<sup>193</sup> N. TRINITY GROUNDWATER CONSERVATION DIST., GROUNDWATER MANAGEMENT PLAN 1 (2010), available at [http://www.tarrantcounty.com/egov/lib/egov/NTGCD\\_Draft\\_Management\\_Plan\\_030210.pdf](http://www.tarrantcounty.com/egov/lib/egov/NTGCD_Draft_Management_Plan_030210.pdf) (discussing the legislative history).

<sup>194</sup> See Tex. Water Dev. Bd., *Groundwater Conservation District Information*, [http://www.twdb.state.tx.us/groundwater/conservation\\_districts/gcdinfo2.asp](http://www.twdb.state.tx.us/groundwater/conservation_districts/gcdinfo2.asp) (last visited Feb. 22, 2014) (linking to conservation district plans). The management plans for the Northern and Upper Trinity Districts mention water quality concerns but no plans for systemic monitoring through sampling. See N. TRINITY GROUNDWATER CONSERVATION DIST., GROUNDWATER MANAGEMENT PLAN (2010), available at [http://www.twdb.state.tx.us/groundwater/docs/GCD/ntgcd/ntgcd\\_mgmt\\_plan2010.pdf](http://www.twdb.state.tx.us/groundwater/docs/GCD/ntgcd/ntgcd_mgmt_plan2010.pdf); UPPER TRINITY GROUNDWATER CONSERVATION DIST., DISTRICT MANAGEMENT PLAN (2010), available at <http://middletrinitygcd.org/mplan2012.pdf>; MIDDLE TRINITY CONSERVATION DIST., GROUNDWATER MANAGEMENT PLAN (2012), available at <http://www.middletrinitygcd.org/mplan2012.pdf>. See also R.R. Comm'n of Tex., *Barnett Shale Information*, available at <http://www.rrc.state.tx.us/barnettshale/index.php> (last visited Feb. 22, 2014).

<sup>195</sup> N. TRINITY GROUNDWATER CONSERVATION DIST., *supra* note 194, at 16 (mentioning water quality concerns, but failing to plan for systemic monitoring through sampling); UPPER TRINITY GROUNDWATER CONSERVATION DIST., *supra* note 194, at 47–48 (same); MIDDLE TRINITY CONSERVATION DIST., *supra* note 194, at 2–3 (focusing exclusively on monitoring of water quantity).

fracking counties, contemplates water quality sampling (although none has occurred to date).<sup>196</sup> The sampling contemplated will be required only annually from one well in each of the counties in the District.<sup>197</sup> There is no mention of chemicals that will be screened or reported.<sup>198</sup> The two ground water conservation district plans covering the core counties of Denton and Johnson do not discuss water quality testing.<sup>199</sup>

Limited water quality analysis is conducted under the Safe Drinking Water Act (SDWA) for “finished” surface water and groundwater resources that serve as public water supplies, but private wells fall outside the regulatory program,<sup>200</sup> and again, the list of regulated chemicals is very short.<sup>201</sup> Under the SDWA, only eighty-nine chemicals are subject to review.<sup>202</sup> Yet hundreds of unregulated contaminants have been detected in public drinking water systems and source waters, some of which are known to have adverse health effects.<sup>203</sup> According to a General Accounting Office Report, EPA has identified more than 6,000 chemicals that it considers the most likely sources of human or environmental exposure, yet the potential health effects of exposure to most, and the extent of their occurrence in drinking water is largely unknown.<sup>204</sup> Since the 1996 amendments to the SDWA, EPA has not recommended any new contaminants for regulation with the exception of perchlorate in 2011.<sup>205</sup> Water-soluble toxic chemicals have been associated with gas industry operations that are not regulated under the SDWA. Theo Colburn et al. compiled a list of water-soluble chemicals used in gas industry operations based on chemicals identified in pit solids in New Mexico, and in drilling and fracking fluids for which information was available.<sup>206</sup> A comparison of this list to the SDWA’s list of

<sup>196</sup> MIDDLE TRINITY GROUNDWATER CONSERVATION DIST., *supra* note 194, at 31.

<sup>197</sup> *Id.*

<sup>198</sup> *Id.*

<sup>199</sup> PRAIRIELANDS GROUNDWATER CONSERVATION DIST., PRAIRIELANDS GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN 2, 16–17 (2012), *available at* [http://prairielandsgcd.org/uploads/PGCD\\_Management\\_Plan.pdf](http://prairielandsgcd.org/uploads/PGCD_Management_Plan.pdf); N. TEXAS GROUNDWATER CONSERVATION DIST., MANAGEMENT PLAN 9 (2012), *available at* [http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CCQQFjAA&url=http%3A%2F%2Fnorthtexasgcd.org%2Fuploads%2FNTGCD\\_Management\\_Plan\\_-\\_final\\_-\\_20120514.pdf&ei=\\_cL\\_UsnfDcjnoASohoDgCg&usq=AFQjCNEzljPozv-0k4oe\\_WqsifA\\_QqpDsA&bvm=bv.61535280,d.cGU](http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CCQQFjAA&url=http%3A%2F%2Fnorthtexasgcd.org%2Fuploads%2FNTGCD_Management_Plan_-_final_-_20120514.pdf&ei=_cL_UsnfDcjnoASohoDgCg&usq=AFQjCNEzljPozv-0k4oe_WqsifA_QqpDsA&bvm=bv.61535280,d.cGU).

<sup>200</sup> U.S. GOV’T ACCOUNTABILITY OFFICE, GAO-11-254, SAFE DRINKING WATER ACT: EPA SHOULD IMPROVE IMPLEMENTATION OF REQUIREMENTS ON WHETHER TO REGULATE ADDITIONAL CONTAMINANTS 5 n.8 (2011). Once established, federal drinking water regulations generally apply to the approximately 153,500 public water systems that provide drinking water to at least 15 service connections or that regularly serve at least 25 people. *Id.* at 8.

<sup>201</sup> *See id.* at 1 (“While 89 contaminants have been regulated pursuant to the act, the number of potential drinking water contaminants is vast.”).

<sup>202</sup> *Id.*

<sup>203</sup> *Id.* at 2.

<sup>204</sup> *Id.* at 1–2.

<sup>205</sup> *Id.* at 2.

<sup>206</sup> Colborn et al., *supra* note 2, at 1039, 1043, 1045, 1049 (identifying 40 chemicals in pit solids drawn from six evaporation pits in New Mexico, 98% of which were listed on CERCLA’s (Superfund) list and 73% of which were listed on the EPCRA list of reportable toxic chemicals;

regulated chemicals reveals that many of these toxic chemicals are not regulated under the SWDA and could escape detection if released into public drinking water systems.<sup>207</sup> Some of the unregulated chemicals include known mutagens, carcinogens, and endocrine-disrupting chemicals.<sup>208</sup>

The endocrine-disrupting chemicals may be particularly problematic. Endocrine-disrupting chemicals are known to cause adverse effects at minute levels of exposure, in the parts per billion or less, and can have unpredictable, delayed, lifelong effects on individuals as well as their offspring.<sup>209</sup> In addition to male and female reproduction, chemicals that interfere with endocrine function have been found to affect neuroendocrinology, thyroid function, metabolism and obesity, breast development, breast cancer, prostate cancer, and cardiovascular endocrinology.<sup>210</sup> As explained by Professor Deborah A. Cory-Slechta, who has studied atrazine's effects on the brain and serves on a science advisory board for EPA, EPA tests chemicals in a way that can vastly underestimate risks: "There are short, critical times—like when a fetus's brain is developing—when chemicals can have disastrous impacts, even in very small concentrations."<sup>211</sup> Linda S. Birnbaum, director of the National Institute of Environmental Health Sciences, explained: "We don't really know what these chemicals do to fetuses or prepubescent children."<sup>212</sup>

As the science continues to advance, new chemicals may be identified for regulation, standards may change, and the industry may be held responsible if it fails to keep pace with the evolving science. The class action lawsuit brought by Midwestern water treatment providers against the makers of the herbicide atrazine that settled in 2012 for \$105 million involved levels of atrazine in raw water and public drinking water that reportedly met federal standards,<sup>213</sup> but were recorded in excess of

---

and identifying 944 products used in gas industry operations, 353 of which could be associated with CAS numbers. Of these chemicals, the study identified 46 chemicals found in the highest number of products).

<sup>207</sup> Compare *id.* at 1052–53 (discussing water soluble chemicals used in drilling and fracking fluids identified by Colborn and TDEX), with EPA, NATIONAL PRIMARY DRINKING WATER REGULATIONS (2009), available at <http://water.epa.gov/drink/contaminants/upload/mcl-2.pdf> (listing chemicals regulated under the SDWA).

<sup>208</sup> See ENDOCRINE DISRUPTION EXCHANGE, HEALTH EFFECTS SPREADSHEET, available at [endocrinedisruption.org/assets/media/documents/MultistateSpreadsheet3-29-11States.xls](http://endocrinedisruption.org/assets/media/documents/MultistateSpreadsheet3-29-11States.xls) (providing detailed health impacts from 650 chemicals used during natural gas operations). See also ENDOCRINE DISRUPTION EXCHANGE, HEALTH EFFECTS SUMMARY STATEMENT 2, 6 (2011), available at <http://endocrinedisruption.org/assets/media/documents/Multistatesummary1-27-11Final.pdf> (summarizing results of Health Effects Spreadsheet). Some of the unregulated chemicals include acetic acid, butanol, ethoxylated nonylphenol, ethanol (acetylenic alcohol), glutaraldehyde, tetramethylammonium chloride, and ethoxylated nonylphenol. *Id.*

<sup>209</sup> Colborn et al., *supra* note 2, at 1049.

<sup>210</sup> Diamanti-Kandarakis et al., *supra* note 3, at 293.

<sup>211</sup> Duhigg, *supra* note 93.

<sup>212</sup> *Id.*

<sup>213</sup> Karjelis, *supra* note 94.

California's standards (which are 50% lower than the federal level).<sup>214</sup> New research suggests that, even at concentrations meeting current federal standards, atrazine may be associated with birth defects, low birth weights, menstrual problems, and that brief doses of exposure before birth may lead to a vulnerability to cancer later in life.<sup>215</sup>

#### V. THE COMMON LAW AND THE DIFFICULT BURDEN OF PROOF

Multiple lawsuits are underway involving alleged contamination of water wells stemming from gas industry operations.<sup>216</sup> Nationwide, there have been at least thirty-six cases, and, in Texas, there have been at least seven, most concerning the Barnett Shale.<sup>217</sup> Chesapeake Energy reportedly agreed to pay \$1.6 million to settle allegations that its fracking activities contaminated water wells in Bradford County, Pennsylvania.<sup>218</sup> Cabot Oil and Gas Corp. reportedly paid \$4.1 million to settle claims by residents of Dimock, Pennsylvania that methane gas found in drinking water resulted from fracking.<sup>219</sup>

Plaintiffs face a difficult burden of proof in these cases. A 2010 Securities and Exchange Commission filing by Cabot Oil & Gas Corp. acknowledged that new disclosure requirements "could make it easier for third parties to initiate litigation . . . in the event of perceived problems with drinking water wells in the vicinity of an oil or gas well or other alleged environmental problems."<sup>220</sup> However, as discussed above, exceptions for

---

<sup>214</sup> Env'tl. Working Group, *The Most Polluted Communities in Iowa*, <http://www.ewg.org/tap-water/whatsinyourwater/2050/IA/Iowa/Atrazine/> (last visited Feb. 22, 2014) (comparing the California Atrazine standard of 0.15 ppb, to the EPA standard of 0.3 ppb).

<sup>215</sup> Duhigg, *supra* note 93.

<sup>216</sup> Holly A. Vandrovec, *The Fight over Fracking: Recent Hydraulic Fracturing Litigation in Texas*, TEX. BAR J., May 2011, at 390, 392; SHARON WILSON ET AL., TEX. OIL & GAS ACCOUNTABILITY PROJECT, NATURAL GAS FLOWBACK: HOW THE TEXAS NATURAL GAS BOOM AFFECTS HEALTH AND SAFETY 8-9 (2011), available at [http://www.shalegas.energy.gov/resources/060211\\_earthworks\\_natural\\_gas\\_flowback.pdf](http://www.shalegas.energy.gov/resources/060211_earthworks_natural_gas_flowback.pdf).

<sup>217</sup> Amy Mall, *Incidents Where Hydraulic Fracturing is a Suspected Cause of Drinking Water Contamination*, [http://switchboard.nrdc.org/blogs/amall/incidents\\_where\\_hydraulic\\_frac.html](http://switchboard.nrdc.org/blogs/amall/incidents_where_hydraulic_frac.html) (last visited Feb. 22, 2014).

<sup>218</sup> Michael Case, *Fracking Know-How: Risks and Risk Allocation in High-volume Hydraulic Fracture for Shale Gas*, CLAIMS MGMT., Jan. 21, 2013, <http://claims-management.theclm.org/home/article/Risks-and-risk-allocation-in-high-volume-hydraulic-fracturing-for-shale-gas> (last visited Feb. 22, 2014).

<sup>219</sup> *Id.*

<sup>220</sup> CABOT OIL & GAS CORP., ANNUAL REPORT 22 (2010) (acknowledging the variety of hazards and risks facing the industry, including: "well site blowouts, cratering and explosions; equipment failures; uncontrolled flows of natural gas, oil or well fluids; fires; formations with abnormal pressures; pollution and other environmental risks; and natural disasters," and noting: "[a]ny of these events could result in injury or loss of human life, loss of hydrocarbons, significant damage to or destruction of property, environmental pollution, regulatory investigations and penalties, impairment of our operations and substantial losses to us").

trade secrets continue to compromise disclosure.<sup>221</sup> Moreover, proving causation in complex toxic tort bodily injury cases is inherently difficult.<sup>222</sup> Relying on the common law to hold industry accountable is dependent on the ability to identify chemicals associated with gas industry operations, track chemicals to their source, acquire data on chemical releases, information on the health effects and dose-response relationships of chemicals and mixtures of chemicals, and the ability to carry the burden of proof under standards of care that incorporate foreseeability. Even where chemicals can be tracked back to gas industry operations, proving that exposure caused health effects can be extremely difficult.<sup>223</sup> Not only may monitoring and exposure data be limited, but there is also limited information available on the relationship between toxic exposure and public health.<sup>224</sup>

One recent case, *Strudley v. Antero Resources Corp.*,<sup>225</sup> was dismissed for failure to comply with a Modified Case Management Order that required, prior to discovery, a prima facie showing of exposure, including sworn expert affidavits: establishing the identity of the hazardous substances; whether these substances could cause the type of diseases and illnesses claimed; the dose or quantitative measurement of the concentration, timing, and duration of alleged exposure; the precise location of any exposure; an identifiable, medically recognizable diagnosis of the specific disease or illness from which each plaintiff allegedly suffers or for which medical monitoring is purportedly necessary; and a conclusion that each such disease or illness was caused by the alleged exposure.<sup>226</sup> The plaintiffs' expert did not have complete water and air sampling data,<sup>227</sup> and was able to conclude only that further discovery was warranted.<sup>228</sup> Although the court found that the evidence showed the existence of "gases and compounds" in both the air and the water, it concluded that there was inadequate data and expert analysis of a causal connection between the plaintiff's injuries and their exposure to drilling activities.<sup>229</sup>

If plaintiffs manage to identify chemical exposure, track its source, and prove damages, defendants may still argue that their actions were not

---

<sup>221</sup> See *supra* Part III (discussing what constitutes a claim secret, various challenges to trade secret claims, and effectiveness of the trade secret scheme).

<sup>222</sup> ZYGMUNT J.B. PLATER ET AL., ENVIRONMENTAL LAW AND POLICY, NATURE, LAW AND SOCIETY 168–170 (4th ed. 2010).

<sup>223</sup> Charles Schmidt, *Blind Rush? Shale Gas Boom Proceeds Amid Human Health Questions*, ENVTL. HEALTH PERSP., Aug. 2011, at A351–52, available at <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3237379/>.

<sup>224</sup> *Id.* at A351. See also EPA, REPORT NO. 10-P-0154, KEY ACTIVITIES IN EPA'S INTEGRATED URBAN AIR TOXICS STRATEGY REMAIN UNIMPLEMENTED 34 (2010), available at <http://www.epa.gov/oig/reports/2010/20100623-10-P-0154.pdf>.

<sup>225</sup> Order Re Defendants' Motion to Dismiss or, in the Alternative, for Summary Judgment at 3, *Strudley v. Antero Res. Corp.*, No. 2011CV2218, 2012 WL 1932470 (D. Colo. May 9, 2012).

<sup>226</sup> *Id.* at 6–7.

<sup>227</sup> *Id.* at 5–6.

<sup>228</sup> *Id.* at 4.

<sup>229</sup> *Id.* at 6.

intentional, negligent, or even foreseeable. Common law claims typically include nuisance,<sup>230</sup> trespass, negligence, and sometimes strict liability.<sup>231</sup> Nuisance may be intentional or negligent.<sup>232</sup> Trespass is also usually regarded as an intentional tort that involves intent to commit an act that violates a property right, or would be practically certain to have that effect.<sup>233</sup> A person can be liable for negligence if he causes harm to another by failing to exercise the care of a reasonable person.<sup>234</sup> If the risk is unknown to the “reasonable person,” the defendant may try to hide behind the current state of knowledge. Where the tort is “intentional,” the defendant will only be charged with responsibility for the “substantially certain” consequences of any actions that the defendant intended to take.<sup>235</sup> Although claims involving surface water spills may be easier, defendants may argue that hydraulic fracturing is not proven to cause drinking water contamination.<sup>236</sup> Uncertainty about chemical toxicity may also negate liability. Strict liability may be more promising,<sup>237</sup> but may still be complicated by foreseeability, as strict liability is limited to the kind of harm, the risk of which makes the activity abnormally dangerous.<sup>238</sup> Industry may argue that water well

---

<sup>230</sup> Texas courts have defined a nuisance as “a condition which substantially interferes with the use and enjoyment of land by causing unreasonable discomfort or annoyance to persons of ordinary sensibilities attempting to use and enjoy it.” *Watson v. Brazos Elec. Power Coop., Inc.*, 918 S.W.2d 639, 644 (Tex. App. 1996) (citing *Bible Baptist Church v. City of Cleburne*, 848 S.W.2d 826, 828 (Tex. App. 1993)).

<sup>231</sup> *Id.* (noting that three types of conduct that may be considered a nuisance are: “1) intentional invasion of another’s interests; 2) negligent invasion of another’s interests; or 3) other conduct, culpable because abnormal and out of place in its surroundings, that invades another’s interests.”).

<sup>232</sup> *Id.*

<sup>233</sup> *Malouf v. Dallas Athletic Country Club*, 837 S.W.2d 674, 676 (Tex. App. 1992).

<sup>234</sup> RESTATEMENT (SECOND) OF TORTS § 283 (1965).

<sup>235</sup> PLATER ET AL., *supra* note 222, at 71 (noting that the defendant will be held responsible even if the defendant did not desire the actions to result in harmful consequences).

<sup>236</sup> Jeffrey King et al., *Factual Causation: The Missing Link in Hydraulic Fracture–Groundwater Contamination Litigation*, 22 DUKE ENVTL. L. & POL’Y F. 341, 341–42, 345 (2011) (positing that hydraulic fracturing does not contaminate groundwater and hence, private landowner lawsuits against drilling companies have been largely unsuccessful.).

<sup>237</sup> Texas does not follow the English rule of strict liability in cases of unintentional torts involving pollution. *Atlas. Chem. Indus. v. Anderson*, 514 S.W. 2d 309, 312 (Tex. Civ. App. 1974), *aff’d*, 524 S.W. 2d 681 (1975) (citing *Turner v. Big Lake Oil Company*, 128 Tex. 155, 96 S.W. 2d 221 (1936)). *See also* *Doddy v. Oxy USA, Inc.*, 101 F.3d 448, 462 (5th Cir. 1996) (citing *Galveston, H. & S.A. Ry. Co. v. Currie*, 96 S.W. 1073, 1077 (Tex. 1906)) (“while [s]ome of the older cases in England seem to assert the absolute liability of an insurer, . . . it is settled in this state that the question is one of negligence’.”). *Cf. Kelly v. McKay*, 233 S.W.2d 121, 122 (Tex. 1950) (applying negligence principles in the context of the use of explosives); *Elliff v. Texon Drilling Co.*, 210 S.W.2d 558, 563 (Tex. 1948) (applying negligence principles to the production of oil and gas). However, in the case of an intentional tort, strict liability may apply. *Atlas. Chem. Indus.*, 514 S.W. 2d 309, 313 (Tex. Civ. App. 1974), *aff’d* 524 S.W. 2d 681 (1975) (“In common law actions for damages resulting from the intentional discharge of pollutants, the doctrine of strict liability, as in the classic law of nuisance and trespass, shall apply.”).

<sup>238</sup> RESTATEMENT (SECOND) OF TORTS § 519 (1977).

contamination from hydraulic fracturing activity was not foreseeable at the time of the claim.

Statutory and regulatory standards could serve to establish negligence per se, a concept in which a legislatively imposed standard is adopted by the civil courts as defining the conduct of a reasonable and prudent person.<sup>239</sup> An administrative rule or regulation can also be used to create the standard for negligence where the purpose of the rule is to afford protection to the class of person to which the injured party belongs from the hazard involved in a particular case.<sup>240</sup> Even where claims are viable, however, relying on the common law's uncertain ad hoc retroactive approach is clearly inferior to a strong regulatory plan that aims to both avoid potential problems and hold industry accountable. Potential common law claims may be outweighed by the expense and uncertainty of litigation.<sup>241</sup> Moreover, settlement agreements requiring confidentiality may remove important information from the public domain.<sup>242</sup>

#### VI. LEAKS, SPILLS, AND ILLEGAL DUMPING: STATUTORY AND REGULATORY CONTROL AT THE FEDERAL LEVEL

Gas industry exemptions from major environmental laws governing waste tracking, reporting, and permitting increase the difficulty of ensuring that wastes are properly managed and disposed. Following intense lobbying from the oil and gas industry,<sup>243</sup> the federal government exempted wastes from oil and gas exploration and production from the Resource Conservation and Recovery Act (RCRA).<sup>244</sup> The RCRA exemption removes

---

<sup>239</sup> *Carter v. William Sommersville & Son, Inc.*, 584 S.W.2d 274, 278 (Tex. 1979).

<sup>240</sup> *Conf'l Oil Co. v. Simpson*, 604 S.W.2d 530, 534 (Tex. Ct. App. 1980).

<sup>241</sup> Andrew Mcfee Thompson, *Free Market Environmentalism and the Common Law: Confusion, Nostalgia, and Inconsistency*, 45 EMORY L.J. 1329, 1358, 1359, 1363 (1996) (criticizing exclusive reliance on common law liability for environmental protection because of the "large transaction costs that can overwhelm common law actions seeking redress for environmental harms," the fact that "common law is not prospective in nature, and thus is unable to prevent environmental harms or anticipate future problems," and institutional incompetency resulting in "crucial environmental policy decisions [being made] by relatively unaccountable judges via a haphazard process of case-by-case adjudication").

<sup>242</sup> *A Tainted Water Well*, *supra* note 24, at A13. See also Paula Reed Ward, *Personal Account from the Marcellus Shale: Stephanie Hallowich*, PITTSBURG POST-GAZETTE, Mar. 20, 2013, <http://www.marcellus-shale.us/Stephanie-Hallowich.htm> (last visited Feb. 22, 2014) (attempting to unseal the settlement).

<sup>243</sup> James R. Cox, *Revisiting RCRA's Oilfield Waste Exemption as to Certain Hazardous Oilfield Exploration and Production Wastes*, 14 VILL. ENVTL. L.J. 1, 3 (2003).

<sup>244</sup> 42 U.S.C. § 6921(b)(2)(A) (2006). See also Clarification of the Regulatory Determination for Wastes from the Exploration, Development and Production of Crude Oil, Natural Gas and Geothermal Energy, 58 Fed. Reg. 15,284, 15,284 (Mar. 22, 1993) (noting that the exception was initially temporary, set by Congress in 1980, and was followed by an EPA study concluding regulation of oil and gas wastes under RCRA was not advisable). All waste that has been brought to the surface during oil and gas exploration and production operations and waste that has "otherwise been generated by contact with the oil and gas production stream during the removal of produced water or other contaminants from the product" is exempt from regulation

drilling and fracking waste from “a cradle to grave” hazardous waste regulatory system where hazardous wastes are tracked from their point of origin to their ultimate point of disposal in a licensed hazardous waste disposal facility.<sup>245</sup> RCRA “identifies treatment standards for hazardous wastes and specifies requirements for generators, transporters, and owners or operators of treatment, storage, and disposal facilities (TSDFs) that manage restricted wastes destined for land disposal.”<sup>246</sup> RCRA broadly imposes strict liability where the past or present handling, storage, treatment, transportation or disposal of any solid waste or hazardous waste may present an imminent and substantial endangerment to health or the environment.<sup>247</sup>

Tracking the industry’s use and disposal of toxic chemicals is also complicated by exemptions from the Emergency Planning and Community Right-to-Know Act’s (EPCRA) reporting requirements that apply to other industries that use toxic chemicals in excess of certain quantities.<sup>248</sup> Where applicable, these requirements include reporting on the presence and amount of toxic chemicals at the facility, the waste treatment and disposal methods, an estimate of the efficacy of those methods, and the quantity of the toxic chemical entering the environment.<sup>249</sup> The EPCRA also requires reporting of toxic releases, but only where the release exceeds reporting thresholds,<sup>250</sup> which may not be obvious where wastes are mixed and diluted.

Gas industry operations are also exempt from federal storm water permitting requirements. Under the CWA, storm water discharges from “all field activities or operations associated with exploration, production, processing, or treatment operations, or transmission facilities, including activities necessary to prepare a site for drilling and for the movement and

---

as a hazardous waste pursuant to RCRA. 58 Fed. Reg. at 15,285. *See also* Cox, *supra* note 243, at 7.

<sup>245</sup> *See* EPA, *Manifest Rule*, <http://yosemite.epa.gov/r10/OWCM.NSF/webpage/Manifest+Rule/> (last visited Feb. 22, 2014).

<sup>246</sup> *See* EPA, EPA 530-R-1-007, LAND DISPOSAL RESTRICTIONS: SUMMARY OF REQUIREMENTS 1–2, 2–6, 7–6 (2011) [hereinafter LAND DISPOSAL RESTRICTIONS], *available at* <http://www.epa.gov/osw/hazard/tsd/ldr/ldr-sum.pdf> (noting that wastes that do not meet treatment standards cannot be land disposed unless EPA grants a variance, extension, exclusion, or the waste is managed in a “no-migration unit”). *See generally* 40 C.F.R. pt. 268 (2012) (explaining the procedures and purposes for land disposal restrictions).

<sup>247</sup> *United States v. Ne. Pharm. & Chem. Co.*, 810 F.2d 726, 738, 741 (8th Cir. 1986). *See also* Brenner Fissell et al., *Environmental Crimes*, 49 AM. CRIM. L. REV. 611, 686 (2012) (describing the minimal knowledge requirements in RCRA as imposing near strict liability on corporate officers).

<sup>248</sup> Emergency Planning and Community Right-to-Know Act of 1986, 42 U.S.C. § 11002(b)(1)(A) (2006); 40 C.F.R. § 372.23 (2012) (excluding Standard Industrial Classification Major Group 13). *See also* EPA, *Is My Facility’s Six-Digit NAICS Code a TRI-Covered Industry?*, <http://www2.epa.gov/toxics-release-inventory-tri-program/my-facilitys-six-digit-naics-code-tri-covered-industry> (last visited Feb. 22, 2014) (not listing oil and gas industry as an industry subject to TRI reporting).

<sup>249</sup> 42 U.S.C. § 11023(g)(1)(C) (2006).

<sup>250</sup> *Id.* § 11004(2) (2006) (requiring reporting of release of “extremely hazardous substance” listed in section 103(a) of CERCLA).

placement of drilling equipment” are exempt from permitting requirements, except in very limited circumstances.<sup>251</sup> EPA interprets this exemption to extend to the “construction of drilling sites, waste management pits, and access roads, as well as construction of the transportation and treatment infrastructure such as pipelines, natural gas treatment plants, natural gas pipeline compressor stations, and crude oil pumping stations.”<sup>252</sup> Gas industry operations are thus exempt from general permit requirements for installing stormwater controls to meet technology-based and water quality-based effluent limits, inspection and effluent monitoring requirements, stormwater pollution prevention plans, and annual reporting of inspection findings and the results of corrective actions.<sup>253</sup>

The storm water regulatory exclusion does not apply to construction activities that result in a discharge of a reportable quantity release or that contribute pollutants (other than non contaminated sediments) to a violation of a water quality standard.<sup>254</sup> Without a comprehensive permitting program, however, monitoring and effective enforcement is more difficult and may depend on the government or a third party to monitor water quality in the receiving waters for a broad spectrum of pollutants that could wash down from gas industry sites, and to track the pollution back to the source.

Disposal of flowback water by underground injection, the primary method of disposal on the Barnett Shale,<sup>255</sup> is regulated pursuant to the Safe Drinking Water Act’s Underground Injection Control Program.<sup>256</sup> However, underground injection of fluids or propping agent (other than diesel fuels) during hydraulic fracturing is exempt from the definition of “underground injection” and regulation pursuant to this SDWA program.<sup>257</sup> EPA may regulate fracturing with diesel fuel, but it has not developed a regulatory program.<sup>258</sup> In response to a recent Congressional investigation, twelve companies reported the use of 32.2 million gallons of diesel fuel, or fluids containing diesel fuel, in their fracturing process from 2005 to 2009 across

---

<sup>251</sup> 33 U.S.C. § 1362(24) (2006); 40 C.F.R. § 122.26(a)(2)(ii). *See also* EPA, FINAL RULE: AMENDMENTS TO THE STORM WATER REGULATIONS FOR DISCHARGES ASSOCIATED WITH OIL AND GAS CONSTRUCTION ACTIVITIES 1, [hereinafter EPA STORM WATER FINAL RULE] *available at* [http://www.epa.gov/npdes/regulations/final\\_oil\\_gas\\_factsheet.pdf](http://www.epa.gov/npdes/regulations/final_oil_gas_factsheet.pdf).

<sup>252</sup> *Id.* at 2.

<sup>253</sup> EPA, FINAL NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) MULTI-SECTOR GENERAL PERMIT (MSGP) FOR STORMWATER DISCHARGES ASSOCIATED WITH INDUSTRIAL SOURCES (2008), *available at* [http://www.epa.gov/npdes/pubs/msgp2008\\_generalifs.pdf](http://www.epa.gov/npdes/pubs/msgp2008_generalifs.pdf).

<sup>254</sup> EPA STORM WATER FINAL RULE, *supra* note 251, at 2.

<sup>255</sup> R.R. Comm’n of Tex., *Hydraulic Fracturing Frequently Asked Questions*, <http://www.rrc.state.tx.us/about/faqs/hydraulicfracturing.php#frac5> (last visited Feb. 22, 2014).

<sup>256</sup> EPA, *Natural Gas Extraction Hydraulic Fracturing*, <http://www2.epa.gov/hydraulicfracturing#uic> (last visited Feb. 22, 2014).

<sup>257</sup> Safe Drinking Water Act of 1974, 42 U.S.C. § 300h(d)(1)(B)(ii) (2006).

<sup>258</sup> *See id.*; Emily A. Collins, *Permitting Shale Gas Development*, 29 J. LAND USE & ENVTL. L. (forthcoming 2014), *available at* <http://ssrn.com/abstract=2321134> (discussing how “states have been left to their own devices in addressing any potential underground migration of fluids and gas as a result of hydraulic fracturing activities” given the absence of federal regulation).

nineteen states, with approximately half used in Texas.<sup>259</sup> None sought permits.<sup>260</sup> In their defense, the companies noted that the EPA had never properly developed rules and procedures to regulate the use of diesel in fracking, despite the clear grant of authority from Congress.<sup>261</sup> In May 2012, EPA published draft guidelines.<sup>262</sup>

Although EPA also retains authority under the SDWA to order remediation where a contaminant “may present an imminent and substantial endangerment,”<sup>263</sup> there are legal questions concerning EPA’s burden of proof that may prove problematic in the context of hydraulic fracturing where it is difficult to track the source of contamination. In the case against Range Resources, discussed in the introductory section,<sup>264</sup> EPA attempted to order Range to conduct surveying and sampling, and to submit remediation plans without shouldering the burden of proof that Range caused the contamination of nearby water wells.<sup>265</sup> According to EPA, there is no requirement that it prove that a respondent caused or contributed to the endangerment as a prerequisite to issuing an Emergency Order.<sup>266</sup> EPA has taken the position that its claim may be complete without any assertion of violation of a statutory or regulatory provision or ongoing harm to a particular individual.<sup>267</sup> In its Motion to Dismiss in *United States v. Range Production Company*, however, Range argued that an order should not be considered final and ripe for enforcement in the absence of pleading and

---

<sup>259</sup> Letter from Henry A. Waxman et al., to Lisa Jackson, Adm’r, EPA (Jan. 31, 2011), available at <http://democrats.energycommerce.house.gov/index.php?q=news/waxman-markey-and-degette-investigation-finds-continued-use-of-diesel-in-hydraulic-fracturing-f>. See also Tom Zeller, Jr., *A Gas Drilling Technique is Labeled a Violation*, N.Y. TIMES, Feb. 1, 2011, at B1.

<sup>260</sup> Zeller, *supra* note 259, at B1.

<sup>261</sup> *Id.* at B7.

<sup>262</sup> EPA, PERMITTING GUIDANCE FOR OIL AND GAS HYDRAULIC FRACTURING ACTIVITIES USING DIESEL FUELS—DRAFT: UNDERGROUND INJECTION CONTROL PROGRAM GUIDANCE #84, at 1 (2012), available at <http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/upload/hfdie selfuelsguidance508.pdf>. See also Settlement Agreement at 2–3, Indep. Petroleum Assoc. of Am. v. EPA, No. 10-1233 (D.C. Cir. Feb. 23, 2012), available at [http://www.eenews.net/assets/2012/02/24/document\\_gw\\_01.pdf](http://www.eenews.net/assets/2012/02/24/document_gw_01.pdf) (containing EPA’s agreement to modify some statements in its initial guidance).

<sup>263</sup> Safe Drinking Water Act of 1974, 42 U.S.C. § 300i(a) (2006).

<sup>264</sup> See *supra* Part I.

<sup>265</sup> See EPA, *supra*, note 36, at 15 <http://www.epa.gov/region6/region-6/tx/tx005.html> (last visited Feb. 22, 2014) (noting that EPA “ordered Range: (i) to notify EPA whether it intended to comply, (ii) to provide potable water to two residences, (iii) to install explosivity meters in two residences, (iv) to conduct a survey and limited sampling of water supply wells in the area, (v) to submit plans for additional soil gas surveys and indoor air concentration analyses of two residences, and (vi) to submit plans to identify gas flow pathways, plans to eliminate gas flow if possible, and plans to remediate impacted areas.”). See also Emergency Order from EPA, *supra*, note 41; United States’ Memorandum in Opposition to Defendants’ Motion to Dismiss, *supra*, note 36, at 3.

<sup>266</sup> United States’ Memorandum in Opposition to Defendants’ Motion to Dismiss, *supra* note 36, at 6 (arguing that Congress did not include such a requirement, except in those situations in which an order requires the provision of alternative water supplies).

<sup>267</sup> *Id.* at 8 (citing *United States v. Hooker Chems. & Plastics Corp.*, 749 F.2d 968, 988 (2d Cir. 1984)).

proof of an actual statutory violation or essential elements of some other theory of liability, including a causal connection.<sup>268</sup>

EPA ultimately dropped the case against Range after an unfavorable Supreme Court decision in *Sackett v. EPA*. *Sackett* also involved a procedural challenge to an EPA compliance order, albeit in a different context and issued under a different federal statute.<sup>269</sup> The *Range* case was embroiled in significant factual and political controversy,<sup>270</sup> and EPA made no statement as to whether the Supreme Court decision influenced its actions in the *Range* case.<sup>271</sup> In *Sackett*, the question was whether landowners could seek pre-enforcement judicial review of an administrative compliance order pursuant to the Administrative Procedure Act.<sup>272</sup> EPA had taken the position that the CWA precluded pre-enforcement judicial review.<sup>273</sup> While faced with confusing precedent as to whether the activity at issue was governed by the CWA,<sup>274</sup> the Court reasoned that landowners would be left without recourse unless and until EPA initiated an enforcement action.<sup>275</sup> Meanwhile, they would risk penalties accruing at a rate of up to \$75,000 a day in potential liability for any failure to comply with an enforcement order.<sup>276</sup>

In *Range*, by contrast, there was no question that the company could (and did) seek judicial review in the court of appeals.<sup>277</sup> Immediate federal judicial review was available by filing a petition under the arbitrary and capricious standard for review in the circuit court pursuant to a section of the SDWA specifically providing for review of “any other final action of the Administrator under this chapter.”<sup>278</sup> Given the “highly deferential” standard of review under the arbitrary and capricious standard, however, EPA argued that it need only plead “a rational nexus” between the company’s conduct

---

<sup>268</sup> Defendants’ Motion to Dismiss for Lack of Subject Matter Jurisdiction or, in the Alternative, for Failure to State a Claim at 16, *United States v. Range Prods. Co. & Range Res. Co.*, 793 F. Supp. 2d 814 (N.D. Tex. 2011) (No. 3:11-CV-00116-F).

<sup>269</sup> *Sackett v. EPA*, 132 S. Ct. 1367, 1374 (2012) (concluding that a civil action may be brought under the Administrative Procedure Act to challenge, on a jurisdictional basis, an EPA administrative compliance order under § 309 of the Clean Water Act, 33 U.S.C. § 1319).

<sup>270</sup> See *supra* note 42 and accompanying text.

<sup>271</sup> Ramit Plushnick-Masti, *EPA’s Water Contamination Investigation Halted In Texas After Range Resources Protest*, HUFFINGTON POST, Jan. 16, 2013, [http://www.huffingtonpost.com/2013/01/16/epa-water-contamination-investigation-fracking\\_n\\_2484568.html](http://www.huffingtonpost.com/2013/01/16/epa-water-contamination-investigation-fracking_n_2484568.html) (last visited Feb. 22, 2014).

<sup>272</sup> *Sackett*, 132 S. Ct. at 1369, 1371; Administrative Procedure Act, 5 U.S.C. §§ 551–559, 701–706, 1305, 3105, 3344, 4301, 5335, 5372, 7521 (2006).

<sup>273</sup> *Sackett*, 132 S. Ct. at 1373.

<sup>274</sup> *Id.* at 1370.

<sup>275</sup> *Id.* at 1372.

<sup>276</sup> *Id.*

<sup>277</sup> United States’ Memorandum in Opposition to Defendants’ Motion to Dismiss, *supra* note 36, at 5.

<sup>278</sup> *Id.* at 8 (citing 42 U.S.C. § 300j-7(a)(2) (2006); *Trinity Am. Corp. v. EPA*, 150 F.3d 389, 394 (4th Cir. 1998)).

and the potential endangerment in this case,<sup>279</sup> not actual causation as urged by Range.

*Range* may also be distinguished in that the company would only be subject to civil penalties for noncompliance if the district court (following an enforcement action brought by EPA) determined in its discretion that penalties were appropriate.<sup>280</sup> Moreover, *Range* involved emergency powers where a predeprivation hearing may not be required.<sup>281</sup> Nevertheless, until the procedural question challenges in the *Range* case are resolved, EPA may hesitate to rely on its emergency powers to require industry to shoulder the burden of proof or even assist in tracking the toxic chemicals released into the environment.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) strict liability standards could eventually apply to properties contaminated with gas industry wastes, but these standards are only invoked once contamination has been discovered, potentially liable parties identified, and cleanup operations undertaken.<sup>282</sup> CERCLA extends strict liability for cleanup following releases of hazardous waste to broadly defined categories of potentially responsible parties.<sup>283</sup> It also authorizes response actions, provides guidelines and procedures, and requires reporting of spills of listed chemicals over regulatory thresholds.<sup>284</sup> In defining the term “hazardous substance,” CERCLA incorporates lists of substances from other environmental statutes.<sup>285</sup> Although it expressly excludes “petroleum, including crude oil,”<sup>286</sup> it does not exempt added hazardous substances that

---

<sup>279</sup> United States’ Memorandum in Opposition to Defendants’ Motion to Dismiss, *supra* note 36, at 23.

<sup>280</sup> *Id.* at 22 (citing 42 U.S.C. § 300i(b) (2002) (“[M]ay . . . be subject to a civil penalty. . .”).

<sup>281</sup> *Id.* at 14.

<sup>282</sup> See Sean H. Joyner, Note, *Superfund to the Rescue? Seeking Potential CERCLA Response Authority and Cost Recovery Liability for Releases of Hazardous Substances Resulting from Hydraulic Fracturing*, 28 J. CONTEMP. HEALTH L. & POL’Y 111, 140–143 (2011) (discussing EPA’s authority to perform CERCLA response actions in the realm of hydraulic fracturing).

<sup>283</sup> Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) § 107(a), 42 U.S.C. § 9607(a) (2006); *Burlington N. & Santa Fe Ry. Co. v. United States*, 556 U.S. 599, 608–09, 614 (2009) (an exception to joint and several liability exists if a CERCLA defendant proves “that a reasonable basis for apportionment exists”); *NutraSweet Co. v. X-L Eng’g Co.*, 227 F.3d 776, 783–784 (7th Cir. 2000) (noting that “[u]nder § 107(a) of CERCLA, . . . an owner of land is strictly liable for hazardous wastes that are contaminating his property, . . . [b]ut under § 113(f) of CERCLA, . . . the landowner may seek contribution from another person who is liable or potentially liable under § 107”) (internal citations omitted); *United States v. Monsanto Co.*, 858 F.2d 160, 167 (4th Cir. 1988).

<sup>284</sup> CERCLA § 102(a), 42 U.S.C. §§ 9602(a), 9603(a) (2006) (requiring notification of releases of “hazardous substance . . . in quantities equal to or greater than those determined pursuant to” § 102 of CERCLA); 40 C.F.R. § 302.4 (2010) (listing hazardous substances and reportable quantities). See generally EPA, *Superfund: Reportable Quantities*, <http://www.epa.gov/superfund/policy/release/rq/> (last visited Feb. 22, 2014) (providing a basic overview of CERCLA).

<sup>285</sup> *Narragansett Elec. Co. v. EPA*, 407 F.3d 1, 2 (1st Cir. 2005).

<sup>286</sup> CERCLA § 101(14), 42 U.S.C. § 9601(14) (2003).

may be present in drilling and fracking waste.<sup>287</sup> EPA relied on its authority under CERCLA to investigate allegations of contamination from hydraulic fracturing operations in the Pavillion, Wyoming area.<sup>288</sup>

Given the difficulty of tracking chemicals once released into the environment—further complicated by trade secret claims and especially difficult if EPA does not even have authority to order the industry to undertake tracking and monitoring studies without first proving causation—there is a significant regulatory gap left for state and local governments. Ideally, the State would shoulder this burden, but, as discussed below, the current rules and regulatory climate at Texas Railroad Commission are not well matched to this very difficult undertaking.

#### VII. ALTERNATE STATE REGULATION: VAGUE REGULATORY STANDARDS AND A CLIMATE OF RELAXED REGULATORY ENFORCEMENT

The Texas RRC, not the TCEQ, the State's primary environmental regulatory agency, has jurisdiction over wastes, spills, and discharges (both hazardous and nonhazardous) resulting from activities associated with the exploration, development, or production of gas (prior to its use in any manufacturing process or as a fuel), including storage, handling, reclamation, gathering, transportation, or distribution of natural gas by pipeline.<sup>289</sup> Although water quality standards are established by the TCEQ, the RRC has responsibility for enforcing any violation of those standards.<sup>290</sup> Discharges regulated by the RRC are not required to comply with regulations of the TCEQ that are not water quality standards (i.e. technology based standards),<sup>291</sup> and activities associated with the exploration, development, or production of oil and gas are specifically exempted from compliance with the TCEQ's regulatory permitting program for stormwater runoff from construction or industrial activities.<sup>292</sup>

In lieu of the RCRA regulatory program, the Texas RRC has created an alternate regulatory program to govern gas industry operations. The Texas RRC explains that the RCRA exemption is based on the unique nature of exempt oil and gas wastes that are said to be generated in large quantities,

---

<sup>287</sup> *United States v. Gurley*, 43 F.3d 1188, 1199 (8th Cir. 1994); *Cose v. Getty Oil Co.*, 4 F.3d 700, 704 (9th Cir. 1993); *S. Pac. Transp. Co. v. California*, 790 F. Supp. 983, 986 (C.D. Cal. 1991); *United States v. Alcan Aluminum Corp.*, 964 F.2d 252, 266 (3d Cir. 1992); *United States v. Amtreco, Inc.*, 846 F. Supp. 1578, 1584–85 (M.D. Ga. 1994).

<sup>288</sup> FOLGER ET AL., *supra* note 32, at 1–2.

<sup>289</sup> 16 TEX. ADMIN. CODE § 3.30 (2013) (Memorandum of Understanding between the Railroad Commission of Texas (RRC) and the Texas Commission on Environmental Quality (TCEQ))

<sup>290</sup> *Id.*

<sup>291</sup> *Id.*

<sup>292</sup> TCEQ, GENERAL PERMIT TO DISCHARGE UNDER THE TEXAS POLLUTANT ELIMINATION SYSTEM 15 (2013), available at [http://www.tceq.texas.gov/assets/public/permitting/stormwater/TXR150000\\_CGP.pdf](http://www.tceq.texas.gov/assets/public/permitting/stormwater/TXR150000_CGP.pdf); TCEQ, *Storm Water Discharges from Industrial Facilities: Am I Regulated?*, [http://www.tceq.texas.gov/permitting/stormwater/TXR05\\_AIR.html](http://www.tceq.texas.gov/permitting/stormwater/TXR05_AIR.html) (last visited Feb. 22, 2014) (redirecting questions to the Texas RRC or the EPA).

but are relatively low in toxicity.<sup>293</sup> Consistent with this rationale, as explained in detail below, the program is lax.<sup>294</sup> However, studies reveal that gas industry wastes include highly toxic chemicals, including chemicals listed as hazardous waste under RCRA.<sup>295</sup> Theo Colborn et al., identified forty toxic chemicals in pit solids drawn from six evaporation pits in New Mexico, including RCRA-listed hazardous wastes.<sup>296</sup> Isolating drilling wastes, Colborn identified twenty-two chemicals, including at least two listed as RCRA hazardous wastes<sup>297</sup> and one listed as a toxic waste under CERCLA<sup>298</sup> following an accidental blowout in Wyoming that contaminated 25,000 square feet of soil before any fracking had begun on the well.<sup>299</sup> During the blowout, residents suffered severe respiratory distress, nausea, and vomiting and had to be evacuated from their homes for several days.<sup>300</sup> Colborn explains that complaints of similar symptoms from residents near other gas operations suggests that the use of toxic chemicals during drilling is not unique.<sup>301</sup>

---

<sup>293</sup> R.R. COMM'N OF TEX., WASTE MINIMIZATION IN THE OIL FIELD 3-2 (2001), available at <http://www.rrc.state.tx.us/forms/publications/wasteminmanual/wastemin.pdf>.

<sup>294</sup> See *infra* Part VIII.

<sup>295</sup> Compare Colborn et al., *supra* note 2, at 1043, 1049; ENDOCRINE DISRUPTION EXCHANGE, POTENTIAL HEALTH EFFECTS OF RESIDUES IN SIX NEW MEXICO OIL AND GAS DRILLING RESERVE PITS BASED ON COMPOUNDS DETECTED IN AT LEAST ONE SAMPLE: LIST OF SUBSTANCES DETECTED 1-3 (2007), available at [http://endocrinedisruption.org/assets/media/documents/summary\\_of\\_pit\\_chemicals\\_revised\\_2-1-08.pdf](http://endocrinedisruption.org/assets/media/documents/summary_of_pit_chemicals_revised_2-1-08.pdf) (identifying chemicals listed as hazardous wastes), with 40 C.F.R. § 261.31 (2012) (listing hazardous wastes from nonspecific sources). See also R.R. COMM'N OF TEX., INTERIM GUIDANCE FOR STATEWIDE RULE 98: STANDARDS FOR MANAGEMENT OF HAZARDOUS OIL AND GAS WASTE 2-8 (2004) [hereinafter RRC INTERIM GUIDANCE], available at <http://www.rrc.state.tx.us/forms/publications/swr98/entiremanual.pdf> (providing examples of oil and gas wastes that might be found on EPA lists).

<sup>296</sup> Colborn et al., *supra* note 2, at 1043, 1049.

<sup>297</sup> *Id.* at 1043; ENDOCRINE DISRUPTION EXCHANGE, ANALYSIS OF PRODUCTS USED FOR DRILLING CROSBY 25-3 WELL 2-5 (2009), available at <http://endocrinedisruption.org/assets/media/documents/Crosby25-3wellsummary4-20-09Final.pdf>; EPA, EPA HAZARDOUS WASTE CODES FOR WASTE STREAMS COMMONLY GENERATED BY SMALL QUANTITY GENERATORS, available at <http://www.epa.gov/osw/hazard/generation/sqg/handbook/insert.pdf> (identifying isopropanol and kerosene); 40 C.F.R. § 261.31 (2012) (using different chemical descriptors).

<sup>298</sup> Colborn et al., *supra* note 2, at 1053 (identifying formic acid as a drilling waste); EPA, EPA 550-B-10-001, LIST OF LISTS: CONSOLIDATED LIST OF CHEMICALS SUBJECT TO THE EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW ACT (EPCRA), COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (CERCLA) AND SECTION 112(R) OF THE CLEAN AIR ACT 1, 3 (2011), available at <http://nepis.epa.gov/Exe/ZyNET.exe/P1007520.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2006+Thru+2010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A\zyfiles\Index%20Data\06thru10\Txt\00000017P1007520.txt&User=ANONYMOUS&Password=anonymous&SortMethod=hl-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=plf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL#> (identifying formic acid as a toxic solvent).

<sup>299</sup> Colborn et al., *supra* note 2, at 1043.

<sup>300</sup> *Id.* at 1053.

<sup>301</sup> *Id.*

As acknowledged by EPA, toxic chemicals, including listed hazardous wastes, are also used in solvents used to clean equipment or to flush pipelines at drilling sites.<sup>302</sup> Colborn identified methylene chloride,<sup>303</sup> a toxic solvent listed as a hazardous waste under RCRA,<sup>304</sup> at well pad sites and in air samples during weekly air quality monitoring near natural gas operations in rural western Colorado, including several readings in high concentrations.<sup>305</sup> Methylene chloride has the potential to leach into groundwater and has been the subject of soil and groundwater remediation action in other contexts.<sup>306</sup>

The idea that the toxicity of these wastes may be safely diluted is clearly at odds with the policy rationale driving the RCRA regulatory program.<sup>307</sup> RCRA seeks to ensure that wastes are properly treated and not simply diluted to mask the concentration of hazardous constituents.<sup>308</sup> Pursuant to the RCRA regulatory program, if any amount of a listed hazardous waste mixes with a nonhazardous solid waste (a broadly defined category of discarded materials),<sup>309</sup> the entire mixture is regulated as a listed hazardous waste.<sup>310</sup> A small vial of listed waste mixed with a large quantity of nonhazardous waste would cause the resulting mixture to bear the same waste code and regulatory status under RCRA as the original listed component.<sup>311</sup>

Congress passed RCRA in response to decades of inadequately controlled dumping that led to contamination of land, ground, and surface

---

<sup>302</sup> EPA, INTRODUCTION TO UIC PERMITTING 1-7, 1-8 (2002), available at <http://www.propublica.org/documents/item/435928-uic-epa-training-doc-good-dwauc-uicpermit.html>.

<sup>303</sup> Theo Colborn, et al., *An Exploratory Study of Air Quality Near Natural Gas Operations*, 20 HUM. & ECOLOGICAL RISK ASSESSMENT: AN INT'L J. (forthcoming 2014), available at <http://endocrinedisruption.org/chemicals-in-natural-gas-operations/air-pollution> (noting that the well pad included sixteen vertical (directional) gas wells that had been drilled, hydraulically fractured, and put into production during the course of the study).

<sup>304</sup> EPA, *Substance Details—Methylene Chloride*, [http://iaspub.epa.gov/sor\\_internet/registry/substreg/searchandretrieve/substancesearch/search.do](http://iaspub.epa.gov/sor_internet/registry/substreg/searchandretrieve/substancesearch/search.do) (last visited Feb. 22, 2014) (enter “Methylene Chloride” into the “Synonym” search box; then click on “Methane, dichloro-”).

<sup>305</sup> Colborn et al., *supra* note 303.

<sup>306</sup> See, e.g., N.Y. Dep't. of Env'tl. Conservation, *Public Notice: Availability of Voluntary Cleanup Project Workplan for Comment*, <http://www.dec.ny.gov/enb2002/20021106/not8.html> (last visited Feb. 22, 2014) (confirming the presence of methylene chloride contamination in subsurface soils and groundwater in the vicinity of a former tank at a pharmaceutical manufacturing plant in New York).

<sup>307</sup> LAND DISPOSAL RESTRICTIONS, *supra* note 246, at 1-3, 5-1.

<sup>308</sup> *Id.* at 1-3.

<sup>309</sup> 40 C.F.R. § 261.2 (2012) (defining discarded materials as any material which is abandoned, recycled, considered inherently waste-like, or a military munition as defined in § 266.202).

<sup>310</sup> LAND DISPOSAL RESTRICTIONS, *supra* note 246, at 1-3, 3-4 (regulating all mixtures as hazardous waste with the exception of ignitable, corrosive, or reactive wastes, which may be diluted in certain cases to remove the hazardous characteristic).

<sup>311</sup> EPA, EPA530-K-05-012, RCRA TRAINING MODULE: INTRODUCTION TO HAZARDOUS WASTE IDENTIFICATION 17 (2005), available at <http://www.epa.gov/wastes/inforesources/pubs/training/hwid05.pdf>.

waters.<sup>312</sup> Severely restricting land disposal is one of RCRA's most important strategies.<sup>313</sup> RCRA generally prohibits land disposal of untreated hazardous wastes.<sup>314</sup> RCRA-exempt wastes regulated by the Texas RRC<sup>315</sup> however are subject instead to the requirements of Statewide Rule 8<sup>316</sup> which allows for "landfarming" and "burial" without treatment and, in some cases without a permit, regardless of whether wastes include toxic chemicals that are listed as RCRA hazardous wastes.<sup>317</sup>

If drilling wastes are disposed of on the same lease where they are generated, and with permission of the surface owner, the Texas RRC does not even require a permit for land farming and burial of "low chloride drilling fluid," including: water base drilling fluids, drill cuttings, sands, and silts obtained while using water base drilling fluids, and wash water used for cleaning drill pipes.<sup>318</sup> Drilling fluids and other drilling wastes, including drill cuttings, sands, and silts, wash water, drill stem test fluids, and blowout preventer test fluids may also be stored in a pit without a permit.<sup>319</sup> Other pits allowed without a permit include reserve pits, mud circulation pits, pits for storage or disposal of spent completion fluids, workover fluids and drilling fluid, silt, debris, water, brine, oil scum, paraffin, or other materials cleaned out of the wellbore,<sup>320</sup> basic sediment pits, flare pits (for temporary storage of liquid hydrocarbons),<sup>321</sup> and water condensate pits (for storage or disposal of "fresh water" condensed from natural gas in conjunction with a gas pipeline drip or gas compressor station).<sup>322</sup> There is no requirement that these pits be lined,<sup>323</sup> and cleanup may include backfilling with dirt.<sup>324</sup>

<sup>312</sup> ROGER W. FINDLEY & DANIEL A. FARBER, CASES AND MATERIALS ON ENVIRONMENTAL LAW 469 (4th ed. 1995).

<sup>313</sup> LAND DISPOSAL RESTRICTIONS, *supra* note 246, at 1-3.

<sup>314</sup> *Id.*

<sup>315</sup> RRC INTERIM GUIDANCE, *supra* note 295, at 1-2.

<sup>316</sup> *Id.* at 2-2. See 16 TEX. ADMIN. CODE § 3.8(e)(4) (2013).

<sup>317</sup> See 16 TEX. ADMIN. CODE §§ 3.8(d)(3)(C)–(D) (2013); R.R. Comm'n of Tex., *Surface Waste Management Manual, Chapter V–Discharges and Land Disposal*, <http://www.rrc.state.tx.us/forms/publications/SurfaceWasteManagementManual/chapter5.php> (last visited Feb. 22, 2014). See also 16 TEX. ADMIN. CODE § 3.8(d)(1) (2013). See generally R.R. Comm'n of Tex., *Surface Waste Management Manual, Application Information for Landfarm Permit*, <http://www.rrc.state.tx.us/forms/publications/SurfaceWasteManagementManual/landspread.php> (last visited Feb. 22, 2014) [hereinafter *Application Information for Landfarm Permit*] (providing requirements for landfarm permit application).

<sup>318</sup> 16 TEX. ADMIN. CODE §§ 3.8(d)(3)(C)–(D) (2013) (requiring restrictions for chloride concentrations and that, before "burial," water base drilling fluid must have been "dewatered" if it is not in excess of 3,000 mg/liter of chloride).

<sup>319</sup> *Id.* § 3.8(d)(4)(A)(i)–(v).

<sup>320</sup> *Id.* § 3.8(d)(4)(A)–(B).

<sup>321</sup> *Id.* §§ 3.8(a)(8), (d)(4).

<sup>322</sup> *Id.* §§ 3.8(a)(16), (d)(4).

<sup>323</sup> See R.R. Comm'n of Tex. *Barnett Shale Information*, <http://www.rrc.state.tx.us/barnettshale/index.php> (last visited Feb. 22, 2014) ("Railroad Commission rules require an operator to take precautions to prevent pollution of surface and subsurface water, but do not include specific requirements for plastic liners in drilling pits and frac water pits. Many operators use liners in areas where the soil is permeable.").

<sup>324</sup> 16 TEX. ADMIN. CODE § 3.8(d)(4)(H)(i)–(iv) (2013).

Pits and landfarming may also be allowed by permit. The RRC may establish lining and other requirements during the permitting process; however, the rules do not include any clear criteria or engineering standards for pits.<sup>325</sup> The permit application for landfarming requires detailed plans,<sup>326</sup> but again, there are no clear regulatory standards or criteria.<sup>327</sup> Land farming is defined as the mixing and applying oil and gas wastes to the land, “in such a manner that the waste will not migrate off the landfarmed area.”<sup>328</sup> RRC Rule 3.8(b) further provides that “[n]o person conducting activities subject to regulation by the commission may cause or allow pollution of surface or subsurface water in the state.”<sup>329</sup> The permitting standard also includes general prohibitions.<sup>330</sup> A permit to dispose of oil and gas wastes by any method, including disposal into a pit, may be allowed if the commission determines “that the maintenance or use of such pit will not result in the waste of oil, gas, or geothermal resources or the pollution of surface or subsurface waters.”<sup>331</sup> However, there are no meaningful criteria defining the extent of contamination that would qualify as “pollution.”<sup>332</sup>

State standards for cleanup operations following leaks and spills are also lacking. The RRC has no mandatory regulatory standards for soil testing, review, or remediation prior to redevelopment.<sup>333</sup> The RRC rules allow the level of cleanup required for “hydrocarbon condensate spills,” defined as “[t]he light hydrocarbon liquids produced in association with natural gas,”<sup>334</sup> to be determined on a case by case basis.<sup>335</sup> The Commission has remarked: “[T]he lack of enumerated standards for condensate spills hamstring[s] field personnel and perpetuates unacceptable risk to the water and subsurface water of the state.”<sup>336</sup> In an effort to address this problem, Commission staff adopted a “field guide” to announce “bench marks and

---

<sup>325</sup> See *id.* § 3.8(d)(6)(A) (stating that conditions of use may include requirements concerning the design and construction of pits and disposal facilities, including requirements relating to pit construction materials, dike design, liner material, liner thickness, procedures for installing liners, schedules for inspecting or replacing liners, overflow warning devices, leak detection devices, and fences).

<sup>326</sup> See *Application Information for Landfarm Permit*, *supra* note 317.

<sup>327</sup> See 16 TEX. ADMIN. CODE § 3.8(d)(6)(A) (2013) (detailing the requirements that may be employed in the permitting process).

<sup>328</sup> *Id.* § 3.8(a)(25).

<sup>329</sup> *Id.* § 3.8(b).

<sup>330</sup> See *id.* § 3.8(d)(6)(A).

<sup>331</sup> *Id.*

<sup>332</sup> *Id.*

<sup>333</sup> The rules for “abandonment” establish cement-plugging standards to isolate and protect all formations bearing usable-quality water, oil, gas, or geothermal resources, but do not address surface soils. See *id.* CODE § 3.14(d)(1)–(2). See also R.R. Comm’n of Tex., *Voluntary Cleanup Program*, <http://www.rrc.state.tx.us/environmental/environsupport/voluntarycleanup.php> (last visited Feb. 22, 2014).

<sup>334</sup> 16 TEX. ADMIN. CODE § 3.91(a)(3) (2013).

<sup>335</sup> *Id.* § 3.91(b).

<sup>336</sup> R.R. Comm’n of Tex., *Field Guide for the Assessment and Cleanup of Soil and Groundwater Contaminated with Condensate From a Spill Incident (Statewide Rules 8, 20 and 9I)*, <http://www.rrc.state.tx.us/environmental/spills/spillcleanup.php> (last visited Feb. 22, 2014).

protocols” and afford an opportunity for voluntary compliance.<sup>337</sup> The guide provides notice of criteria that field personnel “may employ” in evaluating the adequacy of spill response for hydrocarbon condensate spills.<sup>338</sup> The guide provides standards for grab samples with soil to groundwater protection limits identified, but only for total petroleum hydrocarbons (TPH) and benzene, toluene, ethyl benzene, and xylenes (BTEX).<sup>339</sup> There are no guidelines or cleanup standards that address the range of toxic chemicals that may be associated with fracking fluids, drilling fluids, flowback water or produced water.<sup>340</sup>

Regulations with broad directives and lacking in regulatory standards were common in the early days of environmental law and have historically not proven effective.<sup>341</sup> Moreover, recent reports suggest that the RRC has not been successful in implementing its “no pollution” standard. A recent case brought by the Travis County District Attorney’s Officer against a landfarm led to \$1.35 million in fines and raised serious questions about the adequacy of the RRC enforcement program.<sup>342</sup> The case documented a decade of noncompliance including the pumping of stormwater from a landfill into a bayou that continued for years after the RRC wrote a letter requesting compliance.<sup>343</sup> Although unverified, there are also many citizen reports of potential containment problems on the Barnett Shale. Residents have posted pictures and videos that document pits with feeble liners that appear to be failing,<sup>344</sup> and surface water pooling during land farming operations.<sup>345</sup> Reported leaks and spills include black liquid shooting over earth and trees from the side of a drilling rig; produced water running out of an inadequately secured hole at the back of the frac tank and pouring onto the ground; repeated power washing of condensate tanks (followed by

---

<sup>337</sup> *Id.*

<sup>338</sup> *Id.*

<sup>339</sup> *Id.*

<sup>340</sup> Compare *id.* (enumerating cleanup guidelines for five chemicals found in hydraulic fracturing fluid), with FracFocus, *What Chemicals Are Used*, <http://fracfocus.org/chemical-use/what-chemicals-are-used> (last visited Feb. 22, 2014) (enumerating upwards of 50 chemicals commonly found in hydraulic fracturing fluid).

<sup>341</sup> See generally PLATER ET AL., *supra* note 222, at 193–201 (describing the evolutionary history of environmental regulation, including the ineffective “Review-and-Permit” programs as well as the Utilex case).

<sup>342</sup> Dave Fehling, *How ‘Landfarms’ for Disposing Drilling Waste are Causing Problems in Texas*, STATE IMPACT, NATIONAL PUBLIC RADIO, Nov. 12, 2012, <http://stateimpact.npr.org/texas/2012/11/12/landfarms-for-disposing-drilling-waste-causing-problems-in-texas> (last visited Feb. 22, 2014).

<sup>343</sup> *Id.*

<sup>344</sup> TXsharon, *Pictures of Barnett Shale Pollution in Wise County*, BLUEDAZE DRILLING REFORM, July 7, 2008, <http://www.texassharon.com/2008/07/07/pictures-of-barnett-shale-pollution-in-wise-county> [hereinafter *Pictures of Barnett Shale Pollution in Wise County*] (last visited Feb. 22, 2014); TXsharon, *New Barnett Shale Waste Pit Pictures*, BLUEDAZE DRILLING REFORM July 7, 2009, <http://www.texassharon.com/2009/07/07/new-barnett-shale-waste-pit-pictures> [hereinafter *New Barnett Shale Waste Pit Pictures*] (last visited Feb. 22, 2014).

<sup>345</sup> TXsharon, *Barnett Shale Landfarm*, YOUTUBE, June 4, 2009, [http://www.youtube.com/watch?v=\\_jy8TC5Cu20](http://www.youtube.com/watch?v=_jy8TC5Cu20) (last visited Feb. 22, 2014).

testing of the fluid collecting around the tanks reflecting high levels of hydrocarbons).<sup>346</sup> Residents have also reported apparently unlined or inadequately lined sludge ponds near waterways, and have expressed concerns upon witnessing “clean-up operations” where waste pit residue is spread across the site.<sup>347</sup> Soil and gravel have reportedly been used to cover leaks and spills.<sup>348</sup>

Oil and gas operators are required by the RRC to give immediate notice of a fire, leak, spill, or break to the district office.<sup>349</sup> However, except for “oil loss” where the threshold is five barrels, there is no definition of the quantity of spill that must be reported.<sup>350</sup> The RRC maintains records only for those violations that lead to an enforcement action.<sup>351</sup> Unless a violation is egregious or an immediate threat, the RRC allows the operator fifteen to thirty days to correct the violation before taking any enforcement action.<sup>352</sup> In 2010, there were five enforcement actions at fractured well sites across the State.<sup>353</sup> The RRC has noted that funding and staffing constraints limit enforcement actions and that RRC staff has had to oversee expanding development with decreasing funding and staffing.<sup>354</sup>

According to a 2010 review by the Texas Sunset Commission Advisory Commission, a legislative body created to review state agencies,<sup>355</sup> the RRC

---

<sup>346</sup> *Pictures of Barnett Shale Pollution in Wise County*, *supra* note 344; *New Barnett Shale Waste Pit Pictures*, *supra* note 344.

<sup>347</sup> Interview with Alicia Rich, Env'tl. Consultant, Fort Worth, Tex. & Sharon Wilson, Cmty. Organizer (Aug. 2012) [hereinafter Interview with Alicia Rich & Sharon Wilson]. *See also* E-mail from Sharon Wilson, Cmty. Organizer, to author (Feb. 1, 2013) [hereinafter E-mail from Sharon Wilson] (on file with author) (citing *Ruggiero Timeline, Jan. 10, 2010* <https://docs.google.com/document/d/1fkhd2RuyQDj1O6AWir9gYDZX4I0yNPsVgcfzrfo-7A/edit?usp=sharing> (last visited Feb. 22, 2014) (“Tim and Christine witness four men out on the worksite with a flatbed trailer and truck shoveling dirt and gravel onto the flatbed trailer and then spreading it on the right and back side of the yellow frac tank and near the piping next to the frac tank. . . . Christine and Tim learn later that day from an anonymous source that Gilbow Oilfield Services have spilled approximately 9,000 gallons of produced water the day before.”)).

<sup>348</sup> Interview with Alicia Rich & Sharon Wilson, *supra* note 347; E-mail from Sharon Wilson, *supra* note 364 (citing *Ruggiero Timeline, supra* note 347).

<sup>349</sup> R.R. Comm'n of Tex., *Accident Reporting*, <http://www.rrc.state.tx.us/safety/pipeline/accident.php> (last visited Feb. 22, 2014); 16 TEX. ADMIN. CODE § 3.20 (2013).

<sup>350</sup> 16 TEX. ADMIN. CODE § 3.20(b) (2013).

<sup>351</sup> Hannah Wiseman, *Fracturing Regulation Applied*, 22 DUKE ENV'T L. & POL'Y F. 361, 378 (2012).

<sup>352</sup> *Id.* at 372–373 n.65 (citing E-mail from Leslie Savage, Chief Geologist, Oil & Gas Division, R.R. Comm'n of Tex., to Hannah Wiseman, Assistant Professor, Fla. State Univ. Coll. of Law (Feb. 27, 2012) (noting that “[u]nless a violation is egregious or an immediate threat, the RRC may allow the operator 15–30 days to correct the violation before pursuing other mechanisms, including seals and severances, legal enforcement, etc.”)).

<sup>353</sup> Wiseman, *supra* note 352 at 372.

<sup>354</sup> *Id.* at 373 n.66 (citing E-mail from Leslie Savage, *supra* note 352 (responding to a question about why enforcement actions at hydraulically fractured well-sites dropped from 2008 through 2009 to 2011 and explaining that “[l]egal enforcement was down two attorneys” and that the Commission faced other staffing challenges)).

<sup>355</sup> In 1977, the Texas Legislature created the Sunset Advisory Commission to identify and eliminate waste, duplication, and inefficiency in government agencies. The twelve-member

has a particularly poor enforcement record and limited enforcement capacity.<sup>356</sup> While more than 60,000 wells were drilled from 2003 to 2008, representing an increase in production of 75%, inspectors and inspections rose only 6%.<sup>357</sup> In 2009, field staff forwarded less than 4% of the approximately 80,000 oil and natural gas production-related violations to the agency's central office for enforcement action.<sup>358</sup> Although there were 18,000 reports of water-related violations in 2009, the RRC took enforcement action on less than 1% of the violations.<sup>359</sup> The RRC has no record as to the number of serious violations that may have been included in the roughly 17,900 water pollution violations that did not go to enforcement.<sup>360</sup> The RRC relies on the discretion of each district office to determine which violations should be forwarded for enforcement action,<sup>361</sup> and it does not track data on operator violations in any way that would allow for evaluation of the efficacy of enforcement.<sup>362</sup> The Sunset Advisory Commission concluded that the RRC's enforcement process is not structured to deter repeat violations.<sup>363</sup>

The RRC has not formally adopted a penalty schedule and has no procedures to gather public input on appropriate penalty levels.<sup>364</sup> Moreover, the RRC conducts all of its enforcement hearings with in-house staff where the majority of participants (the administrative law judge, the attorneys who bring the charges, and the staff who investigate the violations) are all RRC employees.<sup>365</sup> The Sunset Advisory Commission Report points out that the relationship between the judges, attorneys, and staff provides the opportunity for inadvertent ex parte communication and may allow the RRC's staff (a party) to exert an unfair amount of influence over the administrative law judge's decisions.<sup>366</sup> The agency is also arguably compromised by a structure that includes a full-time three-member elected board (an anomaly in Texas) that relies on campaign contributions from the regulated industry.<sup>367</sup>

The complaint log for the City of Fort Worth suggests that the need for local enforcement and supervision may be significant. A review of the City of

---

Commission is a legislative body that reviews the policies and programs of more than 130 government agencies every 12 years. R.R. COMM'N OF TEX, SUNSET ADVISORY COMMISSION STAFF REPORT 2 (2010) [hereinafter SAC STAFF REPORT], *available at* [http://images.bimedia.net/documents/rct\\_sr.pdf](http://images.bimedia.net/documents/rct_sr.pdf).

<sup>356</sup> *Id.* at 2–3.

<sup>357</sup> Rebecca Jo Reser & David T. Ritter, *State and Federal Legislation and Regulation of Hydraulic Fracturing*, *ADVOC. TEX.*, Winter 2011, at 31, 34 (citing Pro-Publica analysis based on Texas RRC Statistics).

<sup>358</sup> SAC STAFF REPORT, *supra* note 355, at 33.

<sup>359</sup> *Id.* at 33–34.

<sup>360</sup> *Id.* at 34.

<sup>361</sup> *Id.*

<sup>362</sup> *Id.*

<sup>363</sup> *Id.* at 2.

<sup>364</sup> *Id.* at 36.

<sup>365</sup> *Id.* at 36.

<sup>366</sup> *Id.* at 36–37.

<sup>367</sup> *Id.* at 1–2 (noting that most state agencies in Texas have part-time, appointed boards).

Forth Worth's complaint log over an approximately four year period from 2008 through 2012 reveals many entries recording reports of stormwater runoff and chemical spills,<sup>368</sup> including spills of drilling mud,<sup>369</sup> flowback water,<sup>370</sup> and "farm" diesel.<sup>371</sup> Although Fort Worth requires that cleanup begin "immediately,"<sup>372</sup> citizens reported many of the incidents and there is little discussion of cleanup operations.<sup>373</sup> Examples of reported incidents include the following:

Citizen Report of a 1000 gallon tank on its side that appeared to have leaked its contents after having floated off location during a heavy rain. It was sighted in a channel of water leading to a culvert, surrounded by dead plants covered by a black substance. The tank was removed "a couple of days after the original email," before the inspectors responded. The inspectors walked around, but didn't locate the problem. No other follow up is noted.<sup>374</sup>

Operator report of two well heads that were opened so as to allow produced water to flow freely from the well and run off the site, possibly also to a creek. An earthen dam was constructed and clean up operations involved a vacuum truck. The report does not document the total volume spilled or the time taken to complete clean up operations.<sup>375</sup>

Citizen report of "yellow and pink chemicals all over the ground" surrounding the pad site following fracking operations. The City inspector identified the pink chemical as "farm" diesel from filling frac pump tanks in several spots, and the yellow chemical as "resin covered frac sand," in the amount of about two wheelbarrows. Completion Engineer advised that all fracking equipment was just removed and that additional clean up was scheduled. No follow up is noted.<sup>376</sup>

Report from a Scott Reaves (it is not clear if he is the operator) that "a salt water release of approximately 135 bbl., (approximately 5670 gallon[s]) migrated off the pad site approximately 50 yards to a natural drainage." A third party firm was employed by the operator to address bioremediation and spill

---

<sup>368</sup> CITY OF FORT WORTH COMPLAINT LOG (2008–2012) (on file with author) (discussing multiple complaints involving storm water runoff and chemical spills at multiple sites).

<sup>369</sup> *Id.* at Dec. 26, 2008 at McCulley (reporting call from City of Fort Worth code officer concerning drilling mud in the road that was "cleaned" within two hours).

<sup>370</sup> *Id.* at May 26, 2011 at Rowan wellpad (XTO Energy) (reporting that an incident report was filed by a company hired to handle cleanup).

<sup>371</sup> *Id.* at July 29, 2010 at Alliance Tech Pad A (Quicksilver Resources) (complaining of spilled chemicals, inspector confirmed).

<sup>372</sup> FORT WORTH, TEX., CODE OF ORDINANCES ch. 15, art. II, div. VII, § 15-44(B) (2013), available at <http://www.amlegal.com/library/tx/ftworth.shtml>.

<sup>373</sup> See CITY OF FORT WORTH COMPLAINT LOG, *supra* at 368 (Of the ten chemical spill incidents on the Fort Worth log, only three were reported by the companies themselves; the rest were reported by either the city or private citizens.).

<sup>374</sup> *Id.* at Nov. 19, 2009 at Centerport Pad A South.

<sup>375</sup> *Id.* at Nov. 3, 2009 at City of Euless.

<sup>376</sup> *Id.* at July 29, 2010 at Alliance Tech Pad A.

clean-up. The report references a pending incident report and clearance samples.<sup>377</sup>

It is not only contaminated soil from land disposal, leaks, and spills that are of concern, but also roadway accidents and outright illegal dumping. The Parker County Fire Marshal has reported trails of dead vegetation from the dumping of used fracking fluid into county ditches and an uncountable number of big rig rollovers, including situations involving fracking fluid, a slurry of brine, surfactants, acids, and benzene-laced gas liquids, requiring hazardous materials (HAZMAT) suits for cleanup operations.<sup>378</sup> The Fort Worth complaint log describes a citizen's report that Chesapeake was pumping water from a well into Lake Worth in an area just above where children swim.<sup>379</sup> He reported that they were "off-loading something from the trucks as they pump out water, that they were simultaneously running water from fire hydrants, and that he feared some "type of cross contamination."<sup>380</sup> The inspector "copied Kevin Strawser with Chesapeake to let us know what is happening," but no other follow up was noted.<sup>381</sup> Residents have also reported dumping across the road from an injection disposal well and directly into waterways, including a creek leading into Lake Grapevine (a drinking water supply lake).<sup>382</sup>

Exempting gas industry wastes from RCRA removes them from a regulatory program that requires tracking and recordkeeping that discourages illegal dumping and that enables generators to verify that waste shipments reach an appropriate disposal facility. Waste handlers must sign a manifest to create a record of the chain of custody.<sup>383</sup> When the waste shipment is delivered, the receiving facility must also sign the manifest, retain a copy as a record, and return a signed copy back to the generator where the waste originated.<sup>384</sup> Notice is required if a generator does not receive a final manifest verification, or a handler discovers that the shipment does not match the description of the waste on the manifest.<sup>385</sup> By contrast, although the alternate state regulatory program for RCRA-exempt gas

---

<sup>377</sup> *Id.* at May 26, 2011 at Rowan wellpad.

<sup>378</sup> Hargrove, *supra* note 42.

<sup>379</sup> CITY OF FORT WORTH COMPLAINT LOG *supra*, note 368, at Welker July 27, 2011.

<sup>380</sup> *Id.*

<sup>381</sup> *Id.*

<sup>382</sup> Sharon Wilson, *Illegal Dumping Feed*, <http://www.texassharon.com/category/illegal-dumping/feed/> (last visited Feb. 22, 2014) (referencing a picture of an illegal dump into a tributary of Lake Grapevine). *See also* E-mail from Sharon Wilson, Gulf Reg'l Organizer, Earthworks' Oil and Gas Accountability Project, to author (Feb. 1, 2013, 18:08 CST) (on file with author) (reporting a series of leaks, spills, illegal dumping, and cover up operations, including pictures of a large swath of denuded earth, and a denuded flow way leading to a creek). *See also Ruggiero Timeline*, *supra* note 347; Interview with Alicia Rich & Sharon Wilson, *supra* note 347.

<sup>383</sup> EPA, EPA530-F-01-003, ENVIRONMENTAL FACT SHEET, HAZARDOUS WASTE MANIFEST SYSTEM TO BE STREAMLINED (2001), *available at* <http://www.epa.gov/osw/hazard/transportation/manifest/pdf/manifs.pdf>. *See also* 40 C.F.R. § 262.23(a) (2013).

<sup>384</sup> ENVIRONMENTAL FACT SHEET, *supra* note 383. *See also* 40 C.F.R. § 265.71(a)(2) (2013).

<sup>385</sup> ENVIRONMENTAL FACT SHEET, *supra* note 383. *See also* 40 C.F.R. pt. 262, subpt. B (2013).

industry waste requires the use of permitted carriers and receivers, it does not require a manifest.<sup>386</sup> As opposed to the strict liability regime under RCRA, generators may be held liable if they use the services of a carrier or receiver who improperly disposes of the waste, but only if the generator should have known that proper disposal was unlikely and failed to take reasonable steps to remedy the problem.<sup>387</sup> Without a manifest system, tracking may be difficult.

Even wastes that reach their intended destination may not be appropriately treated. Pursuant to the Memorandum of Understanding between the TCEQ and the RRC, gas industry wastes may be disposed of at municipal solid waste (MSW) facilities if the facility is permitted or otherwise authorized to accept waste of the same physical and chemical characteristics,<sup>388</sup> but rules governing waste classification offer little guidance. Although TCEQ rules require prior written approval from the executive director for acceptance or disposal of gas industry wastes,<sup>389</sup> there is no guidance on testing for the range of hazardous chemicals that may be present in drilling and fracking fluid.<sup>390</sup> TCEQ guidelines identify approval and testing requirements for disposal of drilling muds, but they do not specifically address fracking fluids or other gas industry wastes.<sup>391</sup> As for drilling muds, the recommended testing is only for barium, TPH, and BTEX, and in some cases, for hydrocarbons.<sup>392</sup>

In 2010, following an eighty barrel (3,360 gallons) spill of flowback water in Flower Mound, Texas,<sup>393</sup> contaminated soil was disposed of at an MSW landfill with no testing for chemicals other than BTEX and chlorides.<sup>394</sup> The flowback water reportedly came from a damaged gasket on a hatch, flowed off the pad site, pooled, and soaked the soil beside a road silt containment berm.<sup>395</sup> Multiple dump trucks were reportedly used to remove flowback water from the tank and the surface of the ground.<sup>396</sup> One witness reported that at the time she arrived at the scene, “the vacuum truck was

---

<sup>386</sup> See 16 TEX. ADMIN. CODE § 3.8(d)(5)(A) (2013).

<sup>387</sup> *Id.* § 3.8(d)(5)(B).

<sup>388</sup> See *id.* § 3.30(e)(3)(A)–(B).

<sup>389</sup> 30 TEX. ADMIN. CODE § 330.171(b) (2013). See also *id.* § 330.3(148)(P) (defining “Special Waste” to include wastes from the oil, gas, and geothermal industry).

<sup>390</sup> See TCEQ, RG-003, DISPOSAL OF SPECIAL WASTES ASSOCIATED WITH THE DEVELOPMENT OF OIL, GAS, AND GEOTHERMAL RESOURCES I (2006), available at <http://www.deq.louisiana.gov/portal/Portals/0/permits/sw/Disposal%20of%20Special%20Wastes%20Associated%20with.pdf> (providing recommendations for treatment and testing of gas industry wastes at MSW-permitted landfills).

<sup>391</sup> *Id.* at 2.

<sup>392</sup> *Id.*

<sup>393</sup> *Frac Fluid Spill Reported in Flower Mound*, CROSS TIMBERS GAZETTE, Mar. 17, 2010, <http://www.crosstimbersgazette.com/local-news/492-frac-fluid-spill-reported-in-flower-mound.html> (last visited Feb. 22, 2014).

<sup>394</sup> Letter from Todd Thompson, Env'tl. Leader, Williams E & P, to Walter Gwyn, Dir., R. R. Comm'n of Tex. (Apr. 15, 2010) [hereinafter Letter from Todd Thompson to Walter Gwyn].

<sup>395</sup> See *id.* (describing the event and the cleanup operation and including RRC Form H-8).

<sup>396</sup> *Id.*

cleaning up and later the dirt was being dumped and moved around the area.”<sup>397</sup> The operator reported that an estimated sixty-five barrels were recovered, a backhoe was used to remove potentially impacted soils, and the soils were sampled for BTEX chemicals and chlorides.<sup>398</sup> The spill report does not include any discussion of sampling for other chemicals. The waste was classified as “class 2 non-hazardous waste”<sup>399</sup> and reportedly disposed of at the Itasca Landfill.<sup>400</sup>

Given minimal state supervision over land disposal (both disposal on site “as of right,” and disposal subject to permits with no clear standards for regulatory review), supervision by an understaffed and underfunded agency with no apparent hard line on enforcement, the relative ease of illegal dumping with no tracking of the waste, and uncertainty as to whether chemicals that do arrive at their intended destination truly belong in a municipal solid waste facility, there is a significant risk that toxic chemicals may enter surface waters and make their way into groundwater supplies. Groundwater can be contaminated “when rainwater percolates through buried hazardous waste, separates (or leaches) hazardous constituents from wastes, and carries the hazardous constituents into the groundwater supply.”<sup>401</sup> This acknowledged risk is a supporting rationale for land disposal regulations under RCRA.<sup>402</sup> Surface waters are also at risk. Of particular concern for surface waters, GIS mapping of areas on the Barnett Shale reveals many wells in the floodplain, including along tributaries to water supply lakes, and even within the floodplain of at least one lake designated as a sole source of water supply.<sup>403</sup>

---

<sup>397</sup> *Frac Fluid Spill Reported in Flower Mound*, *supra* note 393.

<sup>398</sup> Letter from Todd Thompson to Walter Gwyn, *supra* note 394 (describing the event and the cleanup operation and including RRC Form H-8).

<sup>399</sup> See 30 TEX. ADMIN. CODE § 335.1(20) (2013) (providing the regulatory definition of “Class 2 Wastes”).

<sup>400</sup> Letter from Todd Thompson to Walter Gwyn, *supra* note 394.

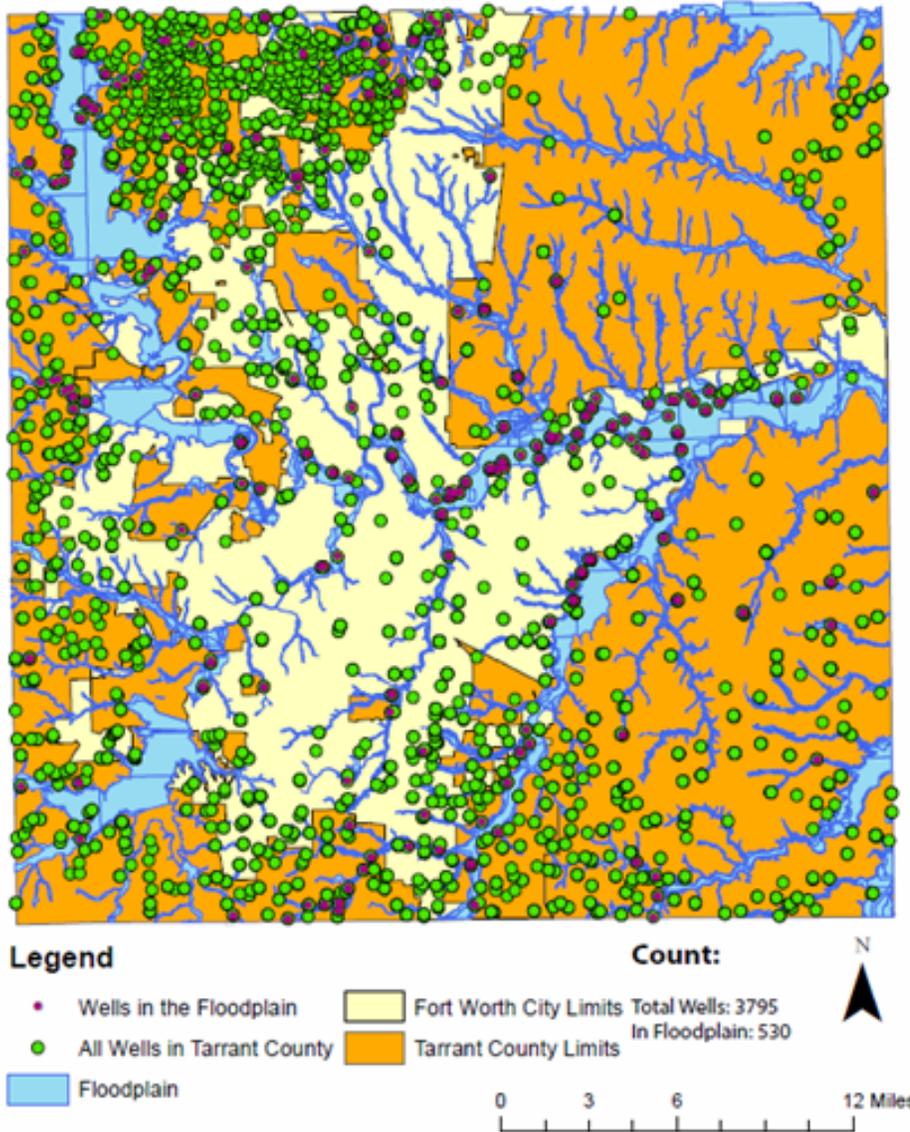
<sup>401</sup> LAND DISPOSAL RESTRICTIONS, *supra* note 246, at 1-3.

<sup>402</sup> *Id.*

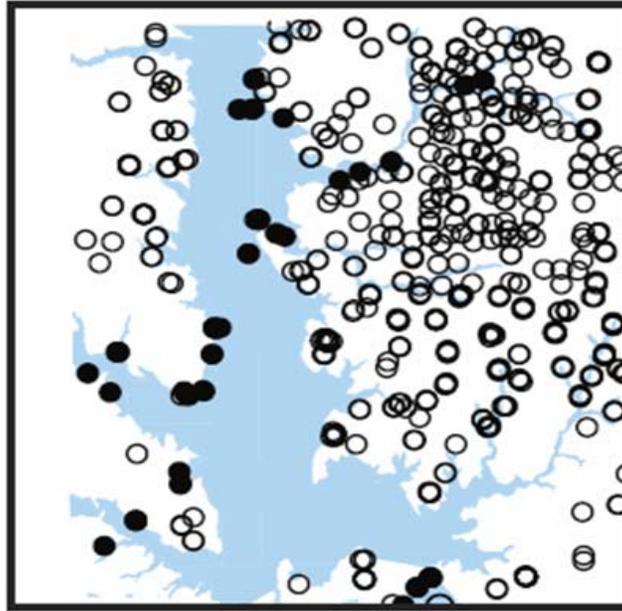
<sup>403</sup> See U.S. ENERGY INFO. ADMIN., BARNETT SHALE, FT. WORTH BASIN, TEXAS, WELLS BY YEAR OF FIRST PRODUCTION & ORIENTATION (MAP) (2008), available at [http://www.eia.gov/oil\\_gas/rpd/shaleusa1.pdf](http://www.eia.gov/oil_gas/rpd/shaleusa1.pdf).

Author: John Laycock  
Data Sources: FEMA, Texas Railroad Commission,  
Tarrant Appraisal District  
1/31/2013

### Gas Wells in the Floodplain: Fort Worth and Tarrant County



# Gas Wells Around Eagle Mountain Lake



- Wells in the Floodplain
- All Wells
- Fort Worth City Limits
- Tarrant County Limits
- Floodplain
- Interstate Highway



Data Sources:  
TRCC, Barnett Shale [shapefile], Austin, Texas, EIS/2012  
FEMA, 2010 Floodplain FEMA Floodplain, [shapefile],  
Washington, D.C., FEMA, 2010  
City of Fort Worth, Tarrant County and City Limits [shapefile], Fort  
Worth, Texas, Fort Worth 2010  
TNRIS, TxDOT Roadways [shapefile], Austin, Texas, TxDOT, 2012

## VIII. MUNICIPAL LAWS: WATER AND SOIL

Local governments on the Barnett Shale have adopted programs to regulate gas industry activities. Many of these programs are extensive and include location, best management, and technology based standards.<sup>404</sup> As discussed below, some local governments have placed restrictions on drilling and fracking additives, and established requirements for leak detection, response, site remediation and water quality monitoring. However, clear standards and criteria to address the myriad of chemicals of possible concern are understandably lacking. With little guidance from state and federal government, the local burden is excessive. Southlake's ordinance stands out in its breadth and depth, but no gas drilling has yet been undertaken in Southlake that might test the rules in practice. Although not a comprehensive report on local practice, this section explores local efforts at some of the larger cities on the Barnett Shale to protect soil and water quality.

Many cities require setbacks from the floodway, although there is significant variation in the approach to floodplain development. Flower Mound and Grapevine will not issue drilling permits in the floodplain, and require a significant setback of 750 feet and 200 feet, respectively.<sup>405</sup> Southlake may allow a drill site or an operation site in the floodplain with specific approval,<sup>406</sup> but prohibits meters, storage tanks, separation facilities, and other aboveground facilities in a floodway or within a 100-year floodplain.<sup>407</sup> Arlington takes the opposite approach. It prohibits wells in the floodplain, but allows tanks and equipment with a floodplain development permit.<sup>408</sup>

Fort Worth also allows gas wells to be drilled in the 100-year floodplain so long as they have a floodplain development permit.<sup>409</sup> As may be expected, however, Fort Worth's floodplain ordinance focuses more on protecting development from flood waters than on protecting the water quality of

---

<sup>404</sup> DALLAS GAS DRILLING TASK FORCE, COMPARISON OF CITY ORDINANCE REGULATIONS FOR GAS DRILLING AND PRODUCTION 18 (2011), *available at* [http://www.dallascityhall.com/pdf/GasDrilling/CityOrdinanceComparison\\_101111.pdf](http://www.dallascityhall.com/pdf/GasDrilling/CityOrdinanceComparison_101111.pdf).

<sup>405</sup> FLOWER MOUND, TEX., CODE OF ORDINANCES ch. 34, art. VII, § 34-420(k) (2011) (requiring a 750-foot setback); GRAPEVINE, TEX., CODE OF ORDINANCES ch. 12, art. VII, § 12-145(c)(13) (2006) (requiring a 200-foot setback).

<sup>406</sup> SOUTHLAKE, TEX., CODE OF ORDINANCES, ch. 9.5, art. IV, § 9.5-242(d) (2011) (requiring both city and, where applicable, U.S. Army Corps of Engineers, approval).

<sup>407</sup> *See id.* § 9.5-242(rr)(3).

<sup>408</sup> *See* Arlington, Tex., Ordinance 11-068, § 5.01(H) (2011), *available at* [http://www.arlingtontx.gov/planning/pdf/Gas\\_Wells/Gas\\_Drilling\\_and\\_Production\\_Ordinance.pdf](http://www.arlingtontx.gov/planning/pdf/Gas_Wells/Gas_Drilling_and_Production_Ordinance.pdf).

<sup>409</sup> FORT WORTH, TEX., CODE OF ORDINANCES, ch. 15, art. I, § 15-34(J) (2013) (incorporating FEMA's definition of the floodplain). *See also* FEMA, *Flood Zones*, <http://www.fema.gov/national-flood-insurance-program-2/flood-zones> (last visited Feb. 22, 2014) ("Flood hazard areas identified on the Flood Insurance Rate Map are identified as a Special Flood Hazard Area (SFHA). SFHA are defined as the area that will be inundated by the flood event having a 1% chance of being equaled or exceeded in any given year.").

receiving waters from pollutants flowing offsite during flooding.<sup>410</sup> The Fort Worth ordinance addresses anchoring, which while clearly important to protect downstream uses from potential containment problems,<sup>411</sup> does not otherwise address protection from leaks, spills, and soil contamination.<sup>412</sup>

Standard municipal stormwater regulations do address the protection of waterways from pollution flowing onsite, but these regulations focus on conventional concerns in urbanizing areas. Flower Mound's Design Criteria Manual, for example, discusses best management strategies and includes information on their potential efficacy in removing pollutants, but only for total suspended solids, phosphorous, nitrogen, and metals.<sup>413</sup> The manual does not reference any special nonpoint-source pollution control considerations for industrial sites where unconventional pollutants such as fracking and drilling fluids may have been spilled.<sup>414</sup>

Standard local stormwater controls can also be prone to failure. A review and field study of regulatory compliance on erosion and sediment pollution control in North Carolina identified significant noncompliance with stormwater requirements stemming from failures to correctly install requisite best management practices and maintain controls.<sup>415</sup> All stormwater and flood control measures are designed for a specific storm event, typically the 100-year storm event for floodplains used by FEMA. Yet for stormwater controls, the reference point sometimes relies on the benchmark for the twenty-five to fifty year storm events.<sup>416</sup> Still, floodplains and precipitation are not static, and storms exceeding these benchmarks are bound to happen.<sup>417</sup> One study of national flood losses concluded that approximately two-thirds of all losses in the United States are from a greater than 100-year storm event.<sup>418</sup>

Some local ordinances appear to incorrectly assume the applicability of state and federal stormwater standards. The Fort Worth ordinance, for example, requests "[a] copy of the stormwater pollution prevention plan as required by [EPA]."<sup>419</sup> Southlake and Flower Mound also specifically

---

<sup>410</sup> FORT WORTH, TEX., CODE OF ORDINANCES, ch. 7, art. VIII, § 7-346 (2013) (protecting against damage from both destructive forces and pollution).

<sup>411</sup> *See id.*

<sup>412</sup> *Id.*

<sup>413</sup> TOWN OF FLOWER MOUND ENG'G SERVS., DESIGN CRITERIA, at app. H-1 (2010) *available at* <http://www.flower-mound.com/DocumentCenter/View/3831>.

<sup>414</sup> *Id.*

<sup>415</sup> Robert G. Paterson, *Construction Practices: The Good, the Bad and the Ugly*, 1(3) WATERSHED PROTECTION TECH. 44, 45–46 (1995), *available at* [http://yosemite.epa.gov/r10/water.nsf/0/159859e0c556f1c988256b7f007525b9/\\$FILE/Construction%20Practices%20the%20Good%20the%20Bad%20and%20the%20Ugly.pdf](http://yosemite.epa.gov/r10/water.nsf/0/159859e0c556f1c988256b7f007525b9/$FILE/Construction%20Practices%20the%20Good%20the%20Bad%20and%20the%20Ugly.pdf).

<sup>416</sup> Raymond Burby et al., *Unleashing the Power of Planning to Create Disaster Resistant Communities*, 65 J. AM. PLAN. ASS'N, 247, 251 (1999).

<sup>417</sup> *Id.* at 251.

<sup>418</sup> *See id.*

<sup>419</sup> *See* FORT WORTH, TEX., CODE OF ORDINANCES ch. 15, art. II, § 15-35(C)(18) (2013). *See also* DESIGN CRITERIA, *supra* note 413, at B-IV-24 (requiring Best Management Practices (BMPs) for watershed protection in order to mitigate the ill effects of rapid and intense "urbanization").

mandate compliance with illusory federal or state stormwater quality prevention-planning requirements.<sup>420</sup> Denton, however, clearly acknowledged that: “There is presently no regulatory oversight of oil and gas-related construction or operations under the National Pollutant Discharge Elimination System (NPDES) permit program, except in very limited circumstances.”<sup>421</sup> Denton undertook an EPA study in 2005 to monitor and assess the impact of gas-well drilling on stormwater runoff and provide regulatory and management strategies to assist local governments.<sup>422</sup>

The Denton study concluded that “[g]as well sites have the potential to negatively impact surface waters due to increased sedimentation rates and an increase in the presence of metals in stormwater runoff.”<sup>423</sup> The study characterized stormwater samples collected from three gas well sites and two reference sites, and included a detailed evaluation of conventional water quality parameters, metals, and petroleum hydrocarbons.<sup>424</sup> The study found that levels of total suspended solids at concentrations 136 times greater than reference sites, at levels comparable to previous studies of construction site sedimentation.<sup>425</sup> It also found total dissolved solids, conductivity, calcium, chlorides, hardness, alkalinity, pH, and metals were significantly higher at gas well sites.<sup>426</sup> Although the study did not detect elevated levels of total petroleum hydrocarbons in stormwater, it acknowledged the potential for accidental spills and leaks.<sup>427</sup> The study did detect elevated levels of total petroleum hydrocarbons in mud pits and concluded that well-drilling mud pits, as well as fracture water pits, merit special attention.<sup>428</sup>

The Denton Study recommended that cities adopt regulations similar to the current National Pollution Discharge Elimination System (NPDES) requirements for construction sites.<sup>429</sup> The study specifically recommended including “stormwater pollution prevention plans, erosion and sediment control best management practices, provisions for containing spills and leaks, procedures for site inspections and enforcement of control measures,

---

<sup>420</sup> See SOUTHLAKE, TEX., CODE OF ORDINANCES, ch. 9.5, art. IV, § 9.5-233(b)(21) (2013) (requiring a storm water pollution prevention plan that complies with all federal, state and local storm water quality regulations). See also FLOWER MOUND, TEX., CODE OF ORDINANCES, ch. 34, art. VII, § 34-421(d)(22) (2010) (requiring a copy of the stormwater pollution prevention plan as required by the TCEQ or the EPA).

<sup>421</sup> EPA, SUMMARY OF THE RESULTS OF THE INVESTIGATION REGARDING GAS WELL SITE SURFACE WATER IMPACTS 1 (2009) [hereinafter SUMMARY] available at [http://www.epa.gov/npdes/pubs/oilandgas\\_gaswellsummary.pdf](http://www.epa.gov/npdes/pubs/oilandgas_gaswellsummary.pdf) (last visited Feb. 22, 2014).

<sup>422</sup> See *id.*

<sup>423</sup> See *id.* at 2. See also KENNETH BANKS & DAVID WACHAL, DEMONSTRATING THE IMPACTS OF OIL AND GAS EXPLORATION ON WATER QUALITY AND HOW TO MINIMIZE THESE IMPACTS THROUGH TARGETED MONITORING ACTIVITIES AND LOCAL ORDINANCES 15 (2007), available at [http://www.epa.gov/npdes/pubs/oilandgas\\_impactgrant.pdf](http://www.epa.gov/npdes/pubs/oilandgas_impactgrant.pdf).

<sup>424</sup> See BANKS & WACHAL, *supra* note 423, at 13.

<sup>425</sup> SUMMARY, *supra* note 421, at 1.

<sup>426</sup> *Id.*

<sup>427</sup> *Id.* at 2.

<sup>428</sup> *Id.* at 4.

<sup>429</sup> *Id.* at 2.

[and] sanctions to ensure compliance.”<sup>430</sup> The study also suggested that cities install berms and discussed available technologies and their relative efficacy.<sup>431</sup> The study further recommended regulations for site location, tree preservation, site management, equipment maintenance, and hazardous materials management and containment.<sup>432</sup> The study included a detailed discussion of predictive tools, modeling, and techniques, and recommended regulating onsite activities and well-drilling locations, specifically focusing on floodplains and other environmentally sensitive areas.<sup>433</sup>

The study recommended that cities consider sampling and setting standards for pits, but acknowledged that cities may not have the staff, resources, or expertise to implement such a complex program.<sup>434</sup> Monitoring runoff from gas-well sites requires special equipment and trained staff.<sup>435</sup> As an alternative, the study recommended design standards, location standards, liners, restrictions on the types of pits allowable, margins at the top to limit the possibility of overflowing pits, pit removal requirements, entirely eliminating open mud pits, requiring drip plans, absorbing materials, safe chemical storage, secondary containment, hazardous materials management plans, and remediation.<sup>436</sup>

Consistent with the Denton Study’s recommendations, some cities have adopted regulations specifically prohibiting landfarming,<sup>437</sup> site disposal of drilling wastes,<sup>438</sup> and open-air pits (requiring instead that drilling wastes be stored in tanks in “closed-loop” systems where steel bins are used to collect drilling waste).<sup>439</sup> Fort Worth allows earthen-lined pits for operations on open space of at least twenty-five acres and not within 1,000 feet of a “protected use.”<sup>440</sup> Although this approach may provide some protection for neighboring uses, depending on the integrity of the liner, supervision, and enforcement, it may not be an effective approach to protect the groundwater aquifer.

Cities have also regulated freshwater fracture ponds.<sup>441</sup> Grand Prairie requires a vector control plan to reduce both mosquitoes and the possibility

---

<sup>430</sup> *Id.*

<sup>431</sup> *Id.*

<sup>432</sup> *Id.* at 3.

<sup>433</sup> *Id.*

<sup>434</sup> *Id.* at 4.

<sup>435</sup> *Id.* at 2.

<sup>436</sup> *Id.* at 4–5.

<sup>437</sup> GRAND PRAIRIE, TEX., CODE OF ORDINANCES ch. 13, ART. XIX, § 13-515(25) (2011).

<sup>438</sup> EULESS, TEX., CODE OF ORDINANCES ch. 40, art. VIII, § 40-15(a)(31) (2009).

<sup>439</sup> FORT WORTH, TEX., CODE OF ORDINANCES ch. 15, art. II, div. II, § 15-31 (2013), (“Closed Loop Mud System means a system utilized while drilling so that reserve pits are not used and instead steel bins are used to collect all drilling waste.”); DALLAS GAS DRILLING TASK FORCE, COMPARISON OF CITY ORDINANCE REGULATIONS FOR GAS DRILLING AND PRODUCTION 18 (2011), available at [http://www.dallascityhall.com/pdf/GasDrilling/CityOrdinanceComparison\\_101111.pdf](http://www.dallascityhall.com/pdf/GasDrilling/CityOrdinanceComparison_101111.pdf) (noting that each requires “closed-loop systems”).

<sup>440</sup> FORT WORTH, TEX., CODE OF ORDINANCES ch. 15, art. II, div. II, § 15-42(A)(3) (2013).

<sup>441</sup> *Id.* § 15-42(A)(17) GRAND PRAIRIE, TEX., CODE OF ORDINANCES ch. 13, art. XIX, § 13-515 (19) (2011).

of chemical control applications.<sup>442</sup> Grand Prairie may permit a pond if is not within 500 feet of protected use, including residences, religious institutions, public buildings, hospitals and medical buildings, nursing homes, schools, or public parks.<sup>443</sup> Once constructed and available, there is some concern about the possible illicit use of these ponds for wastewater storage,<sup>444</sup> which may be particularly problematic in cities that prohibit the use of synthetic liners.<sup>445</sup> The City of Euless requires case by case review for all pits.<sup>446</sup> The City of Southlake completely prohibits the use of fracturing ponds.<sup>447</sup>

South Lake and Fort Worth generally prohibit the deposition of refuse and materials from production operation in public right-of-ways, sewers, natural drainage ways, bodies of water or private property.<sup>448</sup> The cities of Dallas, Southlake, and Grand Prairie all generally require drillers and operators to store hazardous materials and chemicals in a manner that allows for prevention, containment, and rapid remediation in the event of a spill or other release as well as onsite maintenance of hazardous material safety sheets.<sup>449</sup> Southlake's ordinance requires the operator to "take all appropriate pollution prevention actions including but not limited to raising chemical and materials and bulk storage (e.g., placing such materials on wooden pallets), installing and maintaining secondary containment systems, and providing adequate protection from storm water and weather elements."<sup>450</sup> The ordinance also requires drip pans and other containment devices "underneath all tanks, containers, pumps, lubricating oil systems, engines, fuel and chemical storage tanks, system valves, connections and any other areas or structures that could potentially leak, discharge or spill hazardous liquids, semi-liquids or solid waste materials, including hazardous waste."<sup>451</sup> Other cities also include specific requirements for secondary containment for storage tanks.<sup>452</sup>

---

<sup>442</sup> GRAND PRAIRIE, TEX., CODE OF ORDINANCES ch. 13, ART. XIX, § 13-515(19)(a) (2011).

<sup>443</sup> *Id.* § 501.

<sup>444</sup> Interview with Alicia Rich & Sharon Wilson, *supra* note 347.

<sup>445</sup> GRAND PRAIRIE, TEX., CODE OF ORDINANCES ch. 13, art. XIX, § 13-515(19)(a)(3) (2011) ("No artificial liners shall be permitted"); FORT WORTH, TEX., CODE OF ORDINANCES ch. 15, art. II, div. VII, § 15-42(A)(17)(g)(i) (2013) ("Fresh water fracture pits shall not be lined with a synthetic impervious liner unless approved by the gas inspector.").

<sup>446</sup> EULESS, TEX., CODE OF ORDINANCES ch. 40, art. 8, § 40-15(a)(31) (2009).

<sup>447</sup> SOUTHLAKE, TEX., CODE OF ORDINANCES ch. 9.5, art. IV, § 9.5-242(ff) (2013).

<sup>448</sup> DALLAS GAS DRILLING TASK FORCE, *supra* note 439, at 5; FORT WORTH, TEX., ORDINANCE 16986-06-2006 § 15-42(A)(4) (2006) (stating a general prohibition, but also acknowledging the possibility that a city permit could be used for this purpose).

<sup>449</sup> DALLAS GAS DRILLING TASK FORCE, *supra* note 439, at 20.

<sup>450</sup> SOUTHLAKE, TEX., CODE OF ORDINANCES ch. 9.5, art. IV, § 9.5-242(t) (2011).

<sup>451</sup> *Id.* § 242(aa).

<sup>452</sup> The City of Flower Mound's oil and gas ordinance language is typical: "All tanks and permanent structures shall conform to the A.P.I. specification unless other specifications are approved or required by the fire chief. All storage tanks shall be equipped with a secondary containment system including lining with an impervious material. The secondary containment system shall be a minimum of three feet . . . in height and have a storage capacity of one and one-half . . . times the contents of the largest tank in accordance with the fire codes, and be buried at least one foot . . . below the surface. Drip pots shall be provided at the pump out

Some cities require leak detection, compliance, and response plans, but even the Southlake ordinance lacks standards and criteria by which to evaluate the plan. Southlake's ordinance requires the applicant to devise a monitoring and reporting program, as well as methodology to assess and evaluate the impact of drilling, fracturing, production, and other activities.<sup>453</sup> The ordinance anticipates compliance with city guidelines,<sup>454</sup> but there is no separate guidance document available.<sup>455</sup> It prohibits contamination "above regulatory thresholds,"<sup>456</sup> but does not cross-reference any particular regulations that would establish cleanup standards. The ordinance is specific, however, in requiring annual reporting of monitoring results, including a record of all laboratory data sheets, field logs, data summary, and action taken, and requires periodic inspections by a third party.<sup>457</sup> The ordinance also requires soil sampling by a third party before and after drilling,<sup>458</sup> and requires the operator to remove waste materials "to the satisfaction" of the city inspectors.<sup>459</sup> Other cities also require compliance "to the satisfaction" of the inspector without specifying standards or criteria.<sup>460</sup>

Grand Prairie also has a requirement for a leak detection plan that requires the applicant to specify information on methods and equipment that will be used to assess and evaluate the impact of drilling, fracturing, and production.<sup>461</sup> Quarterly leak monitoring and a response plan are also required.<sup>462</sup> Again, the ordinance lacks criteria by which to assess the adequacy of the plan, but contemplates further regulatory development through guidance documents.<sup>463</sup> Grand Prairie has since adopted

---

connection to contain the liquids from the storage tank. Each storage tank shall be equipped with a level control device that will automatically activate a valve to close the well in the event of excess liquid accumulation in the tank." FLOWER MOUND, TEX., CODE OF ORDINANCES ch. 34, art. VII, div. 7, § 34-427(a)(38) (2013). *See also* FORT WORTH, TEX., ORDINANCE 16986-06-2006 § 15-42(A)(29) (2006) ("All tanks and permanent structures shall conform to the American Petroleum Institute (A.P.I.) specifications unless other specifications are approved by the Fire Chief. All storage tanks shall be equipped with a secondary containment system including lining with an impervious material. The secondary containment system shall be a minimum of three feet (3') in height and one and one-half (1½) times the contents of the largest tank in accordance with the Fire Code, and buried at least one foot (1'). Drip pots shall be provided at the pump out connection to contain the liquids from the storage tanks.").

<sup>453</sup> SOUTHLAKE, TEX., CODE OF ORDINANCES ch. 9.5, art. IV, § 9.5-222 (defining "leak detection and compliance plan"); *id.* § 9.5-234(b)(41) (stating the requirement to assess and evaluate the impact of fracturing).

<sup>454</sup> *Id.* § 9.5-234(b)(41).

<sup>455</sup> Telephone interview with Lorrie Fletcher, Planner I, City of Southlake (Aug. 22, 2013).

<sup>456</sup> SOUTHLAKE, TEX., GEN. ORDINANCES ch. 9.5, art. IV, § 9.5-242(fff) (2013).

<sup>457</sup> *Id.* § 9.5-234(b)(41).

<sup>458</sup> *Id.* § 9.5-242(fff)(2).

<sup>459</sup> *Id.* § 9.5-248(b).

<sup>460</sup> *See, e.g.*, FORT WORTH, TEX., CODE OF ORDINANCES ch. 15, art. II, div. VII, § 15-44(B) (2013).

*See also* GRAND PRAIRIE, TEX., CODE OF ORDINANCES ch. 13, art. XIX, § 13-517(b) (2013).

<sup>461</sup> GRAND PRAIRIE, TEX., CODE OF ORDINANCES ch. 13, art. XIX, § 13-505(c)(35) (2013).

<sup>462</sup> *Id.*

<sup>463</sup> *Id.*

guidelines,<sup>464</sup> but the guidelines themselves are also short on standards and criteria.<sup>465</sup> The guidelines require consideration of “the air, soil, and water thresholds anticipated to be safe under current TCEQ and EPA criteria,” but do not reference any specific state or federal standards or criteria.<sup>466</sup> While noting that the rules “may not apply,” the guidelines offer up as “best management practices” an entire regulatory section of EPA’s RCRA rules governing hazardous waste treatment, storage, and disposal facilities.<sup>467</sup> Without any clear standards, it is hard to anticipate what standards operators may choose as appropriate “best management practices.” Neither the ordinance nor the guidance document includes any discussion of appropriate ground or surface waterways to be sampled, the appropriate depth and breadth of a soil contamination sampling zone, soil or water quality sampling methods, or identification of contaminants of concern.<sup>468</sup>

Cities have also adopted regulations to govern site reclamation following abandonment and closure of gas industry operations, but again, regulatory criteria are lacking. Fort Worth requires a surface reclamation plan “in the degree of detail necessary to demonstrate that full site reclamation can be accomplished.”<sup>469</sup> The site must be cleared, graded, and restored “to the same surface conditions as nearly as possible as existed before operations.”<sup>470</sup> The plan must identify measures to restore the property, control surface water drainage, protect surface and groundwater systems, and clean up polluted surface and ground water.<sup>471</sup> The plan must address grading, soil stabilization, and revegetation, waste disposal, road reclamation, and “other practices necessary to ensure all disturbed areas will be reclaimed.”<sup>472</sup> Abandonment must be approved by the gas inspector, and the operator is “responsible for the restoration of the well site to its original condition as nearly as practicable.”<sup>473</sup> The ordinance does not delineate how the gas inspector will make his determination.<sup>474</sup> The Fort Worth ordinance does not specify any requirements for soil sampling for

---

<sup>464</sup> CITY OF GRAND PRAIRIE, TEX., LEAK DETECTION AND COMPLIANCE PLAN GUIDANCE 1–12 (2011), available at <http://www.gptx.org/modules/ShowDocument.aspx?documentid=4947> (the date cited for the ordinance is the codified date (2013), but that it was adopted pre-2011, thus this guidance document (a 2011 document) is relevant to the ordinance).

<sup>465</sup> See *id.* at iii (“This guidance is provided as a starting point . . .”).

<sup>466</sup> *Id.*

<sup>467</sup> *Id.* at 5 (referencing standards in 40 C.F.R. pt. 264 (1986), including facility standards, preparedness and prevention, contingency plans and emergency procedures, the manifest system, releases from solid waste management units, closure and postclosure and financial requirements, use and management of containers, tank systems, surface impoundments, waste piles, land treatment, landfills and incinerators.).

<sup>468</sup> See GRAND PRAIRIE, TEX., CODE OF ORDINANCES ch. 13, art. XIX (2013). See also LEAK DETECTION AND COMPLIANCE PLAN GUIDANCE, *supra* note 464, at iii.

<sup>469</sup> FORT WORTH, TEX., CODE OF ORDINANCES ch. 15, art. II, § 15-45(D) (2013).

<sup>470</sup> *Id.* § 15-41(A)(2).

<sup>471</sup> *Id.* § 15-45(D)(1)–(3).

<sup>472</sup> *Id.* § 15-45(D)(4)–(10).

<sup>473</sup> *Id.* § 15-45(A)–(B).

<sup>474</sup> See *id.*

toxic contamination before or after operations.<sup>475</sup> The City of Euless has similar requirements to those of Fort Worth,<sup>476</sup> but acknowledges that soil sampling may be required on a case by case basis.<sup>477</sup> However, it does not include standards or criteria by which to evaluate the results.<sup>478</sup>

Southlake's ordinance contains considerably more detail, but again there is no clear reference to specific standards.<sup>479</sup> Southlake requires a "phase II environmental site assessment" within sixty days of abandoning a well.<sup>480</sup> Southlake collects "post-operation" samples when equipment is removed from the drill site at the time of abandonment to document that the final conditions are "within regulatory requirements."<sup>481</sup> The ordinance requires that soil samples be "collected and analyzed utilizing proper sampling and laboratory protocol set forth by the TCEQ and/or EPA," and that they include results for total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), chloride, barium, chromium, and ethylene glycol.<sup>482</sup> The ordinance does not specify to which regulatory program of the TCEQ or the EPA, or to which regulatory requirements it refers.<sup>483</sup> As discussed above, the RRC—not the TCEQ—has jurisdiction over most matters related to oil and gas wastes, and the RRC does not have regulatory standards for soil sampling when a site is abandoned.<sup>484</sup>

In addition to site reclamation requirements, some ordinances include minimal setback standards for redevelopment. Fort Worth requires a that a five-foot no-build easement around the center of plugged and abandoned wells, all well casings and cellars be cut and removed to a depth of at least three feet below the surface, and that a permanent marker pipe be installed.<sup>485</sup> The ordinance specifically prohibits structures from being built

<sup>475</sup> *Id.* § 15-42(A)(27) (requiring "consideration [of the] . . . nature of the soil . . .").

<sup>476</sup> EULESS, TEX., CODE OF ORDINANCES ch. 40, art. VII, § 40-14(A) (2009) (stating that drill and operation sites must be "promptly" cleared of "all litter, trash, waste and other substances used, allowed, or occurring in the operations," and that the property be leveled, graded and restored after abandonment "to the same surface conditions as nearly as possible as existed before operations."). *See also id.* ch. 40, art. VIII, § 40-18(A) (stating that that "[w]henver abandonment occurs pursuant to the requirements of the Railroad Commission, the Operator so abandoning shall be responsible for the restoration of the well site to its original condition as nearly as practicable, in conformity with the regulations of this Chapter.").

<sup>477</sup> *Id.* ch. 40, art. VIII, § 40-15(A)(34).

<sup>478</sup> *See id.* (discussing the procedure for taking soil samples, but not explaining how to evaluate results).

<sup>479</sup> *See, e.g.,* SOUTHLAKE, TEX., CODE OF ORDINANCES ch. 9.5, art. IV, div. 2, § 9.5-242(fff)(6) (2011) (requiring remediation only when soil samples contain a "prohibited amount (pursuant to federal or state law) of a hazardous substance").

<sup>480</sup> SOUTHLAKE, TEX., CODE OF ORDINANCES ch. 9.5, art. IV, div. 2, § 9.5-247(d) (2011).

<sup>481</sup> *Id.* § 9.5-242(fff)(5).

<sup>482</sup> *Id.* § 9.5-242(fff)(c).

<sup>483</sup> *See id.* (referencing TCEQ and EPA protocols generally, but not identifying specific relevant requirements).

<sup>484</sup> *See* 16 TEX. ADMIN. CODE § 3.30(b)(2)(A) (2013); TEX. HEALTH & SAFETY CODE § 361.025 (1989); 16 TEX. ADMIN. CODE § 3.14(d)(1)–(2) (2013).

<sup>485</sup> FORT WORTH, TEX., ORDINANCE 16986-06-2006 § 15-45(B)(7), (C)(3) (2006).

over an abandoned well.<sup>486</sup> Southlake also requires a permanent marker at the location of the well site.<sup>487</sup> Southlake further requires that the abandoned sites be marked on the city's land-use map,<sup>488</sup> and restricts structures from being built closer to an abandoned well than "permitted pursuant to state law."<sup>489</sup> Again, however, the ordinance does not identify the state standards, if any, to which it is referring.<sup>490</sup>

Some cities require groundwater sampling before and after operations if gas wells are located within a certain distance of water wells. Distance standards vary.<sup>491</sup> Fort Worth prohibits drilling within 200 feet of a water well and requires pre-drilling and post-drilling "water analysis" and flow rate.<sup>492</sup> The Town of Euless also prohibits drilling within 200 feet of a freshwater well, but requires pre- and post-drilling sampling for all water wells with 500 feet of a gas well.<sup>493</sup> Flower Mound generally requires that drilling set back 1500 feet from any existing fresh water well<sup>494</sup> and requires a third party contractor to evaluate water analysis and flow rate for any well drilled within the setback area.<sup>495</sup>

Local groundwater sampling standards also vary as to the scope of chemicals of concern. The City of Euless specifically requires testing for "methane, chloride, sodium, barium and strontium."<sup>496</sup> Flower Mound requires testing for "methane, chloride, sodium, barium, and strontium, [TPH], [VOCs], ethene and ethane."<sup>497</sup> Neither of these ordinances identifies pollutant levels that will be of public health concern, or the consequences that will result if water quality testing reveals problems.<sup>498</sup> Interviews with planners in Fort Worth and Flower Mound revealed that gas industry operations had never been located in close enough proximity to water wells to trigger application of the ordinance.<sup>499</sup> Planners in those communities do

---

<sup>486</sup> *Id.* § 15-45(D).

<sup>487</sup> SOUTHLAKE, TEX., CODE OF ORDINANCES ch. 9.5, art. IV, § 9.5-247(a) (2011).

<sup>488</sup> *Id.* § 9.5-247(g).

<sup>489</sup> *Id.* § 9.5-247(b).

<sup>490</sup> *See id.* (referencing state law generally, but not identifying specific requirements).

<sup>491</sup> DALLAS GAS DRILLING TASK FORCE, *supra* note 439, at 31–33.

<sup>492</sup> FORT WORTH, TEX., ORDINANCE 16986-06-2006 § 15-42(A)(16) (2006).

<sup>493</sup> EULESS, TEX., CODE OF ORDINANCES ch. 40, art. VIII, § 40-15(a)(18) (2009).

<sup>494</sup> FLOWER MOUND, TEX., CODE OF ORDINANCES ch. 34 art. VII, div. 5, § 34-422(d)(1)(h) (2011).

<sup>495</sup> *Id.* div. 7, § 34-427(a)(19)(a).

<sup>496</sup> EULESS, TEX., CODE OF ORDINANCES ch. 40, art. VIII, § 40-15(a)(18)(2009).

<sup>497</sup> FLOWER MOUND, TEX., CODE OF ORDINANCES ch. 34 art. VII, div. 7, § 34-427(a)(19)(b)(3) (2011).

<sup>498</sup> *See id.* § 34-427. *See also* EULESS, TEX., CODE OF ORDINANCES ch. 40, art. VIII, § 40-15(2009).

<sup>499</sup> Interview with Tom Edward, Senior Gas Well Inspector, in Fort Worth, Tex. (Aug. 20, 2012); Interview with Rick Trice, Assistant Dir. of Planning & Dev. Dep't, Gas Well Div., in Fort Worth, Tex. (Aug. 2013); Interview with Mathew Woods, Dir. of Env'tl. Res., in Flower Mound, Tex. (Aug. 20, 2012); Interview with Jonathan Powell, Oil & Gas Inspector, in Flower Mound, Tex. (Aug. 20, 2012); Interview with Brandon Bammel, Env'tl. Review Analyst, in Flower Mound, Tex. (Aug. 20, 2012).

not have any data that would provide information on whether gas industry operations could have contaminated groundwater resources.<sup>500</sup>

Southlake's ordinance requires pre- and post-drilling sampling, not only for water wells, but also for streams, ponds, and wetlands within 2000 feet of a gas well.<sup>501</sup> Southlake requires quarterly testing until abandonment of all gas wells at a pad site and provides that the testing parameters will be determined by the City as part of a "continuous water testing plan" that will, "at a minimum," include: "volatile organic compounds, total petroleum hydrocarbons, semi-volatile organic compounds, total dissolved solids, total suspended solids, methane, ethane, ethene, sulfate, glycols, chloride, hexavalent chromium, sodium, barium, strontium, and turbidity."<sup>502</sup> All costs related to water sampling and monitoring equipment operation must be borne by the operator of the well.<sup>503</sup> The Southlake ordinance also requires the addition of "non-radioactive tracing or tagging additives" in the fracturing fluids that may allow for chemical identification at the time of inspection, but does not identify appropriate compounds or standards for these additives.<sup>504</sup> Depending on the results of an initial survey, Flower Mound may require an environmental plan to be prepared by a consultant of the town's choosing, while requiring the applicant to pay the fees.<sup>505</sup>

Several cities place restrictions on the type of additives that may be used in drilling fluids, but the ordinances tend to lack specificity. Dallas specifically prohibits "metal additives" in drilling fluids.<sup>506</sup> Euless and Flower Mound require that drillers use "low toxicity glycols, synthetic hydrocarbons, polymers, and esters,"<sup>507</sup> but provide no further guidance as to the compounds that would satisfy the requirement and do not specify procedures for review and approval.<sup>508</sup> Southlake's ordinance includes the same requirements for drilling fluids, but also requires that "[a]ppropriate green fluids shall be used to the extent possible."<sup>509</sup> The ordinance requires the applicant to provide a list of green compounds that will be employed in both the fracturing and drilling process,<sup>510</sup> and allows only "appropriate

---

<sup>500</sup> Interview with Tom Edward, *supra* note 499; Interview with Rick Trice, *supra* note 499; Interview with Matthew Woods, *supra* note 499; Interview with Jonathan Powell, *supra* note 499; Interview with Brandon Bammel, *supra* note 499.

<sup>501</sup> SOUTHLAKE, TEX., CITY CODE ch. 9.5, art. IV, § 9.5-242(gg) (2011).

<sup>502</sup> *Id.*

<sup>503</sup> *Id.*

<sup>504</sup> *Id.* § 9.5-244, 9.5-245.

<sup>505</sup> FLOWER MOUND, TEX., CODE OF ORDINANCES art. VII, div. 5, § 34-421(d)(33) (2002).

<sup>506</sup> See DALLAS GAS DRILLING TASK FORCE, *supra* note 439, at 8 (comparing Dallas, Southlake, Grand Prairie, and Fort Worth).

<sup>507</sup> EULESS, TEX., CODE OF ORDINANCES no. 1852, art. VIII, § 40-15(a)(8) (2009); FLOWER MOUND, TEX., CODE OF ORDINANCES art. VII, div. 7, § 34-427(a)(8) (2011).

<sup>508</sup> See EULESS, TEX., CODE OF ORDINANCES no. 1852, art. VIII, § 40-15 (2009); FLOWER MOUND, TEX., CODE OF ORDINANCES art. VII, div. 5, § 34-421 (2011).

<sup>509</sup> SOUTHLAKE, TEX., CODE OF ORDINANCES ch. 9.5, art. IV § 9.5-242(gg) (2011) (emphasis added).

<sup>510</sup> *Id.* § 9.5-234(b)(50).

green compounds as approved by the city council.”<sup>511</sup> Southlake also prohibits the use of organic solvents, such as trichloroethylene and carbon tetrachloride, for cleaning components of the drilling rig, platform, associated equipment, tools, or pipes<sup>512</sup> and mandates the use of lead-free, biodegradable pipe dope.<sup>513</sup>

#### IX. CONCLUSION

Although the gas industry is quick to claim that there are no proven cases of groundwater contamination related to hydraulic fracturing for natural gas production,<sup>514</sup> local concerns are far more complicated. Surface contamination and the attendant risk to ground and surface waters cannot be denied. Yet, a close review of federal and state regulatory provisions related to chemical reporting, monitoring, disclosure, tracking, and cleanup reveal a fundamental problem: quality monitoring data is scarce. Without adequate data and analysis, we cannot fully evaluate the impact of gas industry operations. As a result of trade secrets exceptions, the full scope of chemicals associated with the industry cannot even be identified.

Existing public disclosure requirements in Texas are of limited effectiveness in advancing the state of knowledge of the potential public health and environmental hazards of gas industry operations. The Texas disclosure rule applies only to new wells and only to fracking fluid, not drilling fluids, chemical solvents, and cleaning fluids. Full disclosure is required only for those fracking chemicals identified as hazardous by OSHA, a list which OSHA itself acknowledges is wholly inadequate. Where trade secrets are at issue, the industry need only disclose very limited information, and only to the RRC. Yet the RRC is not in the business of evaluating chemical toxicity. There are exceptions requiring disclosure of trade secrets to emergency medical personnel, but none allowing disclosure to toxicologists or epidemiologists to conduct sampling; assess hazards, protective measures, or engineering controls; or to conduct studies to determine health effects. There are no requirements for disclosure of the chemical composition of drilling or fracking chemicals spilled on property that have not (yet) resulted in identifiable health effects. Only a state agency or nearby landowners may challenge a claim of trade secret protection. Moreover, pursuant to the statutory scheme in Texas, any assessment as to the need to protect trade secrets is based only on consideration of industry concerns, with no weighing of the public interest.

Even those toxic chemicals that we already know to be associated with gas industry operations may not be detected by limited water quality

---

<sup>511</sup> *Id.* § 9.2-242(t).

<sup>512</sup> *Id.* § 9.5-242(mm).

<sup>513</sup> *Id.* § 9.5-242(oo).

<sup>514</sup> See, e.g., Ed Ireland, *GAO Report Finds No Evidence That Fracking Contaminates Groundwater*, <http://barryonenergy.wordpress.com/2013/06/14/gao-report-finds-no-evidence-that-fracing-contaminates-groundwater/> (last visited Feb. 22, 2014).

monitoring systems. Lists of monitored and regulated chemicals are short and dated. There is no comprehensive or even cohesive approach to monitoring groundwater for industrial chemicals in Texas. Given the difficult burden of proof, common law is also unlikely to serve as a reliable vehicle to identify contamination and hold industry accountable. The difficulty of toxic tort litigation, the ad hoc nature of litigation, and the veil of secrecy following settlement agreements requiring confidentiality all argue in favor of strong regulations governing gas industry operations.

Gas industry operations are largely exempt from federal regulations and generally fall outside the jurisdiction of the state's primary environmental agency. The industry is subject instead to regulation by a notoriously weak regulatory agency with vague standards reminiscent of early environmental laws known to be largely ineffective. The Texas RRC minimally supervises land disposal with no clear standards for regulatory review. In some cases, the RRC allows the industry to bypass even the minimal requirement of a permit. There is no clear threshold for reporting spills or cleanup standards for fracking and drilling fluids. The agency is understaffed and underfunded. There is no manifest system tracking waste from the point of origin to the point of disposal, as there would be if gas industry operations were subject to RCRA. Moreover, there is uncertainty as to whether chemicals that do arrive at their intended destination truly belong in municipal solid waste facilities. In sum, there is a significant risk that toxic chemicals may enter surface waters, contaminate soil, and make their way into groundwater supplies.

Given limited state and federal water quality monitoring, especially for groundwater resources, local governments may want to consider significant monitoring requirements before and after drilling, fracking, and production to assess ground water, surface water, and soil conditions. Local governments have generally recognized the importance of well water monitoring, but might want to consider adopting more extensive monitoring of groundwater resources, as well as extending programs to evaluate surface water resources and other sensitive environmental areas as has been done in Southlake. Texas cities might also consider the regulatory approach taken in Pennsylvania. Pennsylvania reverses the burden of proof by creating a rebuttable presumption that the well operator caused the contamination within 1000 feet of the well and requires the operator to replace water supplies.<sup>515</sup> Operators must ensure that the new supply is as "reliable" and "permanent" as the previous water supply, and that it does not require "excessive maintenance."<sup>516</sup> The law also requires industry to provide "plumbing, conveyance, pumping or auxiliary equipment and facilities necessary for the water user utilize the water supply."<sup>517</sup>

It is difficult to track chemicals back to their source once released into the environment, especially if EPA does not have authority to order the

---

<sup>515</sup> 58 PA. CONS. STAT. ANN. § 3218(c)-(c.1) (West 2013).

<sup>516</sup> 25 PA. CODE § 78.51 (2011).

<sup>517</sup> *Id.*

industry to undertake tracking and monitoring studies as argued in the *Range* case. Like Southlake, other cities might consider requiring tracer chemicals. EPA recently explored tracer chemical options at a technical conference.<sup>518</sup> A recent *New York Times* article noted two recent nonradioactive tracer options that are currently under development and may be viable in the future.<sup>519</sup> One approach uses nontoxic, noninvasive nanoparticles to fingerprint a single well source, so the exact location of a release could easily be determined by lab study.<sup>520</sup> The second approach relies on inert DNA material. Only a thimble full of material would be required for millions of gallons of fluid.<sup>521</sup> Both nonradioactive options are undergoing field testing in 2013.<sup>522</sup> Perhaps the best approach at this time is to follow the Southlake example and allow industry to identify viable tracing compounds.

Especially given vague reporting standards and record keeping at the RRC,<sup>523</sup> local governments should consider adopting clear standards and maintaining full records of leaks, spills and malfunctions to encourage responsible industry practices. Following the stronger RCRA model, cities could consider requiring operators to deliver manifests to the city that document each stage of transportation to reduce the risk of illegal dumping. Local governments could also follow the EPCRA approach and require reporting to a publicly assessable database on the presence and amount of toxic chemicals at every site, all waste treatment and disposal methods, the efficacy of those methods, and the quantity of the toxic chemical entering the environment.

Despite the State's assurances, dilution may not be a solution to the highly toxic chemicals, including the RCRA-listed wastes that have been associated with gas industry operations. As recognized in the RCRA regulatory program, restricting land disposal is critical to protecting groundwater supplies. Many local governments have already banned land disposal and waste pits. Because effective enforcement is difficult and expensive, cities may also want to consider following the Southlake approach of prohibiting all pits, including freshwater pits, or consider

---

<sup>518</sup> AVNER VENGOSH ET AL., DUKE UNIV., NEW ISOTOPIC TRACERS FOR SHALE GAS AND HYDRAULIC FRACTURING FLUIDS (2013), available at <http://www2.epa.gov/sites/production/files/documents/vengosh.pdf>.

<sup>519</sup> Andrew Revken, *Ideas to Watch in 2013: Traceable Gas-Drilling Fluids*, N.Y. TIMES, Jan. 8, 2013, [http://dotearth.blogs.nytimes.com/2013/01/08/ideas-to-watch-in-2013-traceable-frackin-fluids/?\\_r=0](http://dotearth.blogs.nytimes.com/2013/01/08/ideas-to-watch-in-2013-traceable-frackin-fluids/?_r=0) (last visited Feb. 22, 2014).

<sup>520</sup> *Id.*

<sup>521</sup> *Id.*

<sup>522</sup> *Id.*

<sup>523</sup> As discussed in Part VI, oil and gas operators are required by the RRC to give immediate notice of a fire, leak, spill, or break to the district office, except in the case of "oil loss" where the threshold is five barrels, there is no definition of the quantity of spill that must be reported and the RRC maintains records only for those violations that led to an enforcement action. See R.R. Comm'n of Tex., *Accident Reporting*, <http://www.rrc.state.tx.us/safety/pipeline/accident.php> (last visited Feb. 22, 2014); 16 TEX. ADMIN. CODE § 3.20(b) (1976); Wiseman, *supra* note 351, at 378.

devoting enforcement resources to ensuring that those pits are not diverted for waste storage.

Given the potential for leaks, spills, and other accidents, contaminated soil will remain a concern and may threaten redevelopment if gas industry sites are later converted to sensitive uses like residential areas or schools. Cities could look to the Texas Voluntary Cleanup Programs' Risk Reduction Rules (TRRP) for guidance in establishing cleanup standards.<sup>524</sup> Property owners who did not contribute to contamination and who voluntarily participate in this program receive guidance in meeting obligations to avoid CERCLA liability and receive a release of liability from the State in exchange for a successful cleanup.<sup>525</sup> The TRRP establishes contaminant levels for many classes of pollutants (including over 675 contaminants) based on current land use.<sup>526</sup> Pursuant to this approach, if a site is limited to industrial use in the future, lower standards would be applied than where the expected future use is residential.<sup>527</sup> As these guidelines are familiar to Texas geosciences and environmental engineering firms, reliance on these standards, at least as a starting point, would lower transaction costs for natural gas firms.

Local government may also want to consider prohibiting both wells and equipment in the floodplain, especially where waterways lead to surface drinking water supplies. Drilling and fracking fluids include known toxic chemicals, including endocrine-disrupting chemicals that may be problematic at minute levels of exposure and for which there may be no state or federal standards. Significant setbacks would be prudent given that floodwater and stormwater management controls are subject to failure. It would not be unprecedented to consider using the 500 year floodplain as the regulatory benchmark to protect the floodplain from hazardous chemicals. Harris County, Texas, for example, requires critical facilities, including commercial installations that produce, use or store hazardous materials or hazardous waste, to locate, whenever possible, outside the 500-year floodplain.<sup>528</sup>

---

<sup>524</sup> See generally R.R. Comm'n of Tex., *Voluntary Cleanup Program*, <http://www.rrc.state.tx.us/environmental/environsupport/voluntarycleanup.php> (last visited Feb. 22, 2014) (describing the nature of the Voluntary Cleanup Program); TCEQ, *Voluntary Cleanup Program*, <http://www.tceq.state.tx.us/remediation/vcp/vcp.html> (last visited Feb. 22, 2014) [hereinafter RRC Voluntary Cleanup Program]. This program is available if the State has not pursued a response action pursuant to CERCLA. See also TCEQ & EPA, MEMORANDUM OF AGREEMENT BETWEEN THE TEXAS NATURAL RESOURCE CONSERVATION COMMISSION AND THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, REGION 6 at 3–4 (1996), available at <http://www.tceq.texas.gov/assets/public/remediation/vcp/moa.pdf>.

<sup>525</sup> See *Voluntary Cleanup Program*, *supra* note 524; TCEQ & EPA *supra* note 524, at 5; TCEQ, TCEQ REGULATORY GUIDANCE: LAND USE CLASSIFICATION 1–2 (2008), available at [http://www.tceq.texas.gov/publications/rg/rg-366\\_trrp\\_07.html/at\\_download/file](http://www.tceq.texas.gov/publications/rg/rg-366_trrp_07.html/at_download/file).

<sup>526</sup> See REMEDIATION DIV., TCEQ, TIERED DEVELOPMENT OF HUMAN HEALTH PCLS 6 (2013); REMEDIATION DIV., TCEQ, LAND USE CLASSIFICATION 10 (2008).

<sup>527</sup> See LAND USE CLASSIFICATION, *supra* note 526, at 4.

<sup>528</sup> ENG'G DIV., HARRIS COUNTY PUB. INFRASTRUCTURE DEP'T, REGULATIONS OF HARRIS COUNTY, TEXAS FOR FLOODPLAIN MANAGEMENT 22 (2007), available at [http://hcpid.org/permits/docs/FP\\_](http://hcpid.org/permits/docs/FP_)

Given the toxicity of chemicals that have been identified, the uncertain effects of others, and the potential for release into the environment, chemicals like MTBE may contaminate soil and make their way into water supplies. If gas industry wastes make their way into drinking water supplies, local governments also serving as water suppliers could in the future find themselves facing significant costs to remove chemicals from drinking water. Given vague standards and a dismal enforcement record, local governments cannot rely on the State to protect its citizens from the economic and environmental hazards of fracking in urban areas. The State does not require testing to establish baseline conditions, has only limited information on the toxicity and range of chemicals employed, does not aggressively enforce its standards, and reports only those spills that lead to an enforcement action.

Allowing gas industry operations in sensitive urban areas carries a heightened risk of problems deserving of significant regulatory attention. Cities working to establish regulatory standards are faced with a very difficult task given the limited guidance at the state and federal level and the limited scientific knowledge in the area of chemical toxicity. Ideally, a consortium of fracking interests—ranging from industry firms, environmental, and public health organizations—would convene and proactively stipulate best practices and standards, modeling perhaps the approach of the U.S. Green Building Council that established green building management and operations for existing buildings to get LEED certification.<sup>529</sup> Clearly, the first step would be to start by demanding full disclosure of the chemicals employed in gas industry operations.

A constitutional taking challenge may be inevitable, but it is not clear that industry's property rights claims will trump public health concerns. Even if a court were to decide that trade secrets deserved protection as property rights in Texas, the Takings Clause generally requires weighing the importance of the public interest in deciding whether there is a taking of private property.<sup>530</sup> Especially in the context of fracking in urban areas, the public interest ought to weigh heavily in the balance. At a bare minimum, as OSHA has recognized,<sup>531</sup> exceptions to trade secret claims that would allow for disclosure to toxicologists or epidemiologists to conduct studies to assess hazards and potential health effects should be considered. To spread

---

floodplain\_regs.pdf (stating in section 4.05(d)(2) that toxic substances are not to be released into floodwaters).

<sup>529</sup> This best practice guide was a collaboration of many government and industry organizations, such as the International Facility Management Association (IFMA), U.S. Department of Interior, U.S. General Services Administration, UNICCO Service Company, University of California–Santa Barbara, and Industrial Ecology Co. LLC, among others. U.S. GREEN BUILDING COUNCIL, LEED 2009 FOR EXISTING BUILDINGS AND OPERATIONS MAINTENANCE i, ii-v (2013) *available at* [http://www.usgbc.org/sites/default/files/LEED%202009%20RS\\_EBOM\\_07.01.2013\\_current.pdf](http://www.usgbc.org/sites/default/files/LEED%202009%20RS_EBOM_07.01.2013_current.pdf).

<sup>530</sup> *Agins v. City of Tiburon*, 447 U.S. 255, 261 (1980) (“[T]he question [of when a taking has occurred] necessarily requires a weighing of public and private interests.”).

<sup>531</sup> *See* 29 C.F.R. § 1910.1200(i)(3) (2012).

the potential cost of litigation, localities could consider banding together, each adopting full disclosure requirements, and all agreeing to all support any litigation that may follow.

Of course, any local effort is only a partial solution as even home-rule local governments have authority only within the city limits and extra-territorial jurisdiction, which is unlikely to extend throughout the local watershed, groundwater aquifer area, or the zone from which municipal water supplies are sourced.<sup>532</sup> Given also the limited authority of counties in Texas,<sup>533</sup> in addition to establishing strong regulatory programs, local governments should work together to encourage further legislative action at the state and federal level.

---

<sup>532</sup> See Terrence S. Welch, *Containing Urban Sprawl: Is Reinvigoration of Home Rule the Answer*, 9 VT. J. ENVTL. L. 131, 144 n.48 (2007) (describing home rule and general law cities in Texas, and concluding that the distinction is not radically different since section 51.001 of the Texas Local Government Code allows all municipalities, whether general law or home rule, to adopt ordinances, rules, or police regulations that are “for the good government, peace, or order of the municipality or for the trade and commerce of the municipality; and [are] necessary or proper for carrying out a power granted by law to the municipality or to an office or department of the municipality.”).

<sup>533</sup> See generally HOUSE RESEARCH ORG., TEX. HOUSE OF REPRESENTATIVES, DO COUNTIES NEED NEW POWERS TO COPE WITH URBAN SPRAWL? (2002), available at <http://www.hillcountryalliance.org/uploads/HCA/caurbansprawl.pdf>.

200

*ENVIRONMENTAL LAW*

[Vol. 44:135

\*\*