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# Hydraulic Fracturing Wastewater: Making the Case for Treating the Environmentally Condemned

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## NOTES

# HYDRAULIC FRACTURING WASTEWATER: MAKING THE CASE FOR TREATING THE ENVIRONMENTALLY CONDEMNED

*Inessa Abayev**

## INTRODUCTION

The ever-expanding search for domestic energy supplies in the form of natural gas has fueled a stream of concerns about our greatest natural resource: water. That search has led to the proliferation of "hydraulic fracturing," or "hydrofracking" for short, a rapidly growing method of natural gas extraction in many parts of the country that has garnered a tremendous amount of attention over the past few years. Hydraulic fracturing is a drilling process in which a large-volume mixture of water, sand, and chemical additives are injected (or are pumped) deep underground[1] at high pressure,[2] the ultimate goal of which is to reach trapped pockets of natural gas in porous shale rock formations deep below the ground, and create fractures within the rock to open passages that will allow for gas to flow freely up through the well.[3] While hydrofracking is generally

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1. U.S. ENVTL. PROT. AGENCY, NATURAL GAS DRILLING IN THE MARCELLUS SHALE NPDES PROGRAM FREQUENTLY ASKED QUESTIONS 3 (2011), *available at* http://www.epa.gov/npdes/pubs/hydrofracturing_faq.pdf [hereinafter NPDES Frequently Asked Questions] (stating that the Marcellus Shale lies at depths of 5,000 to 9,000 feet).

2. *See* Joseph A. Dammel, *Notes from Underground: Hydraulic Fracturing in the Marcellus Shale*, 12 MINN. J.L. SCI. & TECH. 773, 774 (2011).

3. *Id.*

considered to be an economically profitable industry[4] that could lessen our dependence on foreign energy,[5] it has nonetheless been a hot button topic over the past few years as it involves potentially high health-related costs and other well-warranted concerns.

The federal government sets the floor for water standards and allows individual states to exercise primary domain of disposal regulations if they adopt the federal minimums or choose to raise the floor in their respective home states. With many states participating in this primacy program, wastewater disposal is most closely regulated on the state level.[6] State agencies carry a heavy burden with respect to this task: anywhere from 15% to 80% of the original fracking fluids return to the surface after natural gas recovery.[7] These contents must be disposed of safely under minimum federal, state and local laws.[8] Disposal practices are largely dependent on the particular geology of the region, flowback water quality, economic considerations, and state regulations (regulatory requirements), among other matters.[9] Wastewater disposal, therefore, varies

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4. *See, e.g.*, Hannah Wiseman, *Untested Waters: The Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation*, 20 FORDHAM ENVTL. L. REV. 115, 122 (2009) (stating that hydrofracking "has historically been and will continue to be a profitable method of extracting non-renewable resources.").

5. U.S. DEP'T OF ENERGY, MODERN SHALE GAS DEVELOPMENT IN THE UNITED STATES: A PRIMER 4 (Apr. 2009), *available at* http://www.netl.doe.gov/technologies/oil-gas/publications/epreports/shale_gas_primer_2009.pdf [hereinafter DOE Primer]. The Department of Energy highlights hydrofracking as an attractive energy source because of its reliability: "Eighty-four percent of the natural gas consumed in the U.S. is produced in the U.S. and ninety-seven percent of the gas used in this country is produced in North America. Thus, the supply of natural gas is not dependent on unstable foreign countries and the delivery system is less subject to interruption." *Id.*

6. *See infra* Part II. As this Note will discuss, hydrofracking is exempt from the Resource Conservation and Recovery Act, a statute that provides for the federal oversight of hazardous waste storage and disposal. States must still meet national water and air standards set forth under the CWA and CAA.

7. U.S. ENVTL. PROT. AGENCY, HYDRAULIC FRACTURING RESEARCH STUDY 2 (June 2010), *available at* http://www.epa.gov/safewater/uic/pdfs/hfresearchstudyfs.pdf.

8. *Id.*

9. *Frac Water Treatment: Where Is the Market?*, AMERICAN WATER INTELLIGENCE (July 2011), *available at*

considerably from state to state. In the Appalachian area, not far from where hydrofracking is experiencing a tremendous boom in the Marcellus Shale region, underground injection is not a viable option for disposal.[10] That region is confined to relying on alternative methods, such as filtering and treating wastewater and then releasing it into surface waters. While many states have comprehensive regulations for hydraulic fracturing,[11] there remains room for improvement for the benefit of human health and a cleaner environment.

This Note contends that our current approach to hydrofracking wastewater disposal warrants a comprehensive reassessment, particularly in the Marcellus Shale region. From the front end, as wastewater is now produced at unprecedented rates and volumes, its existence in our environment poses health concerns regardless of the disposal method. With that in mind, there is renewed interest in re-visiting wastewater's exemption as an EPA hazardous waste to bring the substance within that realm. From the back end, our reliance on underground injection for wastewater storage presents challenges that question the long-term sustainability of this practice. This Note argues that treatment facilities can play an increasingly important role in wastewater disposal, but only if they benefit from stricter federal regulations and standards for wastewater handling. An endeavor of this magnitude will require resources and funding to ensure its proper implementation. The federal government has a role to play in these arenas in conjunction with local and state governments, as well as with the private sector.

Part I of this Note sets the stage: it provides an overview of the types of materials found in hydrofracking wastewater – chemical additives mixed into the initial fracking fluid and those it later

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http://www.americanwaterintel.com/archive/2/7/opinion/frac-water-treatment-where-market.html.

10. *See* Marc Levy and Vicki Smith, *Gas Drilling in Appalachia Yields a Foul Byproduct*, ROME NEWS-TRIBUNE, 2009, *available at* http://romenews-tribune.com/view/full_story/5734611/article-Gas-drilling-in-Appalachia-yields-a-foul-byproduct-.

11. *See* Wes Deweese, *Fracturing Misconceptions: A History of Effective State Regulations, Groundwater Protection, and the Ill-Conceived Frac Act*, 6 OKLA. J. L. & TECH 49, 22-32 (2010), *available at* http://www.law.ou.edu/sites/default/files/files/FACULTY/2010okjoltrev49.pdf (outlining the oil and natural gas regulations of Alabama, New York, North Dakota, Oklahoma, Pennsylvania, Texas, and Wyoming).

collects from the Earth – and explains how the substance poses a potential harm to human health and safety. Going a step further, this Part also highlights reasons as to why the continual dependence on wastewater's underground injection may not be as safe or sustainable an option.

Part II introduces the key elements of hydrofracking, including its process, its exemption from federal regulation, and an overview of acceptable methods for wastewater disposal. Each method has its pros and cons. This section argues on behalf of wastewater's inclusion as a hazardous waste under the Resource Conservation and Recovery Act ("RCRA"), from which it is currently exempt.

Part III will examine three prominent justifications for federal regulation within the realm of environmental policy, and champions one proposal's acceptance, particularly as this examination recognizes this as an optimal means toward achieving greater reliance on treatment facilities while addressing human health concerns. Here, we look to the scholarly work of some well-respected members of the environmental law community, including Professor Richard J. Lazarus, Professor Richard L. Revesz, Professor Daniel C. Esty, Professor Richard B. Stewart and Professor William D. Ruckelshaus, to develop a conversation regarding if and when federal environmental regulation is justified.

Lastly, Part IV will offer alternative possibilities for approaching hydrofracking's risks, aside from mandating stricter federal controls. This Part will explore less comprehensive, yet important steps in the right direction as we move toward a safer approach to wastewater disposal.

## I. CONSIDERING THE RISKS: WHAT'S IN THE (WASTE) WATER?

The very word, wastewater, evokes a sense of condemnation, summoning images of a dark, murky, and mysterious substance that is beyond saving, or in this case, beyond reuse. Yet, this Note seeks to view wastewater through a more hopeful lens. Objectively speaking, hydrofracking wastewater does consist of undesirable components,[12] necessitating, in many situations, its long-term

12. *See generally* David A. Dana, *One Green America: Continuities and Discontinuities in Environmental Federalism in the United States*, 24 FORDHAM ENVTL. L. REV. 103, 106 (2013) (arguing that given the wide geographic scale of

disposal underground. The task is challenging but with more appropriate federal designations and superior filtration and treatment technology, hydrofracking may become, to an extent, a reusable resource. Wastewater treatment and recycling facilities are underutilized options mainly, in part, because too few facilities exist and those that do require significant updates. However, if revitalized, they could provide some real solutions to this overwhelming environmental issue.

### *A. Surveying the Contents*

Hydrofracking requires a significant amount of water: the Department of Energy's 2009 Primer on Modern Shale Gas Development estimates that 80,000 gallons of water are needed to drill a well, and another 3,800,000 gallons of water to fracture the well.[13] Thus, on average, each horizontal[14] well uses about five million gallons in a given fracturing operation.[15] Much of that fluid

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fracking, and the anticipated aggregate pollution from fracking, extraboundary solutions, such federal laws and regulations, may be necessary to transport pollution in one form or another).

13. *See* Robert E. Beck, *Current Water Issues in Oil and Gas Development and Production: Will Water Control What Energy We Have?*, 49 WASHBURN L.J. 423, 425 (2010).

14. *See, e.g.*, NEW YORK STATE WATER RESOURCES INSTITUTE, THE MARCELLUS SHALE AND NATURAL GAS 1 (2011), *available at* http://www.shalegas.energy.gov/resources/tws_cornell_nyswri_marcellus.pdf ("In the case of the Marcellus Shale, the natural fractures in the rocks are vertical. Therefore, a vertical well, even with hydrofracking, does not access many fractures. Having the well access many fractures is important, because the gas travels from the pores to the spaces in the fractures, where it can then more rapidly move to the well bore.").

15. *Id. See also* CHESAPEAKE ENERGY COMPANY, WATER USE IN DEEP SHALE GAS EXPLORATION: FACT SHEET 1-2 (May 2012), *available at* http://www.chk.com/media/educational-library/fact-sheets/corporate/water_use_fact_sheet.pdf. Drilling a typical Chesapeake well requires between 65,000 to 600,000 gallons of water, and fracturing the horizontal well requires about 4.5 million gallons per well. On average, each hydrofracking operation consumes about 5 million gallons of water. Chesapeake Energy notes that 5 million gallons is approximately the equivalent of the amount of water New York City uses in seven minutes, a 1,000 megawatt coal-fires power plant uses in 12 hours, a golf course uses in 25 days, or the amount that 7.5 acres of corn uses in a season. Chesapeake Energy is the second-largest natural gas producer in the United States.

returns to the surface for disposal with the original ingredients and some new additions.

### 1. Man-Made Additives

Energy companies include certain chemicals in frack fluids to aid in the process. These chemical additives account for only a nominal percentage of the fracking fluids – about 0.5% to 2% – but nonetheless carry vast implications. The fact that fracking fluids account for a very small percent of the fluid composition does not equate to a low risk of water contamination. Currently without any federal mandate to disclose fracking materials, there is also no way to ascertain the chemical make-up of the drilling or fracturing fluids.[16] Many energy companies logically defend this proposition in the name of industry trade secrets,[17] but some companies, however, have moved toward voluntary disclosure.[18] For instance, Range Resources Corporation, the first gas company that actively drilled in the Marcellus Shale, reported that for the average well in southwest Pennsylvania, fracking fluids require 3.81 million gallons of water, 4.57 million pounds of sand, 1,333 gallons of hydrochloric acid, 1,695 gallons of a friction reducer, 2,211 gallons of an antimicrobial agent and 386 gallons of a scale inhibitor, which included ethylene glycol, a component of antifreeze.[19] Industry members quell concerns

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16. *See* Energy Policy Act of 2005, Pub. L. No. 109–58, 119 Stat. 594, 694 (2005) (exempting disclosure of chemicals used in hydraulic fracturing activity as would ordinarily be required under federal clean water laws).

17. *See* Brian J. Smith, *Fracing the Environment?: An Examination of the Effects and Regulation of Hydraulic Fracturing*, 18 TEX. WESLEYAN L. REV. 129, 131 (2011).

18. *See* Ian Urbina, *Chemicals Were Injected Into Wells, Report Says*, N.Y. TIMES, Apr. 16, 2011, at A16, *available at* http://www.nytimes.com/2011/04/17/science/earth/17gas.html (stating that, some companies have began voluntarily disclosing frack fluid composition. The author views this move skeptically, however, as disclosure will not include those chemicals that are labeled as proprietary, nor is there any mechanism to check if this self-reporting is accurate).

19. *See* PENNSYLVANIA STATE UNIVERSITY, COLLEGE OF AGRICULTURAL SCIENCES, MARCELLUS SHALE WASTEWATER ISSUES IN PENNSYLVANIA—CURRENT AND EMERGING TREATMENT AND DISPOSAL TECHNOLOGIES 2 (Apr. 2011), *available at* http://www.cce.cornell.edu/EnergyClimateChange/NaturalGasDev/Documents/PDFs/marcellus_wastewater_fact_sheet[1].pdf.

by pointing out that chemical additives account for less than an estimated 0.5% of the fracking fluids.[20] While this percentage appears to be around the norm, the problem remains that 1,333 gallons of hydrochloric acid, 1,695 gallons of a friction reducer, 2,211 gallons of an antimicrobial agent and 386 gallons of a scale inhibitor *are* very large amounts, despite the fact that they diluted in the original freshwater – which returns to the surface laden with substances from the Earth. Ultimately, the focus should remain on the fact that even where chemicals in fracking fluids account for just 0.5 to 2 percent of the fluid, a substantial amount of wastewater nonetheless results; if one presumes that an average hydrofracking operation uses about 3 million gallons of total fluid, the result is about 15,000 gallons worth of chemicals in the wastewater.[21] Treatment plants must be able to effectively treat not only millions of gallons of wastewater, including original chemical additives, but also radioactive materials and other solids that might find their way into the fluid.

### 2. Picked Up Along the Way: Total Dissolved Solids

As the liquid formerly known as frack fluid makes its return trip up the well as wastewater, it might very well pick up some unexpected substances along the way. One challenge in disposing of wastewater is the significant amounts of total dissolved solids, or "TDS," contained in returning fracking fluids.[22] TDS are naturally present in bodies of water and can include chloride, sulfate, sodium and manganese.[23] Heightened levels of TDS, however, can make wastewater up to five times as salty as seawater.[24] More importantly,

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20. *Id.*

21. *See, e.g.*, DANIEL J. SOEDER & WILLIAM M. KAPPEL, U.S. GEOLOGICAL SURVEY, WATER RESOURCES AND NATURAL GAS PRODUCTION FROM THE MARCELLUS SHALE 4 (May 2009), *available at* http://pubs.usgs.gov/fs/2009/3032/pdf/FS2009-3032.pdf.

22. *Marcellus Shale Drilling*, MOUNTAIN WATERSHED ASSOCIATION, http://www.mtwatershed.com/marcellus.html (last visited January 5, 2013).

23. PA. DEP'T OF ENVTL. PROT., PENNSYLVANIA ENVIRONMENTAL QUALITY BOARD FINAL AMENDMENT OF REGULATIONS ON WASTEWATER TREATMENT REQUIREMENTS 1 (2011), *available at* http://files.dep.state.pa.us/Water/Wastewater%20Management/WastewaterPortalFiles/TDS/TDSPlainLanguageSummary11-3-11.pdf.

24. *See* Joaquin Sapien & Sabrina Shankman, *Drilling Wastewater Disposal Options in N.Y. Report Have Problems of Their Own*, PROPUBLICA 1 (Dec. 29,

too much TDS can cause adverse effects on "aquatic life, human health and drinking water supplies. High concentrations of TDS can make waters saltier, harder, and potentially toxic to fish and other wildlife."[25] Pennsylvania responded to reports of heightened TDS levels in waterways by amending its state Wastewater Treatment Requirements. Prior to the amendment in 2010, operators were only required to treat and remove heavy metals from wastewater; there were no requirements for treatment of TDS, sulfates, and chlorides.[26]

There was much worry in 2011 following reports of heightened levels of bromide in Pittsburgh-area rivers.[27] Bromide,[28] a salt, is considered harmful when it "reacts with the chlorine disinfectants used by drinking water systems and creates trihalomethanes."[29] The

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2009, 11:00 PM), *available at* http://www.propublica.org/article/drill-wastewater-disposal-options-in-ny-report-have-problems-1229.

25. PENNSYLVANIA ENVIRONMENTAL QUALITY BOARD FINAL AMENDMENT, *supra* note 23, at 1.

26. *Id. See also* Title 25 of the PA Code, § 95.10 for exact standards.

27. In November 2011, the Pittsburgh Water and Sewer Authority accused four industrial wastewater treatment plants of the increased bromide levels in the Allegheny River. The PWSA tested waters downstream from the four plants and concluded that bromide levels were 34 times higher than in areas upstream. The river supplied drinking water to over 500,000 people. Studies show that there is a link between high doses of trihalomethanes and cancer in laboratory animals, but it remains scientifically uncertain whether the substance can cause cancer or other health-related detriment to humans. In response to this finding, the state asked fracking companies to stop sending their wastewater to treatment facilities that ultimately discharge into rivers and streams. *See* Timothy Puko, *Bromide Level High n Parts of Allegheny River*, PITTSBURGH TRIBUNE-REVIEW, May 19, 2012, *available at* http://triblive.com/news/1824972-74/bromide-river-drilling-shale-states-allegheny-authority-department-gas-levels?printerfriendly=true. As of May 2012, bromide levels in the Alleghany River have tapered, presumably in response to the state's request that treatment facilities stop accepting wastewater, but downstream, the levels are still elevated, prompting worry that the cause might have actually been other discharges rather than shale wastewater.

28. Bromide is a "naturally occurring salty compound that can form cancer-causing agents when it combines with the chlorine in drinking water." *See* Bob Bauder & Timothy Puko, *Four treatment plants accused of raising bromide levels in Allegheny*, TRIBLIVE 1 (Nov. 5, 2011), *available at* http://triblive.com/x/leadertimes/news/s_765722.html#axzz2J5VYG4Fu.

29. Marc Levy, *Fracking Wastewater Disposal Process to be Altered in Pennsylvania*, THE HUFFINGTON POST, Apr. 19, 2011, *available at* http://www.huffingtonpost.com/2011/04/20/fracking-wastewater-disposal-pennsylvania_n_851441.html.

problem has been on-going in certain areas with a thriving hydrofracking industry.[30] In Beaver Falls and Fredericktown in Pennsylvania, for instance, treatment facilities have failed tests for trihalomethanes for the past two years.[31]

Some states have come up with creative ways to recycle certain wastewater components – namely brine, but the well-intentioned effort might present more harms than benefits. Given its high salinity, fracking brine is sometimes used to de-ice winter roads, as well as for dust suppression in the summer.[32] The practice has been thought of a way to encourage recycling that could additionally result in some economic stimulus. In West Virginia, for example, environmental regulators and highway officials announced their plans to buy 1.2 million gallons of wastewater, for the salty brine, at about five cents per gallon.[33] The concern with de-icing brine, however, is that the wastewater may contain radioactive contaminants, and that it could runoff into drinking water supplies.[34] Economic stimulus projects and waste recycling are two commendable goals, but state governments must pay closer attention to hazards that could plausibly arise from certain wastewater disposal methods.

### 3. Picked Up Along the Way: Naturally Occurring Radioactive Materials

Another challenging aspect of wastewater concerns the "NORMs," or naturally occurring radioactive materials, that it collects from the Earth. Treatment facilities, for their part, have a hard time treating wastewater because it often returns to the surface with radioactive formation materials from deep underground.[35] Those formation materials may include "brines, heavy metals, radionuclides, and organizes that make wastewater treatment difficult and expensive."[36] The brines themselves often contain "relatively high concentrations of sodium, chloride, bromide, and other inorganic constituents, such

30. *Id.*

31. *Id.*

32. *See* Ian Urbina, *Gas Drillers Recycle Wastewater, but Risks Remain*, N.Y. TIMES, Mar. 1, 2011, at A1, *available at* http://www.nytimes.com/2011/03/02/us/02gas.html?_r=1ref=ianurbina.

33. *Id.*

34. *See id.*

35. Soeder, *supra* note 21, at 5.

36. *Id.*

as arsenic, barium and other heavy metals, and radionuclides that significantly exceed drinking-water standards."[37]

Environmental experts and industry leaders differ on the degree of dangerousness raised by wastewater radioactivity. The energy industry views the worry as unwarranted;[38] some state regulatory offices disagree. West Virginia's water and waste management director has expressed concern on radioactivity levels in wastewater. Recent testing substantiates the speculation: just prior to the de facto-moratorium on Marcellus Shale drilling in New York, the Department of Energy Conservation ("DEC") tested twelve vertical wells in 2008 and 2009.[39] The findings showed that wastewater from ten of the wells, with respect to drinking water standards, contained a radioactive derivative of uranium at levels hundreds of times that of the allowed federal limit.[40]

The challenge in effectively treating wastewater that has potentially come in contact with radioactive materials below the Earth is two-fold: First, it is difficult to know what radioactive materials are in the returning wastewater without testing. Second, publicly owned treatment works plants ("POTWs") do not usually treat materials such as radium.[41] Radium is therefore not susceptible to the conventional secondary biological treatment that POTWs tend to use for wastewater treatment in order to meet effluent limitations and water quality standards.[42] Radium is considered a strong carcinogen that "is among the most dangerous of these metals because it gives off radon gas, accumulates in plants and vegetables and takes 1,600 years to decay."[43] Its danger is well-known: according to the Agency for Toxic Substances and Disease Registry, exposure can result in increased risk to bone, liver, and breast cancer,

37. *Id.*

38. Urbina, *supra* note 32.

39. Sapien, *supra* note 24.

40. *Id.*

41. Mark A. Latham, *The BP Deepwater Horizon: A Cautionary Tale for CCS, Hydrofracking, Geoengineering and other Emerging Technologies with Environmental and Human Health Risks*, 36 WM. & MARY ENVTL. L. & POL'Y REV. 36, 55 (2011).

42. *Id.*

43. Abraham Lustgarten, *Is New York's Marcellus Shale Too Hot to Handle?*, PROPUBLICA (Nov. 9, 2009, 4:10 AM), *available at* http://www.propublica.org/article/is-the-marcellus-shale-too-hot-to-handle-1109.

and can have adverse effects on tooth health.[44] Wastewater is also known to contain barium and strontium.[45] The presence of radioactive materials, or even slight traces of radioactive materials is at least one ground that merits wastewater's consideration under RCRA as hazardous waste. In the booming Marcellus Shale region, where underground injection is uncommon, treatment facilities continue to be a source of disposal.

To be clear, wastewater does not make its way up the well with a radioactive glow while forcefully emitting harmful rays upon anyone who encounters it. But perhaps that is part of the problem. Its risks are much more insidious, and the harms to human health would only manifest themselves after accumulating over time. We cannot yet claim to know the substantive effects of wastewater's reach on human health or the environment, if any.

### *B. Easing the Burden of Underground Injection Wells*

#### 1. Drinking Water Contamination

The road to recognizing hydrofracking's risks to our drinking water has been an uphill battle. In 2004, the EPA accessed the potential for hydrofracking's harms and dispelled any associated health risks in a report entitled "Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs." The lengthy study concluded that there was no hard evidence of fracking's negative environmental effects.[46] It is often cited as evidence to defend hydrofracking from opponents, but the study's assessment is inaccurate for several reasons. Professor Hannah Wiseman elucidates these weaknesses in her work, explaining that the "report largely ignores environmental issues unrelated to underground sources of drinking water."[47] The

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44. NATURAL RESOURCES DEFENSE COUNCIL, PETITION FOR RULEMAKING PURSUANT TO SECTION 6974(A) OF THE RESOURCE CONSERVATION AND RECOVERY ACT CONCERNING THE REGULATION OF WASTES ASSOCIATED WITH THE EXPLORATION, DEVELOPMENT, OR PRODUCTION OF CRUDE OIL OR NATURAL GAS OR GEOTHERMAL ENERGY 15 (Sept. 8, 2010), http://docs.nrdc.org/energy/files/ene_10091301a.pdf.

45. Urbina, *supra* note 32.

46. Adam Orford, *Fractured: The Road to the New EPA "Fracking" Study*, 267 ENV. COUNS. 4 (2010).

47. Wiseman, *supra* note 4, at 134.

report's focus was rather narrow: it specifically sought to determine whether fracking should be regulated under the Safe Drinking Water Act.[48]

As Professor Wiseman points out, hydrofracking can potentially have many other environmental effects.[49] Industry members and fracking supporters cite the report in their favor, but there are significant gaps in the study that discount the EPA's 2004 affirmation that "the injection of hydraulic fracturing fluids into coalbed methane wells poses little or no threat to [underground sources of drinking water] and does not justify additional study at this time."[50] The EPA decided it was indeed necessary to undertake another hydrofracking study to help fill gaps and address additional concerns, and is currently working on this endeavor, with plans to release an interim report in 2012 along with a follow-up report in 2014.[51]

### 2. Accidental Chemical Spills

The rise in hydrofracking activity has been accompanied by accidental chemical and wastewater spills, contaminating both local waters and even air. Within the past year, a number of spills around Pennsylvania communities have prompted government action and industry clean-up efforts. Particularly, the town of Dimock, Pennsylvania is now evoked as a perennial example of a fracking operation gone wrong. In September 2009, a series of spills released thousands of gallons of drilling fluids at a well site operated by Cabot Oil and Gas.[52] The fluids contained a propriety liquid gel component that is considered a potential carcinogen to humans. The gel's maker,

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48. *Id.*

49. *Id.* at 134-35.

50. U.S. ENVTL. PROTECTION AGENCY, *Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing Fracturing of Coalbed Methane Reservoirs*, EPA 816-R-04-003 at 7-5 (June 2004), *available at* http://www.epa.gov/ogwdw/uic/pdfs/cbmstudy_attach_uic_ch07_conclusions.pdf.

51. U.S. ENVTL. PROT. AGENCY, *Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources,* EPA 600-D-11-001 at viii (Feb. 2011), *available at* http://www.shalegas.energy.gov/resources/HFStudyPlanDraft_SAB_020711.pdf.

52. Abrahm Lustgarten, *Frack Fluid Spill in Dimock Contaminates Stream, Killing Fish*, PROPUBLICA (Sept. 21, 2009), *available at* http://www.propublica.org/article/frack-fluid-spill-in-dimock-contaminates-stream-killing-fish-921.

Halliburton, has stated that it has led to skin cancer in animals, and may cause headaches, dizziness, and other central nervous system effects if breathed in or swallowed.[53] Pennsylvania's Department of Environmental Protection ("DEP") attributed the spills to supply pipe failures.[54] The contaminants seeped into a nearby creek, decimating part of the population while causing the remaining fish to begin swimming erratically.[55] Cabot's fracking operation has also led to other health risks in or around Dimock: Cabot wells have contaminated water with methane and metal, and there have been spills from overturned trucks.[56]

### 3. Overburdening Deep-Underground Injection Wells

In Pennsylvania, the limitations on deep-injection wells due to the porous geology of the Appalachian region, together with the state's recent ban on POTWs from accepting fracking wastewater, have led drillers to look for alternative to disposal in nearby Ohio. As a result, trucking wastewater to Ohio for deep-well injection has increased, but this practice, however, might become problematic in the long-run. Unlike Pennsylvania, Ohio does not allow drillers to dispose brine from oil or gas production either directly or via a POTW.[57] Ohio approves of disposal only through underground well injection, road surface application (excluding wastewater or drilling and treatment fluids), in association with enhanced recovery, or an alternative, approved method by the Ohio Department of Natural Resources.[58] The DEP reported that the state sent approximately 12 million gallons of Marcellus Shale wastewater to Ohio for disposal.[59] The majority of the wastewater, 11 million gallons, was disposed of through injection wells and 1 million gallons via treatment

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53. *Id.*
54. *Id.*
55. *Id.*
56. *Id.*
57. Letter from Ohio Department Protection Agency to Director David Mustine, Brine Disposal Pursuant to ORC Section 1509.22 1 (May 16, 2011) (on file with author), *available at* http://www.epa.ohio.gov/portals/35/pretreatment/marcellus_shale/POTW_Brine_Disposal_Letter_may11.pdf.
58. *Id.*
59. Marcellus Shale Wastewater Issues in Pennsylvania, *supra* note 19, at 6.

facilities.[60] Underground injection of wastewater poses well-documented contamination risks to the underground drinking water wells; nonetheless, it is currently viewed as a safer option than treatment. Questions remain, however, regarding the sustainability of trucking Pennsylvania's wastewater to Ohio for deep-well injection.

The risks from trucking wastewater from one state to another presents a unique set of difficulties. Certain states are unable to rely on deep-well injection and therefore cannot truck their wastewater to a neighboring state for disposal. Accidental spills are, after all, accidental, but it is important to highlight this increasing occurrence[61] as well as the dangers of trucking wastewater from a drill site to an underground injection well.[62] For example, in December 2011 a truck hauling wastewater in Monroe County, Ohio, spilled part of its load along two state roads.[63]

### 4. Hydrofracking and Earthquakes

Storing large volumes of wastewater deep underground may be, so to speak, shaking things up. A relatively new and emerging issue

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60. *Id.* at 6-7.

61. *See* Scott Detrow, *AP: Truck Spills Fracking Fluid in Lycoming County*, STATEIMPACT (Sept. 26, 2012, 5:16 PM), *available at* http://stateimpact.npr.org/pennsylvania/2012/09/26/ap-truck-spills-fracking-fluid-in-lycoming-county/. The article reports on a tanker carrying 4,600 gallons of wastewater spilled in Lycoming County. *Id.* It was unclear how much wastewater was released in the spill, *id.*, and, of the story's publication date, the Pennsylvania DEP had not detected harm to nearby Pine Creek fish, *id. See also*, Fred Knight, *Trumbell Co. Residents Protesting Fracking Wastewater*, WOUB PUBLIC MEDIA (July 16, 2012, 10:53 AM), *available at* http://woub.org/2012/07/16/trumbull-co-residents-protesting-fracking-wastewater (describing reactions to a trucking spill on July 7th in near Vienna, Ohio, of about 1,000 gallons of wastewater). *But see Concerns About Small Wastewater Spill on Ohio Roadway*, MARCELLUS DRILLING NEWS (July 11, 2012), *available at* http://marcellusdrilling.com/2012/07/concerns-about-small-wastewater-spill-on-oh-roadway/ (placing the EPA estimate closer to 100-150 gallons).

62. Smith, *supra* note 17, at 135. For an excellent analysis of transboundary pollution law through Supreme Court precedent and statutory interpretation, *see* Thomas W. Merrill, *Golden Rules for Transboundary Pollution*, 46 DUKE L. J. 931 (1997).

63. Kate York & Brad Baur, *Fracking Wastewater Leaked onto Ohio Roads*, THE MARLETTA TIMES (Dec. 24, 2011), *available at* http://www.newsandsentinel.com/page/content.detail/id/555511/Fracking-wastewater-leaked-onto-Ohio-roads.html?nav=5061.

within hydrofracking asks whether it is the cause of low-magnitude seismic earthquakes. The effect of deep-underground drilling and wastewater injection on the Earth's geology, while still provisional, is grounded in reasonable agreement that such a link is feasible.[64]

Oklahoma is one well-publicized example of a state experiencing recent quakes with possible fracking-related origins. The state's Geological Survey has stated that anthropologically triggered seismic activity has presented evidence of correlations to earthquakes in terms of a given area and injection. Others say that the wastewater injection-earthquake link is mere speculation; the more probable answer lies with the state's known fault line and geopressure.[65] Even so, activities associated with hydrofracking create micro-seismic events, resulting from the activity's very nature of drilling into the Earth and subsequently filling underground wells with large volumes of wastewater, but they are generally quite small.[66] Between November 2009 and September 2011, seismologist Cliff Frohlich of the University of Texas at Austin analyzed seismic activity in the Barnett Shale region of Northern Texas.[67] Frohlich used mobile seismometers to identify the epicenters of 67 earthquakes – eight times as many as were reported by the National Earthquake Information Center.[68] The quakes all registered magnitudes of 3.0 or less, but the critical part of his survey was the epicenters' locations.[69]

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64. *See e.g.*, Hannah Wiseman, *Earthquakes and Oil and Gas*, ENVTL. L. PROF BLOG (Nov. 8, 2011), *available at* http://lawprofessors.typepad.com/environmental_law/2011/11/earthquakes-and-oil-and-gas.html.

65. *See* Wayne Greene, *Geologists Have No Easy Answers to Earthquake Questions*, TULSA WORLD, Nov. 7, 2011, *available at* http://www.tulsaworld.com/news/article.aspx?subjectid=12&articleid=20111107_12_0_StateG921222. (Geologists of the Oklahoma Geological Survey were unable to fully comprehend the triggering mechanism for the quakes. While acknowledging fracking's potential for small, localized earthquakes, they dispelled notions that fracking was affecting solid rock formations deep below. *However, their reply seems to address the drilling aspect of fracking, not the underground injection of wastewater.*).

66. *See* Wiseman, *supra* note 65.

67. Charles Choi, *Fracking-Earthquake Connection Suggested in New Study*, THE HUFFINGTON POST (Aug. 7, 2012), *available at* http://www.huffingtonpost.com/2012/08/07/fracking-earthquake-conne_n_1752414.html.

68. *See id.*

69. *Id.*

One third of the quakes were confined to eight regions, and all of the wells nearest to epicenters within those areas reported high rates of injections, specifically 17.6 million meters, or 150,000 barrels, of water per month.[70] However, some suspicion remains: Frohlich noted that 100 Barnett Shale wells with similar injection rates experienced no such seismic activity.[71] He hypothesizes that "fluid injection may trigger earthquakes only if fluids reach and relieve friction on a nearby fault."[72]

The town of Cleburne, Texas, had never registered a quake in its 142-year history up until 2008 and 2009.[73] Within those two years, the town experienced low-magnitude quakes registering 3.3 or less on the Richter scale.[74] University seismologists affiliated with the University of Texas and Southern Methodist University found no conclusive link between nearby fracking operations and the quakes, but agreed that deep-well wastewater injection into the Barnett Shale region could have caused the seismic activity.[75] Recent activity resulting in more prevalent quakes has thrust this issue into the public eye.

### *A. State Regulation Alone is Inadequate*

#### 1. Reports of Water Contamination are Real

Despite these various debates, the sentiment among residents in areas with active hydraulic fracturing is that the activity is at the root of increasing reported health problems. In a Congressional hearing in 2007, Colorado residents testified to troublesome links between fracking and developed health problems.[76] One of the individuals who provided testimony, Steven Mobaldi of Rifle, Colorado, gave a troubling account of his family's health after fracking activity began

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70. *Id.*
71. *Id.*
72. *Id.*
73. Mark Zoback et al., *Addressing the Environmental Risks from Shale Gas Development*, WORLDWATCH INSTITUTE 9 (July 2010), *available at* http://efdsystems.org/Portals/25/Hydraulic%20Fracturing%20Paper%20-%20World%20Watch.pdf.
74. *See id.*
75. *Id.*
76. Wiseman, *supra* note 4, at 138.

about 3,000 feet from their home.[77] Mr. Mobaldi explained that he and his wife "began to experience burning eyes and nosebleeds" and later, his wife felt "fatigue, headaches, hand numbness, bloody stools, rashes, and welts on her skin."[78] The gas company told Mr. Mobaldi to stop drinking his house water, which would "fizz like soda with small bubbles."[79] Further, the family's water began to accumulate sand, and would result in an oil thin film if a glass of water were left out overnight.[80] Growing accounts such as Mr. Mobaldi's go towards legitimizing the correlation between hydraulic fracturing activity and detrimental health costs. For their part, the EPA and select state governments are actively engaging in risk identification and considering how to proceed with these concerns in mind.

2. Antiquated Treatment Facilities

Treatment facilities are not always up to task to treating the unique mixture of components found in wastewater at these new volumes and rates. Alleviating the wastewater burden would entail a comprehensive approach to treatment facilities, beginning with updating antiquated plants and building new plants with the latest treatment technology. Undeniably, simply sending more wastewater for treatment would not suffice as a sustainable solution.

Treatment facilities are understandably not always welcome guests because of the harms they might release onto a community. Pittsburgh's river-water contamination has prompted at least one environmental protection group, Clean Water Action, to advocate that the Pennsylvania DEP move toward prohibiting Marcellus Shale wastewater treatment.

In 2011, Niagara Falls was at the center of similar opposition when the local Water Board announced plans for a treatment facility in town.[81] The Board sought to have a plant built for financial reasons, but was accused of environmental classism as the consequences of the project would have fallen on economically depressed

77. *See id.*

78. *Id.*

79. *Id.*

80. *Id.*

81. Shawn Jeffords, *U.S. Plan to Treat Fracking Water could be Risky, Group Warns*, THE STANDARD (October 2011), *available at* http://www.stcatharinesstandard.ca/ArticleDisplay.aspx?e=3329700.

communities that needed resources.[82] Activists focused on the unknown long-term effects of consuming treated wastewater, urging the Board and the public to reject the proposal.[83] The main alternative, deep-well injection, is not a tenable solution in parts of the Northeast because of the region's porous geology.[84] Even if it were, there remains the looming concern of underground wastewater injections as the cause of small earthquakes and geological movement.

Industrial treatment facilities appear eager and ready for the challenge so long as they are given adequate notice and time to meet new standards.[85] In Pennsylvania, where treatment facility upgrades and new plants are desperately needed, the state government is confident that the technology necessary to treat wastewater contaminated with high levels of TDS is proven and readily available.[86] After Pennsylvania's DEP met with 60 manufacturers and vendors that have the technology to treat wastewater – although some do not yet have facilities in operation – it reported that:

> [M]uch of the hesitancy on the part of technology vendors is the result of uncertainty in the current regulatory

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82. *Id.*

83. *Id.*

84. *See Report: Five Primary Disposal Methods for Fracking Wastewater All Fail to Protect Public Health and Environment*, NATURAL RESOURCES DEFENSE COUNCIL, May 9, 2012, *available at* http://www.nrdc.org/media/2012/120509.asp.

85. *See Pennsylvania Invests $84 Million to Upgrade Wastewater Treatment Programs*, USALCO, Oct. 21, 2011, *available at* http://usalco.com/company/news/pennsylvania-invests-84-million-to-upgrade-wastewater-treatment-programs-548. *See also* Marc Levy, *Fracking Wastewater Disposal Process to be Altered in Pennsylvania*, Huffington Post, Apr. 19, 2011, *available at* http://www.huffingtonpost.com/2011/04/20/fracking-wastewater-disposal-pennsylvania_n_851441.html (explaining that the Pennsylvania governor mandated treatment plants to stop accepting wastewater. The article also notes the response of Paul Hart, the president of a company that co-owns three industrial treatment plants in the state. Hart expressed his surprise over the mandate, particularly because facility owners were given little notice of the move, and also commented that bromide levels were rising but considered the ban an overreaction.).

86. Pennsylvania Dep't Envtl. Prot., Notice of Final Rulemaking Dep't of Envir. Protection Envir Quality Board, 25 PA Code Ch 95, Wastewater Treatment Requirements Order 10 (2010), *available at* http://s3.documentcloud.org/documents/70254/urbina-day-2-in-progress.pdf.

> framework. Companies are reluctant to move forward without a clear direction concerning required treatment levels for TDS. Implementing clearer and stricter regulations will provide regulatory certainty for companies proposing treatment facilities for high TDS wastewaters.[87]

For their part, facility owners seem approving of more stringent disposal regulations. Some facility owners have stated that they abstain from constructing new treatment plants, or updating old ones that have been deemed "grandfathered" by the state, because state wastewater standards are always in flux. More federal standards would at least alleviate some of their concerns and spur this industry to keep up with the growing demands of wastewater disposal.

### 3. State Regulations in Constant Flux

As hydraulic fracturing has been at the forefront of some states individual environmental protection agency's agendas, state regulations have been in a great deal of flux. The continual development of state fracking and wastewater state regulations are strong indicators that states are taking the issue seriously and making efforts to examine impacts. The problem with constant regulation revisions is that treatment facility owners must continually update their plants or face repercussions. Treatment facilities use very particular and sophisticated machinery to treat waste – machinery that is costly to maintain and even more costly to update. Despite the daunting task of handling wastewater at unprecedented volumes in the region due to increased hydrofracking, some current facility owners are eager to build new plants.[88] They remain frustrated, however, with the slow pace at which the state is formulating new treatment facility specifications.[89]

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87. *Id.*

88. Ann Murray, *Deep Shale Gas Wells: So Much Wastewater, So Little Treatment Capacity*, THE ALLEGHENY FRONT, Jan. 14, 2009, *available at* http://www.alleghenyfront.org/transcript.html?storyid=200901131429410.746191.

89. *Id.*

## II. THE NUTS AND BOLTS OF HYDRAULIC FRACTURING

### A. *The History*

With the risks laid out, it is necessary to take a step back and contextualize the enormity of hydrofracking as a process, starting with its history. Despite the growth in recent publicity, hydraulic fracturing is not a recent innovation. The practice of using pressurized water wells to drill for fossil fuels dates back to 1947 when the Stanolind Oil and Gas Corporation began experimenting with the technique.[90] Shortly thereafter, in 1949, the Halliburton Oil Well Cementing Company received a patent for the 'hydrafrac' process which they first used in Texas and Oklahoma."[91] Hydrofracking now occurs across Shale formations within different regions of the country from Colorado to West Virginia. The practice has expanded considerably since then,[92] particularly in the past few years with the drilling boom in the Marcellus Shale.[93]

### B. *Process and Fluid Make-Up*

Water is the main component in hydrofracking fluids and is key to the process.[94] Millions of gallons of water are used for every hydrofracking operation that occurs across hundreds of thousands of wells across the country.[95] Fracking fluids are mostly comprised of

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90. David Hines, *How Long Has Hydrofracking Been Practiced?*, THE INSTITUTE FOR ENERGY & ENVIRONMENTAL RESEARCH (Mar. 15, 2011), *available at* http://energy.wilkes.edu/pages/203.asp (providing a brief history of hydrofracking, and also explaining that the "concept dates as far back as the 1860s when nitroglycerin was used to enhance production from hard rock oil wells in Pennsylvania, West Virginia, and other Appalachian states." Mining companies used the technique as early as 1903.).

91. *Id.*

92. *Id.*

93. David G. Mandelbaum, *Regulation of Unconventional Natural Gas Development*, 25 PROB. & PROP 44, 44-45 (2011).

94. U.S. ENVTL. PROT. AGENCY, *Hydraulic Fracturing Research Study*, EPA 600F10002 at 2 (June 2010), *available at* http://epa.gov/tp/pdf/hydraulic-fracturing-fact-sheet.pdf (stating that up to 99% of fracturing fluids can be water).

95. Ian Urbina, *Regulation Lax as Gas Wells' Tainted Water Hits Rivers*, N.Y. TIMES, Feb. 26, 2011, *available at* http://www.nytimes.com/2011/02/27/us/27gas.html?_r=1&pagewanted=all, (pointing out that there were over 493,000 active gas wells in the country in 2009, which is approximately double the figure from 1990).

water, but also contain sand and chemicals. Those materials are mixed carefully and pumped through a well, down to the shale at high pressure.[96] The pressurized fracking fluid creates cracks in the rock formation.[97] Next, "[b]ehind the fluid comes a slurry containing small granules called proppants – sand, ceramic beads, or bauxite are used – that lodge themselves in the cracks, propping them open against the enormous subsurface pressure that would force them shut as soon as the fluid was gone."[98] Proppants play a critical role in maximizing gas and oil flow from the shale formation. After the fluid is drained, the cracks are left "open for gas or oil to flow to the wellbore. Fracking in effect increases the well's exposure to the formation, allowing greater production."[99]

As mentioned earlier, hydraulic fracturing requires water in staggering numbers for both the drilling of the well in addition to the actual fracturing processes. Hydrofracking requires between three and five million gallons of water in a given operation, between drilling and fracturing of the well.[100] Most of this water comes from surface waters such as lakes, rivers, and municipal supplies; groundwater is also used when surface water supplies are insufficient.[101]

The sand portion of the fracking fluid is the "proppant,"[102] which plays an important role in hydrofracking operations.[103] The granular sands hold or "prop" open the oil and gas-filled pockets nestled deep

96. The Supreme Court of Texas held that hydraulic fracturing that resulted in drainage did not allow for the recovery of damages under the property law rule of capture, but stopped short of labeling the fracture itself a trespass. *See Coastal Oil & Gas Corp. v. Garza Energy Trust*, 268 S.W.3d 1, 6 (Tex. 2006).

97. *Id.*

98. *Id.* at 6-7.

99. *Id.*

100. NPDES Frequently Asked Questions, *supra* note 1.

101. FracFocus Chemical Disclosure Registry, *Hydraulic Fracturing Water Usage* (2011), *available at* http://fracfocus.org/water-protection/hydraulic-fracturing-usage.

102. U.S. ENVTL. PROT. AGENCY, *Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing Fracturing of Coalbed Methane Reservoirs*, EPA 816-R-04-003 at 4-1 (June 2004), *available at* http://www.epa.gov/ogwdw/uic/pdfs/cbmstudy_attach_uic_ch04_hyd_frac_fluids.pdf.

103. *Id.*

within the Shale rock formation, and prevent them from closing during the natural gas recovery.[104]

Chemical additives account for the third main ingredient of fracking fluids.[105] Each fracking operation uses about a dozen chemicals.[106] The EPA reports that the overall concentration of chemical additives in fracking fluids ranges from 0.5 to 2 percent, with water and proppants comprising the remainder of the fluid.[107] However, keeping in mind the sheer amount of fluid necessary to fracture a well – between 2.4 and 7.8 million gallons – the seemingly small percentage translates into thousands of gallons in chemical additives.[108] Aside from its volume, the chemicals range in toxicity, "from the relatively benign (polyacrylamide, guar gum, etc.) to those associated with chronic toxicity or carcinogenic effects (ethylene glycol, glutaraldehyde)."[109]

### C. *Hydrofracking and The Safe Drinking Water Act*

To ensure that our water is protected from those and other contaminates, and that it is safe for consumption, the EPA promulgates minimum health standards.[110] Our nation's drinking water is subject to the provisions of the Safe Drinking Water Act ("SDWA"), which sets standards for public water systems.[111] The SDWA, of Title XIV of the Public Health Law Service Act, was enacted to regulate and protect public water supplies from harmful contaminants.[112] The SDWA became law in 1974, and was

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104. *Id. See also* Dammel, *supra* note 2, at 774 (explaining how proppants help separate fractures within shale rock and prevents them from closing during gas recovery).

105. Smith, *supra* note 17, at 130.

106. Chemical additives, STRATERRA (Jan. 22, 2013, 6:53 PM), *available at* http://www.straterra.co.nz/Chemical%20additives.

107. Matt Armstrong, *The Process and Policy Implications of EPA's Hydraulic Fracturing Study*, 42 No. 6 ABA TRENDS 1 (2011).

108. Hannah Wiseman, *Regulatory Adaptation in Fractured Appalachia*, 21 VILL. ENVTL. L.J. 229, 236 n.31, 238-39 (2010).

109. Armstrong. *supra* note 108, at 1.

110. *See generally* 42 U.S.C. § 300f (2006).

111. *See* 42 U.S.C. § 300g (2006) (establishing that, the SDWA will apply to the public water systems of every state with limited exceptions).

112. Juan A. Schrock, SAFEGUARDING THE NATION'S DRINKING WATER 60 (Juan A. Schrock ed., 2010).

subsequently amended in 1986 and again in 1996.[113] The law authorizes the EPA to take steps to establish standards and ensure compliance with "national health-based standards for drinking water to protect against both naturally-occurring and man-made contaminants that may be found in drinking water."[114] Although the EPA is responsible for setting federal standards, states play a more direct role in the day-to-day oversight of those standards.[115] This occurs when a state applies for "primacy," or the authority to implement the EPA's standards within an individual jurisdiction.[116]

Indeed, the EPA and states work together to meet SDWA goals.[117] One of the EPA's most important means of assuring our water is protected from contamination is through the Underground Injection Control program (UIC),[118] which controls the injection or release of wastes into groundwater.[119] States have the option of applying to the EPA for "primacy," which grants applicant-states the authority to implement drinking water regulations in their states so long as they pledge to adopt minimum SDWA standards or higher.[120] A majority of the hydrofracking wastewater is disposed of via underground wells, and is thereby subject to UIC provisions.[121]

### *D. The Game-Changer: The Energy Policy Act of 2005*

For a short time,[122] hydrofracking fell within the boundaries of federal regulation until Congress rescinded the federal government's

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113. U.S. ENVTL. PROT. AGENCY, *Understanding the Safe Drinking Water Act* 1 (June 2004), http://water.epa.gov/lawsregs/guidance/sdwa/upload/2009_08_28_sdwa_fs_30ann_sdwa_web.pdf.

114. *See id.*

115. *Id.* at 2.

116. *Id.*

117. *Id.* at 1.

118. *See infra* notes 120-22 and accompanying text for a more detailed discussion of the UIC program.

119. Soeder & Kapell, *supra* note 21, at 2.

120. *Id.; see also* Angela C. Cupas, Note, *The Not-So-Safe Drinking Water Act: Why We Must Regulate Hydraulic Fracturing at the Federal Level*, 33 WM. & MARY ENVTL. L. & POL'Y REV. 605, 627, (2009).

121. *See* Armstrong, *supra* note 108, at 13.

122. In 1997, the Legal Environmental Assistance Foundation ("LEAF") brought a claim against the EPA for approving Alabama's UIC program. *See* Dammel, *supra* note 2, at 791. LEAF's lawsuit was a response to the EPA's decision to grant

ability to regulate hydrofracking when it passed the Energy Policy Act of 2005.[123] The Energy Policy Act of 2005 amended the SDWA to exempt hydraulic fracturing from federal regulation, but continued to regulate the use of diesel fuel use in fracking operations.[124] The Act was largely viewed as the result of lobby action by former Vice President Cheney's Energy Task Force and has therefore been nicknamed "The Halliburton Loophole."[125] Debate over the Act was quite polarized, and remains very much alive.[126]

The push to reverse this legislative act continues to manifest itself most prominently via the proposed Fracturing Responsibility and Awareness of Chemicals Act ("FRAC Act").[127] The FRAC Act has been introduced in both the House and Senate, but has not made it past committee referral.[128] As it currently stands, hydrofracking itself is not subject to federal controls. Wastewater generally, however, is subject to minimum federal standards as set forth under the SDWA and the Clean Water Act.

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Alabama primacy in implementing SDWA standards within the state. Alabama had implemented Class II injection wells in 1982 and Class I, III, IV, and V wells in 1983. *Id.* LEAF sued, asserting that the EPA should withdraw Alabama's UIC program because it did not regulate hydraulic fracturing. *Id.* The EPA argued that fracking did not fall under the definition of underground injection because the agency understood the UIC program to apply to wells whose primary function was the injection of fluids. *Id.* at 791-92. The 11th Circuit disagreed, finding in Legal Envtl. Assistance Found. v. U.S. Envtl. Prot. Agency, 118 F.3d 1467, 1469 (11th Cir. 1997) that the statutory definition of underground injection indeed encompassed hydraulic fracturing. *See also* Dammel, *supra* note 2, at 792. The case left a lasting impact on hydraulic fracturing regulation for several years; for a brief period, fracking operations fell within the realm of federal regulation by way of the UIC program. *See id.* at 791-92.

123. Dammel, *supra* note 2, at 792.

124. *See* Wiseman, *supra* note 4, at 145.

125. Earthworks, *Halliburton Loophole*, http://ogap.earthworksaction.org/issues/detail/inadequate_regulation_of_hydraulic_fracturing (last visited Jan. 7, 2013) (noting that the Energy Policy Act of 2005 is commonly referred to as the "Halliburton Loophole").

126. *See id.*

127. Earl L. Hagstrom, *Navigating Legal Issues Around the Marcellus Shale, in Hydraulic Fracturing in the Marcellus Shale: Strategies for Legal and Regulatory Compliance*, ASPATORE SPECIAL REP. 5, 4 (2011).

128. *Id.*

### E. *After Natural Gas Recovery: Wastewater Disposal Methods*

Many aspects of hydrofracking are contentious, but wastewater is perhaps atop that list. Without stringent regulations and oversight, water is particularly susceptible to causing water contamination precisely because it is released back into streams, rivers and other surface waters that supply drinking water after treatment. Local residents across the country are justifiably concerned about potential drinking water contamination. A look back at the numbers can best qualify the concern: each fracking operation will produce an estimated 1.2 million gallons of wastewater.[129] Those 1.2 million gallons of wastewater contain the original chemical additives and will additionally be exposed to radioactive elements deep below the Earth's surface.[130] It returns to the surface with much of the original amounts of water, proppants and chemical additives, as well as with heavy salts known as brine and naturally occurring radioactive materials absorbed by the water from deep underground.[131] A description of common substances found in wastewater might look like this: "surfactants, friction reducing chemicals, biocides, scale inhibitors, polymers, cross linkers, pH control agents, gel breakers, clay control agents and propping agents."[132] When the aforementioned naturally occurring materials are added to this mixture, the fluids pose potential health risks and must be disposed of carefully.

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129. Sapien & Shankman, *supra* note 24.

130. *Id. See also* Hagstrom, *supra* note 128, at 49 for an explanation that, fluid produced or recovered from the well is generally considered toxic, because it may contain naturally occurring heavy metals and radioactive materials as well as the chemical compounds comprising the fluid. *See also* United States Environment Protection Agency, whose studies "indicate that water recovered or produced from the well can contain hydrogen sulfide, aluminum, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, iron, lead, magnesium, radium 226, and radium 228."

131. Urbina, *supra* note 18; *see also* Ian Urbina, *supra* note 32.

132. Petition for Rulemaking Pursuant to Section 6974(a) of the Resource Conservation and Recovery Act, *supra* note 44, at 9.

### 1. Injection Wells

One of the most common ways to dispose of wastewater is to inject it deep underground in specialized wells.[133] Disposal through underground injection wells are regulated under the Clean Water Act ("CWA") through the EPA's Office of Water.[134] The CWA's purpose is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[135] One of the key provisions of the CWA provides for the National Pollutant Discharge Elimination System (NPDES),[136] which controls point-source direct discharges (i.e. pipes or constructed ditches) of wastewater from Publicly Owned Treatment Works facilities.[137] The NPDES discharge standards state that:

> NPDES discharge permits contain numeric effluent limitations for certain pollutants (and in some cases, pollutants that are specific to certain industries). Facilities must periodically monitor their effluent (collect and analyze wastewater samples) and submit Discharge Monitoring Reports to demonstrate compliance. NPDES permits are valid for five years; upon application for renewal, the governing permit agency must provide public notice of pending permits an provide opportunity for public comment. . . .[138]

Under the auspices of the EPA, the UIC program oversees permits for the six categories of underground injection wells.[139] The

133. Press Release, Natural Resources Defense Council, Press Release, Report: Five Primary Disposal Methods for Fracking Wastewater All Fail to Protect Public Health and Environment (May 9, 2012), *available at* http://www.nrdc.org/media/2012/120509.asp.

134. *See* U.S. ENVTL. PROT. AGENCY, *About the Office of Water* (Apr. 12, 2012), http://www.epa.gov/aboutepa/ow.html.

135. *See* 33 U.S.C. § 1251 (2002).

136. U.S. ENVTL. PROT. AGENCY, Office of Wastewater Mgmt. (Mar. 12, 2009), *available at* http://cfpub.epa.gov/npdes/.

137. Joseph J. Bernosky, OVERVIEW OF ENVIRONMENTAL LAWS AND REGULATIONS: NAVIGATING THE GREEN MAZE 43 (2011).

138. *Id.* at 44.

139. U.S. ENVTL. PROT. AGENCY, Basic Information About Injection Wells, Underground Injection Control,

categories are differentiated primarily based upon the type of fluid to be injected.[140] The underground wells are used for "long term ($CO_2$) storage, waste disposal, enhancing oil production, mining, and preventing salt water intrusion."[141] Class I wells are used to store hazardous wastes, industrial non-hazardous liquids, or municipal wastewater beneath the lowermost [Underground Source of Drinking Water ("USDW")]; Class II wells – most commonly used to store fracking wastewaster – store "brines and other fluids associated with oil and gas production, hydrocarbons;" Class III wells store "fluids associated with solution mining of minerals beneath the lowermost USDW;" Class IV wells store "hazardous or radioactive wastes into or above USDWs," however, they are banned unless specifically authorized under a federal or state ground water remediation project; Class V wells store materials not include under the previous four well categories, and are used to "store non-hazardous fluids into or above USDWs;" lastly, Class VI wells store $CO_2$ for long-term storage purposes.[142] Injection wells are considered the safest disposal method because the wastewater does not reach drinking water supplies.[143]

### 2. Land Application

Wastewater can also be recycled via land application – however, this is a highly toxic disposal method for the environment and as a result, very rarely used.[144] In one case study, the United States Department of Agriculture explored this model of wastewater disposal; however, the results were negative and left significant damage to the treated area.[145] In June 2008, researchers applied 303,000 liters of treated hydrofracking wastewater fluid from a gas

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http://water.epa.gov/type/groundwater/uic/basicinformation.cfm (last updated May 4, 2012).

140. *See id.*

141. *Id.*

142. U.S. ENVTL. PROT. AGENCY, Classes of Wells, Underground Injection Control, http://water.epa.gov/type/groundwater/uic/wells.cfm (last updated Aug. 2, 2012).

143. However, some cases of contaminated drinking water aquifers have been attributed to injection wells, especially where there is evidence of a poorly constructed well casing.

144. Mary Beth Adams, *Land Application of Hydrofracturing Fluids Damages a Deciduous Forest Stand in West Virginia*, 40 J. ENVTL QUAL. 1340, 1340 (2011).

145. *Id.*

well to 0.20 hectares in the Fernow Experimental Forest in West Virginia.[146] Researchers noted an almost immediate detriment to vegetation where the fluid was applied, with field personnel reporting foliage browning and wilting during the application, as well as "leaf scorch and curling, and leaf drop."[147] Within a few days of application, almost all of the affected ground vegetation had died, and within seven to ten days, leaves began to fall prematurely from their trees.[148] After two years, 56% of trees within the affected land area were dead.[149] This case study is pertinent as it further illustrates the toxicity of wastewater contents. Even when treated, there is accumulating support for defining those contents as hazardous waste under federal law.[150]

Admittedly, the land application contained a significant flaw insofar as the researchers used a larger dose of fluid than desired in order to minimize the forest surface area affected.[151] Yet despite this evident defect in the study's process, it is troubling that "the application met the terms of the permit issued by the West Virginia Division of Environmental Protection, Office of Oil and Gas, which is a concentration-based standard."[152] Land application remains a lawful form of wastewater disposal despite its proven harm to land and vegetation.

### 3. Treatment Facilities

Wastewater may also be disposed of via treatment facilities,[153] which generally come in two forms: privately owned industrial

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146. *Id.* The Fernow Experimental Forest, one of the USDA Forest Service's Experimental Forests, serves as an outdoor experimental laboratory and classroom for research.

147. Adams, *supra* note 145, at 1341-43.

148. *Id.* at 1341.

149. *Id.*

150. *Id.* at 1343.

151. This justification itself suggests that researchers expected the wastewater to have a detrimental effect on the land to begin with – further proving that those wastes must be regulated as hazardous material, and also suggesting that land application is an unacceptable form of disposal without this limitation.

152. *Id.* at 1343.

153. This Note does not address all of the wastewater disposal methods available. One notable exclusion is the evaporation pit method, which plays a role in disposal of fracking wastes in western states such as Wyoming. *See generally* Allan Ingelson, *Sustainable Development and the Regulation of the Coal Bed*

treatment facilities, and municipally owned treatment facilities – which are commonly known as Publically Owned Treatment Works ("POTW"). Treatment facilities have been widely criticized for hazardous discharges into community waterways. As discussed in this Note, the criticism is substantiated by the fact that treatment facilities face a unique set of challenges. Inadequate facilities are one looming problem: the hydrofracking boom has led to an increase in waste volume.[154] Further, wastewater is difficult to treat because the industry does not always disclose the contents of the original fracking fluids, and the wastewater returns with radioactive materials from the Earth, heavy metals, and salty brines.[155] Facilities do their best with the information they have. Despite these formidable obstacles, treatment facilities – with the proper regulatory guidance and technological investment – can be a tremendous source of relief in terms of wastewater disposal.

States are paying close attention to wastewater treatment and are taking positive steps to monitor it, but more can be done. One of the ways that states have begun to constructively address wastewater treatment issues is to fund upgrades on existing facilities that lack either the capability or the ability to fully treat all of the chemicals and radioactive traces in the wastewater. In October 2011, Pennsylvania Governor Tom Corbett "announced the investment of $84 million in 18 non-point source, drinking water, and wastewater projects in 14 countries."[156] The majority of the funds – $69 million – will be in the form of low-interest loans, and the remaining $15 million will be in grants.[157] Of the seventeen approved projects, eleven are wastewater projects that range from upgrading wastewater treatment plants to installing sewage collection lines.[158]

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*Methane Industry in the United States*, 20 J. NAT. RESOURCES & ENVTL. L. 51, 78 (2005-2006).

154. *Marcellus Shale Wastewater Issues in Pennsylvania*, *supra* note 19, at 5.

155. *See id.* at 2.

156. *Governor Corbett Announces $84 Million Investment in Water Infrastructure Projects in 14 Counties*, PR Newswire, Oct. 26, 2011, *available at* http://www.prnewswire.com/news-releases/governor-corbett-announces-84-million-investment-in-water-infrastructure-projects-in-14-counties-132622573.html.

157. *See id.*

158. *Id.*

From an economic perspective, wastewater treatment represents a tremendous opportunity for new innovation and investment. New technologies are being developed to this day to meet growing industry demands.[159] In Pennsylvania, two new wastewater treatment facilities were expected to open in October 2012 in Clarion and McKean, with cutting edge technology supplied by Altelas Inc.[160] With support from the Department of Energy, Altelas created a patented water desalination process, AltelaRain.[161] AltelaRain heats wastewater until it evaporates; this produces clean water vapor that naturally separates from contaminant particles and allows for the water portion to be condensed and collected.[162] A nearby waste-coal-fired power plant will supply the necessary heat to power the process, making this technology energy efficient in and of itself.[163] The treated water exceeds Pennsylvania DEP standards, making it pure enough to release into surface waterways or to reuse in future well operations.[164]

Treatment facilities are beginning to pop just west of the Pennsylvanian border as well, in Ohio.[165] In May 2011, the city of Warren, Ohio opened the doors to its first treatment plant equipped to handle wastewater generated from Marcellus Shale drilling.[166] There are plans to open additional facilities in Ashtabula, East Liverpool, and Steubenville.[167]

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159. *See* Lis Stedman, *Bloomberg Report Finds Shale Gas Wastewater Treatment Innovations Increasing*, IWA PUBLISHING, (Oct. 30, 2012), *available at* http://www.iwapublishing.com/template.cfm?name=news1367. A report by Bloomberg New Energy Finance, a research firm, found that treatment technology is rapidly increasing, with over 300 patents filed in 2011 alone.

160. *New Wastewater Treatment Facilities to Open with Doe-Tested Technology*, WASTE MANAGEMENT WORLD (Oct. 3, 2012), *available at* http://www.waste-management-world.com/index/from-the-wires/wire-news-display/1755064146.html.

161. *See id.*

162. *Id.*

163. *Id.*

164. *Id.*

165. *Ohio's First Marcellus Shale Wastewater Treatment Plant Now Open for Business*, MARCELLUS DRILLING NEWS (May 10, 2011), http://marcellusdrilling.com/2011/05/ohios-first-marcellus-shale-wastewater-treatment-plant-now-open-for-business/.

166. *Id.*

167. *Id.*

### *F. Revisiting RCRA: One Possible Solution?*

How should we deal with wastewater woes? The chemical make-up of fracking fluids, coupled with radioactive materials and corrosive salts from the Earth, returns a fluid mixture of potential hazards that require heightened care during the disposal process.[168]

#### 1. Wastewater's RCRA Exemption Should be Re-visited

The preceding section described wastewater's risks from start to finish: the original fluids are chemically-infused, and return to the surface post-operation with a host of radioactive, corrosive additives that somehow must be safely disposed of. One way to make this entire process safer is to subject wastewater to federal regulation as an official hazardous waste. As mentioned earlier, hazardous wastes are subject to regulation by federal law under the Resource Conservation and Recovery Act (RCRA).[169] Treatment facilities offer relief at the back-end when it comes to our approach to wastewater, but it is also worth re-assessing how we handle wastewater from the front-end. This is where RCRA enters the picture.

RCRA generally provides the regulatory answer for these types of environmental matters.[170] RCRA establishes a "cradle to grave" regulatory scheme that identifies and provides for the safe handling of wastes, specially addressing treatment, storage and disposal.[171] Congress amended the 1965 Solid Waste Disposal Act in 1976, thereby creating RCRA to address inadequate regulation against groundwater contamination under the Clean Water Act.[172]

Under RCRA, hazardous waste is defined as a solid waste[173] which may "cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or … pose a substantial present or potential hazard to human health or the environment when improperly treated, stored,

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168. *Marcellus Shale Wastewater Issues in Pennsylvania*, *supra* note 19, at 2.

169. *See* 42 U.S.C. §§ 6901 *et seq.* (1976).

170. *Id.*

171. Linda A. Malone, *The Resource Conservation and Recovery Act (RCRA)—In General*, 1 Envtl. Reg. of Land Use § 9:11, 2 (2012).

172. *Id.*

173. Solid wastes are not limited to actual solids – gases and liquids can qualify as RCRA solid waste. RCRA § 1004(27), 42 U.S.C. § 6903(27).

transported or disposed of, or otherwise managed."[174] Wastes are considered hazardous if the EPA deems them so, or if testing finds them to be hazardous.[175] Wastes that are deemed hazardous under RCRA are subject to extra controls than industrial wastes. For starters, the waste's generator must notify either the EPA or the appropriate state agency responsible for waste regulation that it is in possession of it.[176] From there, RCRA imposes onerous disposal policies for the hazardous wastes.

So, luckily, RCRA holds a special place within its statutory walls for murky concoctions boasting of hazardous components, precisely like fracking wastewater.[177] Problem solved. Well, not exactly. Fracking wastes have been exempt from RCRA's hazardous "waste definition" for over two decades.[178] RCRA did not, however, initially exempt oil and gas wastes from its statutory oversight.[179] The exemption's history dates back to December 1978:

> In December 1978, the EPA proposed hazardous waste management standards that included reduced requirements for several types of large volume wastes. Generally, EPA believed these large-volume 'special wastes' are lower in toxicity than other wastes being regulated as hazardous waste under RCRA. Subsequently, Congress exempted these wastes from the RCRA Subtitle C hazardous waste regulations pending a study and regulatory determination by EPA. In 1988, EPA issued a regulatory determination stating that control of E&P wastes under RCRA Subtitle C regulations is not warranted.[180]

A temporary exemption was issued in 1980, which provided that "drilling fluids, produced water, and other wastes associated with the

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174. *See* RCRA § 1004(5), 42 U.S.C.A. § 6903(5).

175. Malone, *supra* note 173.

176. *Id.*

177. *See generally* 40 C.F.R. § 260.

178. *See* RCRA §3001(b)(2)(A).

179. Wiseman, *supra* note 108, at 244.

180. U.S. ENVTL. PROT. AGENCY, *Exemption of Oil and Gas Exploration and Production Wastes from Federal Hazardous Waste Regulations*, EPA 530-K-01-004 at 5 (2002) http://www.epa.gov/epawaste/nonhaz/industrial/special/oil/oil-gas.pdf.

exploration, development, or production of crude oil or natural gas. . . " were beyond RCRA's reach.[181] The EPA soon thereafter announced its determination, making the temporary exemption final.[182] Hydrofracking wastes derive their moniker – "E&P wastes" – from the "exploration" and "production" reference in that amendment.

The 1988 RCRA exemption for hydrofracking wastes has outlived both its justification and utility.[183] The exemption dates back to 1988 before the hydrofracking boom of the twenty-first century.[184] Given the sheer breadth with which fracking expands and continues in certain regions, the need for heightened regulation of wastewater is greater than ever.

The EPA determined that regulation of hydrofracking wastes was "unwarranted" at the time of the exemption in 1988 based on three main reasons that arguably no longer hold true today. First, the EPA grounded its rationale in economics: "handling and disposing the waste would be 'extremely' high, and that compliance costs could 'reduce domestic production by as much as 12 percent.'"[185] These estimates were based on data that is now about two decades old – the EPA should re-visit this statistic to check if it still applies in light of the fact that domestic natural-gas drilling has significantly expanded. Furthermore, today's estimate of recoverable energy from Shale rock was unavailable at the time of this assertion. Second, the EPA had concluded that the existing state and federal laws for waste management was adequate, voiding the need for further regulation. As emphasized previously, fracking has expanding significantly since 1988: the amount of wastewater produced from just one fracking operation is about 3,800,000 gallons, but upwards of 5 million gallons. Lastly, the EPA recognized the undeniable difficulties in RCRA's complex statutory scheme, and "crowned its analysis with a discussion of the impracticably and inefficiency of attempting to regulate oil and gas wastes" under RCRA.[186] Despite this obstacle, much has been researched and written on hydrofracking; the EPA is

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181. *See id.* at 6.

182. *Id.*

183. *See generally* Petition for Rulemaking Pursuant to Section 6974(a) of the Resource Conservation and Recovery Act, *supra* note 44, at 5.

184. *See* Wiseman, *supra* note 109, at 246.

185. *Id.* at 245-6

186. *Id.* at 246.

in a more knowledgeable position today than it was in 1988 and could use the plethora of information available today to determine the ins and outs of wastewater's application to hazardous waste disposal.

The idea behind hydrofracking as a method of horizontal drilling has generally remained the same over time, but the list of chemicals used has expanded tremendously, providing additional cause for the EPA to re-examine the 1988 exemption. Only some of the chemicals used in fracking fluids are likely remain the same today as they did in 1988.[187] Today, energy companies chose about a dozen chemicals from over 250 possibilities for their fracking fluids.[188] The EPA was not aware of this entire range of possibilities at the time of exemption, and therefore could not have accounted for them all. Indeed, a sampling of wastewater from Pennsylvania and New York "contained high concentrations (as compared to acceptable drinking water concentrations) of chemicals not described by EPA in its 1988 report, such as antimony and thallium."[189] The EPA acknowledged wastewater's toxicity at the time of the RCRA exemption as a risk to human health, and that risk has only increased over time.[190]

Both academics and government agencies have produced a plethora of research describing the hazardous nature of fracking fluids and wastewater. A group of Cornell professors submitted a comment to the New York State Department of Environmental Conservation ("NYS DEC") outlining their findings on hydrofracking that focused particularly on the dangers of fracking chemicals.[191] They highlighted that hydraulic fracturing may use at least two known carcinogens: benzene and formaldehyde.[192] Their studies affirmed that nearly half of all wastewater from Pennsylvania and West Virginia contain benzene, a high-risk carcinogen, at concentrations "nearly 100 times the maximum contaminant level (5 μg/L) established by the EPA. The maximum concentration was

187. *See id.*

188. *Id.* at 238-39.

189. *Id.* at 279.

190. *Id.* at 277.

191. *See* Susan Riha and Charles L. Pack, et al., Comments on the draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program, CORNELL UNIVERSITY (2009), *available at* http://cce.cornell.edu/EnergyClimateChange/NaturalGasDev/Documents/PDFs/dSGEIS%20Comments%20_Riha_.pdf.

192. *Id.*

nearly 400 times higher."[193] Other fracking substances such as xylene and monoethanolamine may be carcinogens as well; however, the authors of the Comments noted differing schools of thought as to their carcinogenic activity.[194]

Additionally, the NYC DEC has indicated that certain fracking substances have hazardous effects. Benzene, toluene, ethylbenzene and xylene "are associated with adverse effects on the nervous system, liver kidneys and blood-cell-forming tissues," while some glycol ethers "can affect the male reproductive system and red blood cell formation in laboratory animals at high exposure levels."[195] Professor Hannah Wiseman has pointed out that since the Energy Policy of Act of 2005 – which excluded hydrofracking from federal regulation, but kept regulations in place for diesel oil use, which is on the EPA's Contaminant Candidate List – two additional substances have been added to the EPA's Contaminant Candidate List.[196] Those two substances – ethylene glycol and methanol – are hazardous. Given this reality, there is some difficulty justifying the continuing RCRA exemption.[197]

### 2. Fracking Wastewater Meets RCRA's Hazardous Waste Tests: Ignitability, Corrosivity, Reactivity and Toxicity

As a statutory matter, RCRA sets forth four tests to determine whether a substance is hazardous.[198] While the tests are objective, the actual decision whether to label something as hazardous under RCRA is subjective. Hydrofracking wastewater qualifies as a hazardous waste under RCRA's parameters. Turning to the nuts and bolts of Section C candidacy, the EPA can move to specify a solid waste as a hazardous waste if it meets even just *one* of four

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193. *Id.*

194. *Id.*

195. N.Y. STATE DEP'T OF ENVTL. CONSERVATION 5-62. *See also* Wiseman, *supra* note 108, at 279-80.

196. *See* Beck, *supra* note 13, at 438.

197. *See* Exemption of Oil and Gas Exploration and Production Wastes from Federal Hazardous Waste Regulations, *supra* note 181, at 19.

198. *See* John C. Dernbach, *The Unfocused Regulation of Toxic and Hazardous Pollutants*, 21 HARV. ENVTL. L. REV. 1, 35-36 (1997).

characteristics: ignitability, corrosivity, reactivity, and toxicity.[199] To provide a brief overview of the four characteristics:

> [*I*]*gnitability* is determined by the flashpoint of liquids and the ability of solids to combust spontaneously; *corrosivity* is determined by the acidity or alkalinity (as measured by pH) of the material, or by its ability to corrode a certain amount of steel in a certain time; *reactivity* means materials that explode or violently react, or that produce toxic fumes under ordinary conditions; and *toxicity* refers to specific concentrations of a list of chemicals of concern.[200]

To determine RCRA toxicity, a substance is tested to see how it reacts when introduced to mildly acidic water – also known as the Toxicity Characteristic Leaching Procedure (TCLP) – if it were disposed of in a RCRA subtitle D landfill.[201] With this test, the EPA is particularly concerned with the produced leachate's presence and concentration of forty toxic constituents.[202] Fracking wastewater should qualify as a hazardous waste under RCRA because it meets not one but *all four* of the hazardous waste characteristics. Wastewater is ignitable, contains significant amounts of highly corrosive salts (i.e. brine), can be reactive, and is toxic.[203]

### 3. Financial Implications of Listing Wastewater under RCRA Section C

Obliging drilling companies to dispose of wastewater as hazardous waste could result in their financial benefit.[204] Energy companies worry that listing fracking wastewater as a Section C hazardous waste would be extremely costly to them, but they could potentially

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199. JOHN S. APPLEGATE AND JAN G. LAITOS, ENVIRONMENTAL LAW: RCRA, CERCLA, AND THE MANAGEMENT OF HAZARDOUS MATERIALS 52 (2006).

200. *See id.* at 52-3.

201. *Id.*

202. *Id.*

203. *See* NRDC Petition for Rulemaking Pursuant to Section 6974(a) of the Resource Conservation and Recovery Act, *supra* note 44, at 37-41.

204. *See* Water and Land Use Law Clinic, CORNELL UNIVERSITY LAW SCHOOL, Gas Shale Rush: Guide on the Legal Issues 10 (Mar. 2009), *available at* http://www.otsegocounty.com/depts/pln/documents/CornellU-LegalIssuesforLocalOfficials.pdf.

enjoy a number of long-term financial benefits if Congress implements this proposal. Local and state regulations, and even federal regulations, have been in a constant state of debate and change ever since hydrofracking began to boom. Listing wastewater as a hazardous waste would allow for some closure to the debate, and would require treatment facilities to update their plants appropriately, or build new ones with this new standard in mind.[205] But, assuming that wastewater regulation under Section C turns out to be quite costly for companies, the long-term financial end result could be quite favorable. Energy companies might decide to use less toxic drilling and fracturing materials; resulting in less liability and saving them from costly litigation expenses as well as negative publicity.[206]

From any perspective, RCRA has been the elephant in the room in the hydrofracking wastewater disposal debate. Environmental advocates argue that RCRA should be amended to include fracking wastewater as hazardous waste. Opposing parties contend that wastewater does not rise to a RCRA level of hazardous wastes, and that states have handled wastewater fairly well thus far. Furthermore, federal mandates might not work well because of the varying nature of wastewater disposal practice across state based on funding, geography, available technologies, and other considerations.

## III. FEDERAL ENVIRONMENTAL REGULATION

As the potential harms continue to build, the time is ripe to critically consider stricter federal regulation, or at the least, to progress that conversation. Should the national government step in and regulate at a federal level given that there is cause to believe that state-to-state regulation alone is inadequate?[207] It is certainly a contentious issue. Environmental regulation is no stranger to federalism; it readily accepts the notion that states are more effective in certain enforcement mechanisms than the federal government, and vice versa. If federal regulation is the optimal route to explore in this

205. Murray, *supra* note 88.

206. Petition for Rulemaking Pursuant to Section 6974(a) of the Resource Conservation and Recovery Act, *supra* note 44 at 36.

207. Though certainly, states have made impressive headway on this tremendous environmental issue, and their individual efforts and accomplishments over the past few years are not forgotten.

context, that regulation must be first justified on a theoretical basis prior to discussion of its implementation.

### A. Environmental Policy and Regulations

Environmental policy has historically developed as a series of legislative responses triggered by public uneasiness over polluted waterways, poor air quality, oil spills, and the inadequate disposal of hazardous materials, among other concerns.[208] Though environmental concerns took a backseat to issues of war and peace for a significant part of the twentieth century, they suddenly appeared at the forefront of legislation in the second half of the century.[209] Congress passed an impressive number of statutes and statutory amendments in the 1970s, during the so-called "environmental decade,"[210] giving birth to the Clean Air Amendments, the Occupational Safety and Health Act, the Environmental Pesticide Control Act, the Endangered Species Act, the Safe Drinking Water Act, the Clean Water Act, the Resources Conservation and Recovery Act, and the Toxic Substances Control Act.[211] But the seemingly sudden national interest in environmentalism was actually not as haphazard as it appears at first glance.[212] Scholar Richard Lazarus explains that environmental concerns did not just emerge out of nowhere, but rather that "[t]he underlying social and political pressures for law reform in response to environmental protection concerns has similarly been building up over decades."[213] In no small part, these pressures developed from an increased awareness of the risks and dangers posed by technologies and activities when gone unchecked.[214]

Yet, how should governments respond to insidious health risks that at the moment remain intensely debated due to major political, economic, and potential health implications? The environmentalism of the 1960s and 70s was largely driven by powerfully visual, palpable, and unambiguous pollution: take, for example, Ohio's

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208. *See generally* RICHARD J. LAZARUS, THE MAKING OF ENVIRONMENTAL LAW (2004).

209. *Id.*

210. CAROLYN MERCHANT, AMERICAN ENVIRONMENTAL HISTORY: AN INTRODUCTION, 198 (2007).

211. *Id.*

212. Lazarus, *supra* note 208, at 54.

213. *Id.* at 54-5.

214. *Id.* at 57.

Cuyahoga River burning or the massive oil spill that engulfed the coast of Santa Barbara, both of which occurred in 1969.[215] Justifying sweeping regulation for harms of this sort is easy.[216] But what about the more subtle harms of low-level toxins found in certain pesticides or plastics? Or, returning back to our subject matter, how does one justify sweeping, federal regulation for hydrofracking wastewater, which, objectively speaking, does not necessarily pose immediate and tangible harms?

Today, justifications for federal action have developed into sophisticated frameworks of analysis that consider risks, benefits, costs, competition, trade-offs, and politics, among a myriad of other considerations. Three prominent justifications arguing on behalf of federal environmental protection – the race-to-the-bottom problem, spillover effects, and risk assessment – are discussed below.

### *B. The Hydrofracking Race-to-the-Bottom*

Federal regulation may be justified when states under-regulate lucrative industries in order to attract their business, essentially in competition with other states.[217] Race-to-the-bottom theory addresses this phenomenon, postulating that states establish suboptimally lax environmental standards to attract mobile companies to the state.[218] Races-to-the-bottom have had detrimental effects on the environment in the past. A closer look at the arguments is necessary to weigh whether states are indeed racing to the bottom and lowering state regulations in order to attract the hydrofracking industry.

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215. *Id.* at 59.

216. *See* Lazarus, *supra* note 208, at 58-9. (The environmentalism of the 1960s and 70s was not only pushed forth due to large-scale, direct harms such as the Cuyahoga River or Santa Barbara oil spill. It is also attributed to literary pieces that sparked discussion on the chemical industry, pesticides, carcinogens and toxins in general. Rachel Carson's *Silent Spring*, a pesticide-caused fish kill in the Mississippi River, DDT contamination in Wisconsin and potentially toxic levels of mercury among swordfish, all of which happened in the 1960s, significantly contributed to the public's shift toward environmentalism.)

217. Kristen H. Engel, *State Environmental Standard-Setting: Is there a "Race" and Is It "To the Bottom"?* 48 HASTINGS L.J. 271, 274 (1997).

218. *Id.*

### 1. Questioning Federal Action Based on Race-to-the-Bottom Theory

As a leading environmental law scholar and proponent of decentralized regulation, Professor Richard Revesz has contributed a great deal of scholarship on this topic. Grounded in pragmatism, Professor Revesz' starting point in favor of decentralization rests on three independent grounds.[219] The first ground cites our country's substantial size and diversity. To that end, Professor Revesz offers that an accepted regulatory system should not wholly discount public preferences among different regions.[220] Second, federal regulation applies broadly to diverse regions of the country, but its benefits do no always apply uniformly everywhere.[221] Last but not least is the ever-present elephant in the room: the costs of implementation.[222]

Professor Revesz analyzes other scholarly works that support federal regulation to eradicate the effects of a race-to-the-bottom, but ultimately finds their conclusions lacking.[223] Proponents generally advocate that without centralized regulation, states will compete with one another for industry business at the expense of environmental protections.[224] Professor Revesz rejects this rationale, explaining that jurisdictions may compete over more than just one variable, such as environmental protection, which might negatively affect social welfare.[225] To elucidate this point, Professor Revesz considers two hypothetical sovereigns: States 1 and 2.[226] In the absence of federal regulation, State 1 implements a low level of environmental protection but a high level of worker safety policy. State 2 does the opposite, and implements a high level of environmental protection but a low level of work safety.[227] The two states offer differing

219. Richard L. Revesz, *The Race to the Bottom and Federal Regulation: A Response to Critics*, 82 MINN. L. REV. 535, 536 (1997).

220. *See id.*

221. *Id.*

222. *Id.* at 537.

223. Richard L. Revesz, *Rehabilitating Interstate Competition: Rethinking the "Race-to-the-Bottom" Rationale for Federal Environmental Regulation*, 67 N.Y.U. L. REV. 1210, 1211 (1992).

224. *Id.* at 1245.

225. *Id.*

226. *Id.* at 1216.

227. *Id.* at 1245.

incentives to attract industry, yet a competitive equilibrium exists.[228] This competitive equilibrium would cease if the federal government were to impose a high level of environmental protection.[229] This scheme would not harm State 2's position, however State 1 would have to lower its work safety level or suffer the loss of industry to State 2.[230] Through this model, Professor Revesz demonstrates that "federal environmental standards can have adverse effects on other state programs. Such secondary effects must be considered in evaluating the desirability of federal regulation."[231]

2. Proponents Argue on Behalf of the Race's Merits

Proponents of federal regulation based on a race-to-the-bottom have too produced a plethora of scholarly work and sound arguments. Using a similar "island jurisdictions" model (the Prisoner's Dilemma), other scholars have demonstrated how a lack of centralized standards in fact leads to lower social welfare standards.[232] Professor Kristen H. Engel describes a scenario in which States A and B harmoniously co-exist.[233] A dilemma arises when State A relaxes its pollution standards, thereby attracting at least some of State B's industry.[234] State A's newly relaxed environmental standards would lead to more pollution from new and existing plants, and "at the same time that they produce more products and economic benefits."[235] States pursue their own rational, economic-efficient agendas, but this approach results in "inefficient allocations, suboptimal environmental standards, and reduced overall welfare."[236] Professor Daniel Esty similarly challenges Professor Revesz's work, affirming that states *do* act strategically in competing for industry benefits and should be subject to federal controls.[237]

228. *Id.*
229. *Id.*
230. *Id.*
231. *Id.* at 1246.
232. *See generally* Engel, *supra* note 217.
233. *Id.* at 304. To clarify, Engel uses the indicator State A and State B, whereas Revesz uses State 1 and State 2.
234. *Id.*
235. *Id.*
236. *Id.* at 276.
237. Daniel C. Esty, *Revitalizing Environmental Federalism*, 95 MICH. L. REV. 570 (1996).

### 3. Hydrofracking and the Race-to-the-bottom

The arguments for and against federal action based on a possible race-to-the-bottom all present legitimate points for consideration. Race-to-the-bottom theory is certainly compelling and plausible, however, the disparate hydrofracking policies within the several Marcellus Shale states strongly suggest that a hydrofracking race-to-the-bottom is not occurring. The Marcellus Shale extends deep underground, covering parts of Ohio, West Virginia, Pennsylvania, and New York, as well as small portions of Maryland and Virginia.[238] Among those states, two serve as good examples to disprove a race-to-the-bottom in this case: New York and Pennsylvania. In 2008, then-New York Governor David Patterson ordered the state's Department of Energy Conservation ("DEC") to conduct an environmental review of hydrofracking.[239] At the time, Governor Patterson also issued a de facto moratorium on drilling, via executive order, until the review was complete.[240] Since then, the New York State Department of Energy Conservation has turned away all new drilling permit requests, and to-date, continues its environmental review.[241] On the other hand, there is Pennsylvania – another state that is abundantly rich in Marcellus Shale natural gas. Yet unlike New York, Pennsylvania is now the epicenter of Marcellus Shale drilling. Since 2008, Pennsylvania has doubled the state's Department of Environmental Protection oil and gas inspection staff, and implemented a number of new water quality standards and hydrofracking regulations.[242] The jump in Pennsylvania drilling permits is even more astounding: whereas the state issued 117 hydrofracking permits in 2007, that figure

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238. Water and Land Use Law Clinic, Cornell Univ. Law Sch., *Gas Shale Rush: Guide on the Legal Issues* 1 (Mar. 2009), *available at* http://www.otsegocounty.com/depts/pln/documents/CornellU-LegalIssuesforLocalOfficials.pdf.

239. Nicholas Kusnetz, *New York Proposes Permanent Ban on Fracking Near Watershed and State Land*, PROPUBLICA (June 30, 2011), *available at* http://www.propublica.org/article/fracking-still-on-hold-in-new-york-pending-environmental-review.

240. *See id.*

241. *Id.*

242. Lynn Kerr McKay, Ralph H. Johnson & Laurie Alberts Salita, *Science and the Reasonable Development*, 32 ENERGY L.J. 125, 132 (2011).

skyrocketed to about 3,300 permits in 2010.[243] All of this drilling proceeds despite proven reports of water supply contamination and public health concerns due to inadequate wastewater treatment.[244]

### *C. Spillover Effects as a Persuasive Argument to Regulate on a Federal Level*

Even if the New York and Pennsylvania case-study deviates from race-to-the-bottom rationale, this conclusion is at odds with the accepted-truth that theoretically, states always have an incentive to externalize spillover effects. Leading legal scholars have posited that, spillover effects, also known as transboundary pollution, provide overwhelming justification for federal regulation.[245] The race-to-the-bottom and transboundary pollution are closely related. Professor Thomas W. Merrill, explained that transboundary pollution may necessitate greater, centralized regulation within the context of environmental law.[246] Air, water and to an extent, groundwater pollution, has the capacity to cross state boundaries, and pollution that originates in one state and spills over into another is extremely difficult for either jurisdiction to regulate, let alone to regulate effectively.[247] It is feasible that the source state would be reluctant to impose expensive controls on the local industry because political outsiders would reap the benefits of such action.[248] The affected state may not be able to obtain jurisdiction over actors in the source state; and even if it is able to obtain jurisdiction, the affected state may have trouble enforcing any decree it enters.[249] The inherent difficulties for any single state to regulate transboundary pollution

243. Urbina, *supra* note 18.

244. *See generally* Jad Mouawad and Clifford Krauss, *Dark Side of a Natural Gas Boom*, N.Y. TIMES, Dec. 8, 2009, at B1, *available at* http://www.nytimes.com/2009/12/08/business/energy-environment/08fracking.html?pagewanted=all.

245. *See* Jonathan Adler, *When is Two a Crowd? The Impact of Federal Action on State Environmental Regulation*, 31 HARV. ENVTL. L. REV. 67, 79-80. *See also id. at nn. 5, 25, 48, 139, 143, 147-48.* Thomas W. Merrill, *Golden Rules for Transboundary Pollution*, 46 DUKE L.J. 931, 932 (1997).

246. Merrill, *supra* note 246, at 932.

247. *Id.*

248. *Id.*

249. *Id.*

presents a clear case for shifting regulatory authority toward more centralized levels of governance.[250]

In support of this assessment, Professor Robert L. Glicksman offers that, "pollution knows no boundaries, and it seems unlikely that upwind states would ever adequately take into account the concerns of downwind states."[251] There is little incentive for upwind states to cooperate with downwind states, "and the transactional costs of establishing interstate regulation are too high for the states, except in special cases."[252] The federal legislature is nationally focused and a "natural forum to establish regulations and procedures to resolves interstate conflicts."[253] Thus, the federal legislature "should create the strongest justification for federal intervention."[254]

Wastewater disposal does not appear to be directly susceptible to a race-to-the-bottom. A state's wastewater disposal policy is tied to its fracking policy – and as this Note explains, some states have seen a significant rise in their hydrofracking industry while other states have brought the practice to a halt. This suggests that a race-to-the-bottom is not ostensibly occurring, and this conclusion necessitates an alternative justification for greater federal standards for wastewater.

### *D. Risk Assessment as a Justification for Federal Wastewater Standards*

The Wingspread Conference Center in Racine, Wisconsin, laid the foundation for dealing with hazardous and toxic wastes and their unintended consequences on the environment, known as the Wingspread Statement on the Precautionary Principle.[255] Risk

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250. *Id.*

251. Robert L. Glicksman, *From Cooperative to Inoperative Federalism: The Perverse Mutation of Environmental Law and Policy*, 41 WAKE FOREST L. REV. 719, 735 (2006).

252. *Id.*

253. *Id.*

254. *Id.*

255. Global Development Research Center, *Wingspread Statement on the Precautionary Principle* (Jan. 23-25, 1998), *available at* http://www.gdrc.org/u-gov/precaution-3.html ("The release and use of toxic substances, resource exploitation, and physical alterations of the environment have had substantial unintended consequences on human health and the environment. . . . Therefore it is necessary to implement the Precautionary Principle: Where an activity raises threats of harm to the environment or human health, precautionary measures should

assessment and risk management is among the rationales for federal regulation within the realm of environmentalism. Almost any regulatory process begins with recognizing a risk, and then assessing that risk. Risk assessment is a "process in which information is analyzed to determine if an environmental hazard might cause harm to exposed persons and ecosystems."[256] Environmental risk assessment involves an interdisciplinary discussion that draws on "such diverse fields as biology, toxicology, ecology, engineering, geology, statistics, and the social sciences to create a rational framework for evaluating environmental hazards."[257] Once the risks have been evaluated from a variety of angles, with particular attention to "such factors as the goals of public health and environmental protection, relevant legislation, legal precedent, and application of social, economic and political values," the regulatory agency might be ready to take action.[258] What follows is referred to as "risk management," in which the relevant agency proceeds with forming a plan of action with all of the previously-named considerations in mind.[259]

Risk assessment comes under fire from industry members because it rests on assumptions that are said to be untestable and even exaggerated.[260] Critics are skeptical of risk assessment because it is a forward-looking, preventive approach to regulation.[261] Further bolstering their viewpoint, critics contend that assessment is based on "unprovable assumptions" and that the process is vulnerable to manipulation by environmental and political groups.[262] But waiting for overwhelming, concrete evidence of human health risks puts people in jeopardy, essentially using them as guinea pigs.[263] The

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be taken even if some cause and effect relationships are not fully established scientifically.").

256. U.S. ENVTL. PROT. AGENCY, EXAMINATION OF EPA RISK MANAGEMENT PRACTICES 2 (Mar. 2004), *available at* http://www.epa.gov/OSA/pdfs/ratf-final.pdf.

257. *Id.*

258. William D. Ruckelshaus, *Risk, Science, and Democracy*, 1 ISSUES SCI. & TECH. 19, 28 (1985).

259. *Id.*

260. *Id. at 27.*

261. *Id.*

262. *Id.*

263. *Id.*

underlying argument here underscores the *precautionary principle*.[264] This regulatory approach "reflects the implicit judgment that, in the absence of some degree of *ex ante* regulatory review, new technologies will create novel, severe, and irreversible – but avoidable – harms to human health and the environment.[265] It also reflects the value judgment that protection of human and environmental health trumps quantitative measures of risks and economic efficiency."[266] This argument is particularly salient to the hydrofracking debate.

The EPA's first Administrator, William D. Ruckelshaus, addressed the controversial nature of government action based on risk assessment in his work.[267] Ruckelshaus explained that risk assessment poses a political hurdle because it "may be imbued with values repugnant to one or more parties involved."[268] It might be that some members of the regulated community "believe that the structure of risk assessment inherently exaggerates risk, while many environmentalists believe that it will not capture all the risk that might actually exist."[269] This disagreement unfortunately cannot be resolved immediately with scientific data; thus, at least some regulatory action must be premised on educated assumptions rather than comprehensive scientific data.[270]

Further, Ruckelshaus finds that both positions, at their extreme, are flawed.[271] Regulation that is justified solely in situations where there is a concrete, scientifically provable connection between the pollutant and a health effect is at the very least imprudent. This rationale would effectively allow for the "release of unlimited quantities of substances that cause cancer in animals, on the assumption that there will be no analogous effect on people and there must be thresholds for carcinogenesis."[272] Risk assessment requires acknowledgement of the fact that some risks are controlled in excess "as a kind of

264. John S. Applegate, *Taming the Precautionary Principle*, 27 WM. & MARY ENVTL. L. & POL'Y REV. 13, 13 (2002).
265. *See id.*
266. *Id.*
267. *See generally* Ruckelshaus, *supra* note 258.
268. *Id.* at 28.
269. *Id.*
270. *Id.*
271. *Id.* at 29.
272. *Id.*

insurance, with the cost of control as its premium."[273] Ruckelshaus concludes that an agency working toward reducing fear of a risk, even unreasonable fear, performs a valid social function.[274] On the other hand, some argue that any identifiable risk should be completely eliminated to the extent possible, given available technologies. What exactly constitutes the "best available technology" is infinitely debatable. Even when it is clear what the best available technology for a situation might be, this ideal goal is at times difficult to reconcile with financial costs and feasibility.

Hydrofracking is a multi-faceted issue with layers upon layers of environmental, economic, and political considerations. It has received public support from the current Administration. It also remains the preferred method of natural gas recovery in more recent times. Yet despite the substantial economic stimuli that hydrofracking can realistically bring to suburban and rural parts of the country still in the midst of an economic downturn, a number of state governments have not hesitated to regulate the process more closely.[275] The risks are still stalwartly debated but they are increasingly viewed with a wary eye by state regulators. Turning back to this Note's topic, wastewater disposal is primarily evaluated under risk assessment and justifications for federal regulation would likely be based in this theory, rather than the race-to-the-bottom theory.[276]

### *E. Take-Away*

Environmental policy is often a game of chance. We take chances when we choose to regulate or deregulate threats to our health, safety and natural environment. Reflecting on these frameworks, one could argue that all three are occurring with respect to hydrofracking perhaps just as easily as one could say that none are compelling enough to act on. For the purposes of this Note, the race-to-the-bottom can never be fully discounted but based upon the fact that

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273. *Id.*

274. *Id.*

275. *See generally* Deweese, *supra* note 11, at 23-31.

276. Dammel, *supra* note 2, at 804. (explaining that, "[i]n the context of hydraulic fracturing, the precautionary principle [of regulating under scientific uncertainty] could be a beacon guiding states and federal regulators through the circus act of balancing the promotion of production while also protecting the public and environment.").

several states have moratoria – real or de facto – on fracking, it is difficult to conceive that states are really "racing" down and loosening environmental standards, to win over the fracking industry for their economic boons. Spillover effects, as we have seen, have manifested themselves as a problem. Pennsylvania and Ohio provide a good case-study of this point. Still, spillover effects can be controlled and restricted; the same cannot be said with as much confidence for health risks.

## IV. ALTERNATIVES

Bringing almost any hydrofracking aspect under federal regulation would be a tremendous endeavor. Assuming that enough members of Congress can prevail past the strong political opposition, the EPA would be tasked with effectively regulating a multi-billion industry that has proliferated at an extraordinary rate across the country. This scenario is both challenging on many levels. Congress might reject this notion, as it effectively has since the 2005 exemption, and instead prefer to explore less demanding, alternative methods of regulation.

### *A. Rethinking the Ingredients*

One way to mitigate wastewater's harms would be to regulate the original components of fracking fluids by replacing them with biodegradable materials where possible.[277] Such a proposal would require substantial research into its feasibility, and cooperation by the energy industry.[278] But it has been done before: most pertinently, the EPA made the leap to ban the use of diesel fuel in fracking mixtures in 2004.

Congress could encourage this alternative by providing incentives to switch to biodegradable materials.[279] Those incentives could include tax breaks to participating companies or federally-assisted "research and development efforts to explore suitable organic fracturing fluids."[280]

277. Cupas, *supra* note 121, at 631.
278. *Id.*
279. *Id.*
280. *Id.*

This proposal is far from unattainable: the energy industry has risen to the task of replacing harmful substances in their operations with friendlier materials in the past. In a petition for rulemaking, the Natural Resources Defense Counsel explained that several companies have reformulated their hydrofracking fluids, and should continue this campaign. EnCana stopped using the chemical 2-Butoxyethanol – which has been known to cause reproductive issues in animals; BJ Services stopped using fluorocarbons – persistent environmental pollutants, and Antero Resources Corporation pledged to only use "green frac" materials in their operations in certain Western, Colorado communities, to name a few examples.[281] Some companies have also instituted on-going campaigns to test chemicals and reform fluid composition where possible. Chesapeake Energy, states that through its Green Frac program, "the company has eliminated 25% of the additives used in hydraulic fracturing fluids in most of its shale plays."[282] Nonetheless, the government has a part to play by offering greater financial incentives in hopes that it will spark industry-wide reformulation of fracking fluids.

### *B. Green Energy Alternatives*

Any critical analysis of hydrofracking would be remiss to fail to mention the possibility of shifting the national focus away from hydrofracking, toward renewable, green sources of energy. Fracking opponents, particularly in the New York state region, have adapted this platform as their desirable alternative to fracking. Anti-fracking advocates appeal to fellow residents, politicians and community groups with a common message: the country must wean off of fossil fuel dependence, and this includes natural gas attained from hydrofracking.

Hydrofracking is a multi-billion dollar industry that, despite a handful of moratoria in key states, continues to expand each year and is generally viewed favorably. Natural gas is the cleanest-burning of all the fossil fuels.[283] It is favored over other conventional energy

281. Petition for Rulemaking Pursuant to Section 6974(a) of the Resource Conservation and Recovery Act, *supra* note 44.

282. Chesapeake Energy, *Green Frac* (last visited Jan. 5, 2013), *available at* http://www.chk.com/environment/drilling-and-production/pages/green-frac.aspx.

283. DOE Primer, *supra* note 5, at 5-6. ("[O]f all the fossil fuels, natural gas is by far the cleanest burning. . . . 82.3% of [greenhouse gas] emissions in the U.S. in

sources because it emits half as much $CO_2$ as coal, and approximately 30% less $CO_2$ than fuel oil.[284] It produces less carbon dioxide per unit than coal or oil, does not distribute the neurotoxin mercury, nor does it pollute our lungs and atmosphere with soot and sulphur.[285]

Relative to other fossil fuels, natural gas certainly has its advantages. The federal government too supported the innovation and promise of natural gas development. Looking back at the 2012 State of the Union speech, President Obama proclaimed that the United States sits atop enough natural gas to power the country for nearly 100 years, and that the fracking industry can support over 600,000 jobs by the end of the decade.[286]

In his recent article on climate justice, energy scholar Professor Daniel A. Farber explained the fundamental economic rationale for pursuing renewable energy over fossil fuel production:

> If fossil fuels are not allowed or are severely limited, there is a huge incentive to make renewable energy and energy conservation cheaper, so the economic incentive to use fossil fuels becomes smaller. Moreover, use of fossil fuels requires a huge investment in infrastructure – railroads to coal mines, new coal-burning power plants, oil refineries, oil supertankers, and so forth. After the existing infrastructure for fossil fuels decays, use of fossil fuels will be less appealing than at the present, when fossil fuels have the advantage of an existing infrastructure that has already been paid for. Thus, switching away from fossil fuels is like ending an addiction: very difficult at the beginning, but easier over time. Although there is no guarantee against a possible relapse, maintaining a multigenerational policy for

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2006 came from CO2 as a direct result of fossil fuel combustion. Since CO2 makes up a large fraction of U.S. [greenhouse gas] emissions, increasing the role of natural gas in U.S. energy supply relative to other fossil fuels would result in lower [greenhouse gas] emissions.").

284. *Id.* at 5.

285. *Cleaner, Not Cooler*, THE ECONOMIST, Aug. 6, 2011, *available at* http://www.economist.com/node/21525418.

286. Wendy Koch, *Obama Calls for Offshore Oil Drilling and Clean Energy*, USA TODAY, Jan. 24, 2012, *available at* http://content.usatoday.com/communities/greenhouse/post/2012/01/obama-calls-for-offshore-oil-natural-gas-and-clean-energy/1#.T4UD9u1HID4.

> a move away from fossil fuels is likely to provide fewer incentives for reversion than a massive investment trust.

This rationale holds a great deal of weight in the hydrofracking context. Each fracking operation establishes a well, drills down to retrieve natural gas, disposes of the wastewater, and moves on to a different location.

### *C. Back to Federalism: States Volunteering to Impose Stricter Standards*

States enjoy their autonomy on many regulatory matters and do not necessarily revel in the thought of new federal mandates. States agencies have indeed impressively arisen to environmental challenges throughout the past few decades.[287] Even after the "environmental decade" the federal government was not always prepared or composed enough to approach environmental protection.[288] This led to some extraordinary environmental regulation by some state governments; from New Jersey's Hazardous Site Remediation Act, Michigan's Air Pollution Laws, and California's Proposition 65 and Toxic Hot Spot Law.[289] Similarly, states can continue to push for higher standards in the hydrofracking industry.

## CONCLUSION

Shale natural gas has a seat at the energy policy table for years to come. It is here to stay and has its advantages in certain areas, but as most things, it has disadvantages as well. In the wake of the 2010 Deepwater Horizon oil gush, a lack of enthusiasm for green energy, and environmentally questionable drilling methods, hydrofracking is hailed as the best option available.[290] Though it may be a relatively

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287. March Sadowitz & John D. Graham, 6 RISK: HEALTH, SAFETY & ENV'T. 17, 31 (1995). *See also* Revesz, *supra* note 224, at 1228.

288. Sadowitz & Graham, *supra* note 288, at 31.

289. *Id.* at 31-33.

290. Barring a boom in the market for renewable wind and solar energy sources, which are currently experiencing setbacks. *See* Diane Cardwell, Renewable Sources of Power Survive, But in a Patchwork, N.Y. TIMES, Apr. 11, 2012, at F5, *available at* http://www.nytimes.com/2012/04/11/business/energy-environment/renewable-energy-advances-in-the-us-despite-obstacles.html?_r=0

clean drilling method, there is much to be said about its potential to contaminate drinking water supplies by way of wastewater.

The goal of this Note was to explain wastewater's hazards, to set forth the challenges presented by our dependence on underground injection, and to suggest a renewed interest in treatment facilities for disposal. This interest is already on the rise: reports show that the wastewater treatment equipment market is expected to achieve steady growth once EPA promulgates new standards, thereby giving this industry greater stability.[291] But simply increasing reliance on treatment facilities is not a comprehensive solution. Wastewater treatment can prove dangerous without stricter standards and increased technology. Perhaps the attention should not be solely on the back end of the disposal process with treatment, but on front end of the issue with how we classify this substance to begin with.

There is no easy answer to the issues raised by hydrofracking, but the concerns are sufficiently urgent to hold our attention and garner sustained research in this field. Simply put, more must be done to ensure the safety of communities and the environment. States might explore new and creative courses of action, or as this Note contends, perhaps fracking should be re-evaluated on a federal level. One way to assure that wastewater is handled with greater concern for environmental safety and human health is to regulate it under RCRA as a hazardous waste.

Given the risks, the future of hydraulic fracturing wastewater treatment will remain murky and continue to threaten our drinking water unless the government takes proactive regulatory steps. The EPA took one such positive step in October 2011, when the agency announced its intent to issue new pre-treatment rules for fracking

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(explaining that, the low costs of hydrofracking natural gas coupled with negative publicity suffered by the now-collapsed solar panel company, Solyndra, which received a $535 million federal loan guarantee, has dimmed renewables spotlight in the U.S. to an extent. However, Cardwell points to new initiatives that forge ahead under the renewable energy banner and promise to reinvigorate interest and investment in this industry).

291. Press Release, Frost & Sullivan, *The Chance of Long-Term Natural Gas Buoys Wastewater Treatment Equipment in the Shale Gas Industry*, July 12, 2012, *available at* http://www.marketwatch.com/story/frost-sullivan-the-chance-of-long-term-natural-gas-buoys-wastewater-treatment-equipment-in-the-shale-gas-industry-2012-07-12.

wastewater.[292] This proposed rulemaking, coupled with news of Pennsylvania's investment in its treatment facilities, is a very promising start. Additionally, some states have begun mandating full disclosure of fracking chemicals by law.[293] Greater transparency with respect to the contents of fracking fluids will undoubtedly facilitate states and the federal government to issue more comprehensive guidelines and standards on wastewater treatment.

Hydraulic fracturing can be done better, safer. And, as a society that is deeply invested in the long-term health of our citizens and our environment, a RCRA amendment and improved wastewater treatment technology should be part of the conversation on how we can work toward that objective.

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292. *See* U.S. ENVTL. PROT. AGENCY, *EPA Announces Schedule to Develop Natural Gas Wastewater Standard/Announcement is Part of Administration's Priorities to Ensure Natural Gas Development Continues Safely and Responsibly*, Oct. 20, 2011, *available at* http://yosemite.epa.gov/opa/admpress.nsf/0/91E7FADB4B114C4A8525792F00542001.

293. *See* Robert Sullivan, *States Push Hydrofracking Disclosures*, THE ENERGY REPORT, Sept. 27, 2011, *available at* http://www.theenergyreport.com/pub/na/11058 (stating that, although the degree of disclosure varies, several states have enacted regulations requiring disclosure, including but not limited to Texas, Pennsylvania, Arkansas, Michigan, Wyoming and Montana).