

# FRACKING AND THE FOOD SYSTEM



ISSUE BRIEF • JULY 2016

The oil and gas industry likes to promote fracking as a boon to farmers and rural communities, but the dream often turns into a nightmare. In the United States, fracking has polluted water wells, sickened people and livestock, and reduced available farmland — proving that fracking and a healthy food system are not compatible.

Fracking takes place primarily in rural agricultural areas, and many US farmers have leased their land to the oil and gas industry. Since the fracking boom emerged a few years ago, there have been countless negative impacts on the food system. Fracking fluid spills have sickened and killed livestock and contaminated cropland across the country.<sup>1</sup> These incidents go hand-in-hand with fracking, hurting farmers and affecting consumer confidence in the food produced in these areas. Furthermore, fracking consumes an enormous amount of water and also releases methane, a greenhouse gas,<sup>2</sup> which fuels climate change that may strain future water availability in key agricultural regions.

Farmers, whose livelihoods depend on the health of the land, face especially stark choices. Many who own the rights to the oil and gas beneath their land have leased it to drilling companies for the promise of royalty payments, which they can use to pay down debt or invest in their farming operations. Others who own or rent the surface land but not the minerals beneath have seen well pads, roads and pipelines cross their land with no compensation or recourse. Either way, the problems that fracking brings to communities — competition for land and water, environmental damage, human health impacts — far outweigh fracking's economic benefits, and persist long after the drilling companies leave.

## Effects on Agriculture

### *Water Contamination*

There are numerous documented cases of fracking contaminating drinking water sources.<sup>9</sup> A draft study by the US Environmental Protection Agency (EPA) surveyed several incidents across the United States. Fracking fluid spills at drilling sites have reached surface water. Poorly constructed wells have allowed natural gas to infiltrate aquifers. Faulty pipelines have spilled toxic wastewater into surface and ground water sources.<sup>10</sup> In some regions, contamination may be widespread. In a Texas study, nearly 70 percent of tested water wells located near an oil or gas well tested positive for chemicals associated with exploration, suggesting that drilling may have led to contamination.<sup>11</sup>

This is problematic because nearly all rural residents in the United States rely on groundwater for their drinking water, and many farmers also use it to irrigate crops and raise livestock.<sup>12</sup> Contaminated groundwater not only puts these communities' health in jeopardy, but also impacts their livelihoods. There have been many instances where groundwater contaminated by fracking poisoned livestock, causing illness, reproductive issues and death.<sup>13</sup> However, there are no common procedures for isolating livestock exposed to chemicals

## What Is Fracking?

“Fracking” is short for hydraulic fracturing, the process of injecting a mix of water, sand and chemicals into wells at high pressure to crack rock formations that hold oil or natural gas. Often combined with horizontal drilling techniques, fracking is used to extract oil and gas from shale and other “tight” rock formations.

Fracking companies use hundreds of thousands to millions of litres of water to frack a single well.<sup>3</sup> For decades, companies have experimented with chemical additives to maximise oil and gas production. Fracking generates enormous volumes of salty, radioactive wastewater that can be difficult and costly to dispose of.<sup>4</sup>

from the food chain; the animals might be quarantined or not slaughtered for human consumption, but dead animals sent to a rendering plant could be used for livestock or pet feed.<sup>14</sup>

An overview of livestock exposure to fracking fluids found that the most common exposure came from contaminated wells and springs.<sup>15</sup> Cows exposed to fracking fluids have experienced difficulty breeding and higher rates of stillborn and deformed calves.<sup>16</sup>

In two cases, only part of a herd of beef cattle was exposed to fracking wastewater. In each case, many of the exposed cattle died, and those that survived experienced problems breeding, whereas the unexposed cattle experienced no unusual problems. According to researchers, these two cases “approach the design of a controlled experiment, and strongly implicate wastewater exposure in the death, failure to breed, and reduced growth rate of cattle.”<sup>17</sup>

Pets are also victims. In Pennsylvania, a two-year-old boxer dog had to be euthanised after lapping up fracking wastewater that was intentionally spread on the nearby road.<sup>18</sup>

Frustratingly, without baseline testing of water wells *before* drilling takes place, it is difficult for farmers to prove that drilling contaminated their water.<sup>19</sup> Baseline testing is not necessarily required by drilling companies, and adequate testing is expensive for farmers to conduct themselves.<sup>20</sup> Additionally, there are at least 692 unique ingredients that have been used in fracking fluids,<sup>21</sup> but baseline tests typically only screen for a limited number of contaminants associated with drilling.<sup>22</sup>

### Air Pollution

Drilling, fracking, venting, flaring, wastewater storage and other activities at well sites generate hazardous air pollution. One peer-reviewed study analysed air samples near fracking sites in five US states; nearly 40 percent of samples tested positive for toxic chemicals, such as cancer-causing benzene or formaldehyde, above federal safety standards.<sup>23</sup> Hydrogen sulfide, a deadly gas, was found at levels up to hundreds of times what is considered to be life-threatening.<sup>24</sup>

Studies have long noted concerns related to the effects of toxic emissions associated with oil and gas activities on

livestock, including a 2001 study that linked flaring with stillbirths and calf mortality among cattle.<sup>25</sup> Fracking is bringing these and other airborne health risks to new regions. In December 2015, six cows were found dead together inside the Cimarron National Grasslands in Kansas, which also houses an oil field with fracking wells.<sup>26</sup> A seventh cow died apart from the group, and a veterinarian confirmed that the cows died from toxic inhalation.<sup>27</sup> The Grasslands issued an emergency closure on four sections of the park while they investigated the incident.<sup>28</sup> This investigation may provide evidence of toxic air pollution associated with fracking.

Fracking also contributes to ground-level ozone (the main component of smog), which can cause respiratory issues, especially among sensitive populations such as those with asthma.<sup>29</sup> Fracking has caused ozone levels to spike in some rural areas of the United States — at times exceeding those of smoggy urban areas like the Los Angeles Basin.<sup>30</sup> Ozone pollution also reduces crop yield and makes plants more susceptible to disease.<sup>31</sup> According to the US Department of Agriculture (USDA), “ground-level ozone causes more damage to plants than all other air pollutants combined”.<sup>32</sup>

### Agricultural Production and Farmer Livelihood

The rise of fracking in the Marcellus Shale region of Pennsylvania correlates with a sharper decline in dairy farming. A Penn State Extension study found that in counties with more than 10,000 dairy cows in 2007, those with more than 150 Marcellus Shale wells experienced a 16.3 per cent decline in total dairy cows on average between 2007 and 2010, compared to a 2.7 per cent increase in cows in counties with no Marcellus wells.<sup>34</sup> Researchers speculate a variety of explanations, from farmers using their royalty monies to retire, to farmers feeling “forced out” due to the negative effect of wells. Regardless of the reason, a decline in dairy herds may have a negative economic impact on neighbouring communities.<sup>35</sup>

Farmers also compete with oil companies for water and other agricultural inputs, including in the semi-arid US West, where water is already scarce.<sup>36</sup> Using the FracFocus database, the US EPA estimated that the fracking industry used an average of 166 billion litres of water annually between 2011 and 2012.<sup>37</sup> (The actual volume is likely higher because

### But Isn't Natural Gas a “Bridge Fuel”?

The fracking industry and its supporters have long touted natural gas as a “bridge fuel” to a future powered by renewable energy, since burning natural gas releases less carbon dioxide than burning oil or coal.<sup>5</sup> However, studies suggest that an abundance of natural gas may increase consumption of the gas, potentially negating these climate benefits.<sup>6</sup> Additionally, natural gas is mostly methane, a potent greenhouse gas. Methane emissions from fracking can offset reductions in carbon dioxide that come from burning natural gas instead of oil or coal.<sup>7</sup> The “bridge fuel” theory may sound promising, but in reality, the industry wants to maintain our dependence on natural gas.<sup>8</sup>

not all states require companies to report to FracFocus.) Farmers can also face increased costs for inputs like land and labour due to increased competition with the drilling industry.<sup>38</sup>

Fracking also reduces available farmland. In the Marcellus gas fields of Pennsylvania, well pads and supporting infrastructure (including roads and pipelines) have an estimated footprint of 3.6 hectares per well.<sup>39</sup> When this infrastructure covers farmland, it limits the available space for growing crops and raising livestock.

Oil and gas drilling wastewater is increasingly being used to irrigate crops, including in California where water is scarce. In 2014, half the water used on more than 18,000 hectares in one agricultural region in California was supplied by oil companies.<sup>40</sup> California regulations require wastewater to be treated before use as irrigation, but do not address drilling wastewater specifically.<sup>41</sup> Studies have shown that drilling chemicals can persist in wastewater even after treatment; one study detected methylene chloride — a toxic chemical that affects the nervous system — in treated wastewater at 5 to 11 times the allowed limit in drinking water.<sup>42</sup>

In April 2015, the Central Valley Regional Water Quality Control Board ordered drilling companies with wastewater ponds to test for chemicals related to drilling and to disclose the results to state regulators.<sup>43</sup> One test sample from a Chevron wastewater pond detected benzene, a cancer-causing component of crude oil, at levels nearly 500 times California's allowed limit in drinking water.<sup>44</sup> However, in other parts of California, irrigation with fracking wastewater may be occurring without additional testing. The extent to which contaminants in the wastewater are being absorbed by plants and entering the food chain remains unknown.

Fracking wastewater is full of toxic materials and salt, and surface spills can be deadly to vegetation.<sup>45</sup> One North Dakota farmer notes that the industry's wastewater spill from over 50 years ago contaminated 32 hectares of her land, and that land remains unproductive to this day.<sup>46</sup>

### **Farmer Profile:**

#### **"We're living in the middle of hell."**

Steve and Jacki Schilke's cattle ranch is situated in the heart of the North Dakota fracking boom. Since 2008, dozens of fracking wells were drilled within 4.8 kilometres of the Schilke ranch, and the industry also built a waste disposal pit near the family's home. The Schilke's watched their dog and cattle fall ill, and Jacki herself began to suffer health issues. The state health department found a toxic chemical in their well water, and independent air testing found toxic chemicals in the air, both of which likely contributed to these health issues. The couple began shooting their sick cows to avoid sending potentially contaminated animals to market, hurting their ranch income.<sup>33</sup>

Agricultural products from California eventually also find their way to European consumers. Mainly almonds, but also wine, pistachios, walnuts and raisins are exported to EU member states, especially to Germany, Spain and the UK.<sup>47</sup> No fewer than one-third of California's almond exports are destined for the EU.<sup>48</sup>

### **Transportation**

Communities living near oil and gas patches know how drilling booms significantly increase truck traffic. A synthesis of five national and regional studies found that each well development requires an average of 2,200 truck trips.<sup>49</sup> This contributes to traffic jams and wreaks havoc on roadways — as much as €11,000 to €20,000 in costs for each well, according to a Pennsylvania study.<sup>50</sup>

Farmers also compete with drilling companies for cargo shipping capacity. In North Dakota, the rise in oil transport by rail has caused a backlog in shipments of grain, costing farmers money when they cannot get their crops to market.<sup>51</sup>

### **Consumer Confidence**

As the public becomes increasingly aware of the dangers of fracking, people are more sceptical about consuming food from areas where intensive fracking is taking place. In 2015, a bill was introduced into the California legislature that would have required the labelling of food that was irrigated by oil and gas wastewater, but the bill died before making it to the floor.<sup>52</sup> Currently there is no requirement to label such crops, creating public concern over potential exposure to a host of toxic chemicals.<sup>53</sup>

Fracking also threatens consumer confidence in organic agriculture, as current USDA organic standards do not explicitly prohibit the use of fracking wastewater for irrigation.<sup>54</sup> This has raised concerns that some organic produce might be irrigated in fracking wastewater.<sup>55</sup>

Fracking companies are finding additional ways to infiltrate the food system. In February 2016, Antero Resources announced that it would begin deriving food-grade salt from fracking waste.<sup>56</sup> Such salt could contain radioactive materials and therefore be harmful to health.<sup>57</sup> However, table salt is considered safe by the US Food and Drug Administration (FDA) under the "Generally Recognized as Safe" rule, meaning that companies can process and market salt without FDA review.<sup>58</sup> A professor at the University of Cincinnati College of Law petitioned the FDA for an expert opinion in this matter, hoping that the agency will conclude that salt derived from fracking waste will have to undergo an FDA review before entering the market.<sup>59</sup>

### **Fracking Hurts Rural Communities**

When farmers and other rural landowners lease their land for fracking, the gains are temporary, while the damage can be long-lasting. Scenic vistas are replaced with a landscape of drilling pads, which harms tourism and recreation industries like hunting and fishing. Traffic accidents and fatalities double or even quadruple.<sup>60</sup> Home values sometimes increase but can also decline due to fears over contamination of private water sources.<sup>61</sup>

Even after weighing the additional revenue that drilling brings in, local communities sometimes suffer a net loss from oil and gas development.<sup>62</sup> This is because communities must improve roads and other infrastructure worn away by heavy use and also increase spending on emergency, sewer and social services.<sup>63</sup> Additionally, even when the local economy benefits from fracking, these benefits are not evenly distributed across the community, leaving some residents with increased economic insecurity.<sup>64</sup>

Fracking can also impact a farmer's ability to get financing and insurance. In 2013, Rabobank announced that it will no longer provide loans to farmers who have active shale gas leases, due to its policy of not investing in fossil fuel extraction with unknown risks.<sup>65</sup> In 2012, Nationwide Mutual Insurance (which provides agricultural insurance) issued a statement clarifying that "fracking-related losses have never been a covered loss under personal or commercial lines policies", citing the difficulties in assessing the risks associated with fracking.<sup>66</sup> Similarly, traditional homeowners' insurance doesn't cover earthquakes, a problem for residents of Oklahoma where fracking wastewater disposal is linked to a surge in earthquakes.<sup>67</sup> Even homeowners with earthquake insurance have had their claims denied when the earthquakes were assumed to be human-induced.<sup>68</sup>

Negative impacts are not isolated to communities with active oil and gas wells. Each well requires up to 9,000 tonnes

of sand for use in drilling, and frac sand mines exist in the upper US Midwest where fracking is not even taking place.<sup>69</sup> These mines can consume an enormous amount of water and expose nearby communities to harmful silica dust.<sup>70</sup>

Additionally, the United States is crisscrossed by 4 million kilometres of pipelines carrying oil, natural gas and other hazardous materials.<sup>71</sup> Accidents are occurring at a rate of nearly two per day,<sup>72</sup> putting farmland and drinking water in danger, including in areas without oil and gas drilling. In one major catastrophe in North Dakota, a pipeline spilled 3.8 million litres of fracking wastewater onto the Fort Berthold Indian Reservation.<sup>73</sup>

## Recommendations

The rapid expansion of oil and gas fracking in the United States has created significant environmental and public health problems. Many of these problems are inherent to the practice and cannot be avoided through regulation, which is why fracking should be banned.

Instead of believing the false promises of the oil and gas industry, we should invest in economic development in rural communities that safeguards our food and water. We should also develop policies that allow farmers to make a fair living farming on their land, rather than resorting to leasing their farms for polluting energy production.

## Endnotes

- 1 Bamberger, Michelle and Robert E. Oswald. "Impacts of gas drilling on human and animal health." *New Solutions*, Vol. 22, Iss. 1. 2012 at 55 to 59; Flesher, John. "AP exclusive: Drilling boom means more harmful waste spills." *Associated Press*. September 8, 2015.
- 2 Howarth, Robert W., Renee Santoro and Anthony Ingraffea. "Methane and the greenhouse-gas footprint of natural gas from shale formations." *Climatic Change*. Vol. 106. June 2011 at 688.
- 3 Gallegos, Tanya J. et al. "Hydraulic fracturing water use variability in the United States and potential environmental implications." *Water Resources Research*. Vol. 51, Iss. 7. July 2015 at 5841.
- 4 Rahm, B.G. et al. "Wastewater management and Marcellus Shale gas development: trends, drivers, and planning implications." *Journal of Environmental Management*. Vol. 120. May 15, 2013 at introduction.
- 5 Lowe, John E. Executive Vice President, Exploration and Production. ConocoPhillips. "Drilling for Answers: Oil Company Profits, Runaway Prices and the Pursuit of Alternatives." Testimony before the Select Committee on Energy Independence and Global Warming, US House of Representatives. April 1, 2008 at 14 and 17; Plumer, Brad. "Is fracking a 'bridge' to a clean-energy future? Ernest Moniz thinks so." *Washington Post*. March 4, 2013.
- 6 McJeon, Haewon et al. "Limited impact on decadal-scale climate change from increased use of natural gas." *Nature*. Vol. 514. October 23, 2014 at abstract.
- 7 Howarth, Santoro and Ingraffea (2011) at 687.
- 8 Ludlam, David. West Slope Colorado Oil & Gas Association. "Ludlam: Natural gas is more than 'bridge fuel' to future." *Houston Chronicle*. November 3, 2015; DeMarban, Alex. "Exxon Mobil, Conoco, BP explore Alaska LNG export project." *Alaska Dispatch News*. January 5, 2012.
- 9 US Environmental Protection Agency (US EPA). [External Review Draft]. "Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources." (EPA/600/R-15/047a.) June 2015 at ES-13 to ES-19; DiGiulio, Dominic C. and Robert B. Jackson. "Impact to underground sources of drinking water and domestic wells from production well stimulation and completion practices in the Pavillion, Wyoming, field." *Environmental Science & Technology*. Vol. 50, Iss. 8. March 29, 2016 at abstract.
- 10 US EPA (2015) at ES-13 to ES-19.
- 11 Hildenbrand, Zacariah et al. "A comprehensive analysis of groundwater quality in the Barnett Shale region." *Environmental Science & Technology*. Vol. 49, Iss. 13. June 16, 2015 at results and discussion.
- 12 Clark, D.W. and D.W. Briar. US Geological Survey (USGS). Water Resources Division. "What is Ground Water?" Open-File Report 93-643. Reprinted April 2001 at 1; Maupin, Molly A. et al. USGS. "Estimated Use of Water in the United States in 2010." Circular 1405. November 5, 2014 at 27 to 28.
- 13 Bamberger and Oswald (2012) at 55 to 59.
- 14 *Ibid.* at 64 and 67.
- 15 *Ibid.* at 59.
- 16 *Ibid.* at 60.
- 17 *Ibid.* at 60.
- 18 Bamberger, Michelle, and Robert Oswald. (2014). *The Real Cost of Fracking: How America's Shale Gas Boom Is Threatening Our Families, Pets, and Food*. Boston: Beacon Press at 34 to 36.
- 19 *Ibid.* at 49 to 50.
- 20 *Ibid.* at 27.
- 21 US EPA. "Analysis of Hydraulic Fracturing Fluid Data from the FracFocus Chemical Disclosure Registry 1.0." (EPA/601/R-14/003.) March 2015 at 2.
- 22 Bamberger and Oswald (2014) at 27.
- 23 Macey, Gregg P. et al. "Air concentrations of volatile compounds near oil and gas production: a community-based exploratory study." *Environmental Health*. Vol. 13, Iss. 82. October 30, 2014 at 5 to 8.
- 24 *Ibid.* at 8; Committee on Acute Exposure Guideline Levels et al. (2010). *Acute Exposure Guideline Levels for Selected Airborne Chemicals, Volume 9*. Washington, DC: The National Academies Press at 176.
- 25 Waldner, C.L. et al. "Associations between oil- and gas-well sites, processing facilities, flaring, and beef cattle reproduction and calf mortality in western Canada." *Preventative Veterinary Medicine*. Vol. 50, Iss. 1-2. July 19, 2001 at abstract; Coppock, R.W. et al. "Toxicopathology of oilfield poisoning in cattle: a review." *Veterinary and Human Toxicology*. Vol. 38, Iss. 1. February 1996 at abstract.
- 26 US Department of Agriculture (USDA). Forest Service. [Press release]. "Cimarron National Grassland implements emergency closure." January 6, 2016; Food & Water Watch analysis of FracFocus Chemical Disclosure

- Registry. Ground Water Protection Council and Interstate Oil and Gas Compact Commission. Available at <http://www.fracfocusdata.org/DisclosureSearch/>. Accessed April 19, 2016.
- 27 Bickel, Amy. "Cimarron National Grassland implemented emergency closure after cattle found dead." *Kansas Agland*. January 11, 2016.
  - 28 USDA (2016).
  - 29 US EPA. [Fact sheet]. "Ozone: Good up high, bad nearby." (EPA-451/K-03-001.) June 2003.
  - 30 Helmig, D. et al. "Highly elevated atmospheric levels of volatile organic compounds in the Uintah Basin, Utah." *Environmental Science & Technology*. Vol. 48, Iss. 9. March 13, 2014 at 4707.
  - 31 US EPA (2003).
  - 32 USDA. Agricultural Research Service. [Issue brief]. "Effects of ozone air pollution on plants." March 17, 2012.
  - 33 Gibson, James William. Earth Island Journal. "How the North Dakota fracking boom shook a family." *The Guardian*. December 4, 2012.
  - 34 Penn State Extension. [Fact sheet]. "Pennsylvania Dairy Farms and Marcellus Shale, 2007–2010." 2012 at 2.
  - 35 *Ibid.* at 4.
  - 36 Hitaj, Claudia, Andrew Boslett and Jeremy G. Weber. "Shale development and agriculture." *Choices*. Vol. 29, Iss. 4. 2014 at 1.
  - 37 US EPA (2015) at ES-6 to ES-7.
  - 38 Hitaj, Boslett and Weber (2014) at 3.
  - 39 Johnson, Nels. The Nature Conservancy – Pennsylvania Chapter. "Pennsylvania Energy Impacts Assessment. Report 1: Marcellus Shale Natural Gas and Wind." November 15, 2010 at 9 to 10.
  - 40 Harkinson, Josh. "These popular fruit and veggie brands may be grown with oil wastewater." *Mother Jones*. July 24, 2015.
  - 41 California Code of Regulations § 60304.
  - 42 Cart, Julie. "Central Valley's growing concern: Crops raised with oil field water." *Los Angeles Times*. May 2, 2015; US EPA Region 9. "Drinking Water Standards and Health Advisory Table." June 2007 at 20; US EPA. [Fact sheet]. "Methylene chloride (dichloromethane)." Revised January 2000.
  - 43 Amec Foster Wheeler Environment & Infrastructure, Inc. Prepared for Chevron U.S.A. Inc. "Technical Report: Wastewater Sampling." Project FR1416063A. June 15, 2015 at appendix A; Food & Water Watch staff interview with Holcomb, Ronald. Central Valley Regional Water Quality Control Board. April 14, 2016.
  - 44 *Ibid.* at table 2; US EPA Region 9 (2007) at 16; US Department of Health and Human Services. Agency for Toxic Substances and Disease Registry. [Fact sheet]. "Benzene - ToxFAQs™." (CS2499555-F.) August 2007 at 1 and 2.
  - 45 Vengosh, Avner et al. "A critical review of the risks to water resources from unconventional shale gas development and hydraulic fracturing in the United States." *Environmental Science & Technology*. Vol. 48, Iss. 15. March 7, 2014 at section 3.
  - 46 Gottesdiener, Laura. "In shadow of oil boom, North Dakota farmers fight contamination." *Al Jazeera America*. September 6, 2014.
  - 47 University of California, Agricultural Issues Center. "Estimating California's Agricultural Exports." Available at <http://aic.ucdavis.edu/pub/exports.html>. Accessed June 13, 2016.
  - 48 USDA Foreign Agricultural Service. "EU-28 Tree Nuts Annual 2015." September 22, 2015 at 3.
  - 49 Felsburg Holt & Ullevig. Prepared for Boulder County. "Boulder County Oil and Gas Roadway Impact Study." January 14, 2013 at 9 and 10.
  - 50 Joyce, Christopher. "With gas boom, Pennsylvania fears new toxic legacy." *National Public Radio*. May 14, 2012; McChesney, John. Rural West Initiative. Sanford University. "Feeling overwhelmed by pace of the oil boom, North Dakota residents want to hit the brakes." November 2, 2011; Abramzon, S. et al. "Estimating the consumptive use costs of shale natural gas extraction on Pennsylvania roadways." *Journal of Infrastructure Systems*. Vol. 20, Iss. 3. September 2014 at discussion.
  - 51 Nixon, Ron. "Grain piles up, waiting for a ride, as trains move North Dakota oil." *New York Times*. August 25, 2014.
  - 52 California State Legislature. ABX2-14. "Food labeling: Wastewater from oil and gas activities." 2015-16 Session.
  - 53 Harkinson (July 2015).
  - 54 7 U.S.C. § 205.602 (2003).
  - 55 Harkinson, Josh. "There might be fracking wastewater on your organic fruits and veggies." *Mother Jones*. August 20, 2015.
  - 56 Mezo, Ingrid. "FDA asked if fracking sludge can be processed into salt." *Food Chemical News*. March 10, 2016.
  - 57 *Ibid.*
  - 58 21 U.S.C. § 182.1 (1988).
  - 59 Mezo (2016).
  - 60 Clark, Megan. "Highway fatality rates quadruple over 10 years in oil-drilling states as heavy traffic slams roads." *International Business Times*. July 11, 2014.
  - 61 Muehlenbachs, Lucija, Elisheba Spiller and Christopher Timmins. "The housing market impacts of shale gas development." *American Economic Review*. Vol. 105, Iss. 12. 2015 at 3634.
  - 62 Cockerham, Sean. "Oil boom a loser for North Dakota cities, counties, study finds." *McClatchy DC*. September 9, 2015.
  - 63 *Ibid.*
  - 64 Schafft, Kai. Penn State University. Department of Education Policy Studies. "Busted amidst the boom: The creation of new insecurities and inequalities within Pennsylvania's shale gas boomtowns." Intended submission to *Social Problems*, February 2015 at 12 to 13.
  - 65 "Rabobank will not finance shale gas extraction." *Dutch News*. July 1, 2013.
  - 66 Nationwide Mutual Insurance. [Press release]. "Nationwide statement regarding concerns about hydraulic fracturing." July 13, 2012.
  - 67 National Association of Insurance Commissioners and the Center for Insurance Policy and Research. [Issue brief]. "Hydraulic fracturing (fracking)." December 25, 2015; Walsh, F. Rall, III and Mark D. Zoback. "Oklahoma's recent earthquakes and saltwater disposal." *Science Advances*. Vol. 1, Iss. 5. June 18, 2015 at discussion.
  - 68 Jones, Corey. "'Extraordinary denial rate' of 9 in 10 earthquake claims rattles Oklahoma Insurance Commissioner John Doak." *Tulsa World*. March 5, 2015.
  - 69 Minnesota Department of Natural Resources. Division of Lands and Minerals. [Fact sheet]. "Silica sands of Minnesota." March 2014 at 1 and 2.
  - 70 Minnesota Department of Health (MDH). [Fact sheet]. "Silica Sand Mining & Health." Updated June 2014; MDH. [Fact sheet]. "Silica Sand & the Environment." Updated June 2014.
  - 71 US Government Accountability Office. Report to Congressional Committees. "Pipeline Safety: Better Data and Guidance Needed to Improve Pipeline Operator Incident Response." (GAO-13-168.) January 2013 at highlights.
  - 72 US Department of Transportation. Pipeline and Hazardous Materials Safety Administration. Office of Pipeline Safety. Data & Statistics. "Pipeline Incident 20 Year Trends." Query conducted by Food & Water Watch on April 18, 2016.
  - 73 Wood, Josh. Associated Press. "Near spill, reservation wrestles with oil's impact." *Williston Herald*. July 14, 2014.

**Food & Water Europe** is a program of Food & Water Watch, Inc., a non-profit consumer NGO based in Washington, D.C., working to ensure clean water and safe food in Europe and around the world. We challenge the corporate control and abuse of our food and water resources by empowering people to take action and transforming the public consciousness about what we eat and drink.

Copyright © June 2016 by Food & Water Europe. All rights reserved.  
This issue brief can be viewed or downloaded at [foodandwaterwatch.org](http://foodandwaterwatch.org).

