Hydraulic Fracturing, Uncooperative Federalism, and Technological Innovation

by Carlos R. Romo*

According to the U.S. Department of Energy ("DOE"), the "[h]andling and disposal of [waste] water is the single greatest environmental impediment to domestic oil production."[1] In particular, hydraulic fracturing ("HF") operation (or the injection of fluids into shale formations to extract oil and gas hydrocarbons) is water-intensive. By some estimates, a typical hydrocarbon well requiring HF stimulation activities may require an average of four million gallons of water to initiate production.[2] Between 25% and 75% of the fluid used in HF operations flows back to the surface after drilling operations cease ("flowback water"). In addition, for every barrel of oil produced, approximately three barrels of naturally occurring saline water are released from above or below the shale formations ("produced water").[3] An estimated 98% of waste from hydrocarbon production consists of this produced water or flowback water (collectively "produced water").[4] As domestic oil and gas development continues to expand at nearly unprecedented rates, the oil and gas industry faces significant regulatory uncertainty as local, state, and federal entities more closely examine how to regulate this waste.[5] The governance schemes that seek to regulate the recycling of these vast quantities of oil and gas waste provide important, unexplored lessons about the roles of the states and federal government in environmental regulation and the states' ability to encourage needed technological innovation through unique state regulation.[6]

Through a system rarely seen in the federally-dominated environmental field, states, not the Environmental Protection Agency ("EPA") or Congress, primarily influence oil and gas water management.[7] States regulate produced water as an oil and gas waste in one of three ways: (1) by allowing disposal via injection back into the well; (2) evaporation from ponds, treatment at a stationary treatment facility, and subsequent discharge into surrounding waterways; or (3) reusing and recycling the wastewater on-site or at a stationary facility.[8] Water scarcity, injection well availability, water quality concerns, and local water costs all affect which of these options is used in a particular area.[9]

States have embarked upon a variety of regulatory approaches to manage hydrocarbon wastewater.[10] Pennsylvania, for example, has nearly mandated the reuse of hydrocarbon wastewater because of water quality concerns resulting from prior management of produced waters at publicly owned water treatment facilities used with drinking water. According to some estimates, operators are currently recycling as much as 90% of wastewater in the state.[11] Water scarcity is

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1. U.S. Dep't of Energy, Oil & Natural Gas Environmental Program Produced Water Management 1 (2005), *available at* http://www.netl.doe.gov/technologies/oil-gas/publications/prgmfactsheets/PrgmPrdwtrMgt.pdf.
2. *Id.*
3. John A. Veil et al., A White Paper Describing Produced Water From Production of Crude Oil, Natural Gas, and Coal Bed Methane (2004), *available at* http://www.circleofblue.org/waternews/wp-content/uploads/2010/08/prodwaterpaper1.pdf; U.S. Envtl. Prot. Agency, EPA/600/D-11/001, Draft Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources 36 (2011); *see Innovations in Water Use for Hydraulic Fracturing: Hearing Before a Meeting of the Tex. House Comm. on Natural Res.* (Feb. 13, 2013) (presentation by Karen Sinard, Oxy Petroleum), *available at* http://www.legis.state.tx.us/tlodocs/83R/handouts/C3902013021314001/C3902013021314001.pdf (follow "OXY" hyperlink) (last visited Oct. 6, 2013) (One company recently reporting that it produces up to twenty barrels of water for every barrel of oil produced.).
4. U.S. Dep't of Energy, *supra* note 1. *See also Hydraulic Fracturing and Water Use: Get the Facts,* Energy in Depth (July 16, 2013), http://energyindepth.org/national/hydraulic-fracturing-and-water-use-get-the-facts/.
5. *Id.* at 1–2.
6. *See generally* Veil et al., *supra* note 3.
7. *Id.* at 25.
8. *See* Am. Petrol. Inst., Water Management Associated With Hydraulic Fracturing 7.1, (2010), *available at* http://www.shalegas.energy.gov/resources/HF2_e1.pdf. Most states define oil and gas wastes to include produced water. *See, e.g.,* Tex. Nat. Res. Code Ann. §91.1011(b) (West 1985) ("'Oil and gas waste' includes salt water, brine, sludge, drilling mud, and other liquid, semiliquid, or solid waste material . . .").
9. *See* Am. Petrol. Inst., *supra* note 8.
10. *See, e.g.,* John C. Ruple & Robert B. Keiter, *Water for Commercial Oil Shale Development in Utah: Allocating Scarce Resources and the Search for New Sources of Supply,* 30 J. Land Resources & Envtl. L. 95, 133–38 (2010).
11. *See* Press Release, Katy Gresh, Commonwealth of Pa. Dep't of Envtl. Prot., DEP Calls on Natural Gas Drillers to Stop Giving Treatment Facilities Wastewater (Apr. 19, 2011) *available at* http://www.portal.state.pa.us/portal/server.

also driving regulatory incentivization of recycling and reuse in places like the Eagle Ford Shale in Texas.[12] Additionally, water rights statutes and litigation are key considerations for stakeholders and regulators in managing produced water recycling in such states as New Mexico, Colorado, Wyoming, and Utah.[13] Community concerns over water management issues such as truck traffic (water disposed of in disposal wells must be trucked to the disposal well) also influence regulation.[14] Water-cost concerns are also paramount considerations for operators in managing water use and disposal.[15] Operators recently noted that in some regions, as much as $1.5 million of the approximately $6 million required to drill an HF well is due to the costs of water management.[16]

These various motivations to reduce water use associated with drilling and HF have resulted in significant capital investments in new recycling and treatment technologies that may minimize or even eliminate discharges from treatment facilities.[17] With new investments and capital to resolve this industry-wide problem, novel treatment technologies have emerged to treat water for potential reuse.[18] Treatment technologies using physical, chemical, biological, and membrane technologies (e.g. reverse osmosis) to achieve higher percentages of reuse have become more prevalent.[19] A promising innovation, which is now encouraged through state regulation, is the treatment of water for reuse in future HF operations at nearby wells.[20]

The new investments into recycling technology have made produced water recycling more widespread, and thus more economical. As wastewater recycling technologies become increasingly more common, state oil and gas and environmental regulators have begun to encourage the adoption of recycling technologies as a new method for hydrocarbon waste treatment and disposal.[21] In some instances, states are encouraging water reuse through streamlined permitting of treatment technologies that can be used in the normal course of hydrocarbon waste management.[22] Some states have adopted specific rules and permitting processes that expressly address wastewater recycling as a means to encourage treatment and reuse.[23]

Still, just as states are addressing produced water management and using regulatory rulemaking and permitting to encourage recycling, EPA has proposed a new rulemaking to address water treatment in the oil and gas sector under its authority under the Clean Water Act ("CWA").[24] New regulations proposed by 2014 will be based off of recommendations stemming from EPA's study of water use in the oil and gas sector.[25] Regulation under the CWA is likely to both directly and indirectly affect treatment and reuse of produced water, but it is unclear how such directives will affect the industry and states.

Recent legal scholarship on environmental federalism provides a framework for examining proposed EPA regulation of produced water recycling. Only a small portion of this literature, however, examines the potential for state resistance to federal regulation to prompt technological innovation.[26] This Article accordingly explores state approaches to produced water recycling as a case study to demonstrate how "uncooperative federalism" promotes innovation and diffusion of new technologies.[27] It highlights the types of regulatory frameworks states have adopted to encourage recycling of produced water and analyzes how proposed federal regulation under the CWA may stymie this needed progress. It then suggests how similarly uncooperative approaches could address other environmental challenges and proposes a framework for identifying those areas best suited to this approach.

The Article proceeds in five parts. Part I provides general background on the key legal considerations supporting the use of produced water recycling. Part II discusses the various state regimes that have emerged to regulate the industry and the ways in which these approaches have adapted

pt/community/newsroom/14287?id=%2017071%20&typeid=1; Stephen Rassenfoss, *From Flowback to Fracturing: Water Recycling Grows in the Marcellus Shale,* J Petro. Tech., July 2011, at 49. While this has been couched by some as a voluntary measure, EPA Region III has asked for state confirmation that the 15 POTWs are prohibited from accepting produced water. *See* Rassenfoss, *supra* note 4, at 48. New York has a *de facto* moratorium on drilling in the Marcellus Shale pending issuance of a final Supplemental Generic Environmental Impact Statement. *SGEIS on the Oil, Gas and Solution Mining Regulatory Program,* N.Y. State Dep't of Envtl. Conservation, http://www.dec.ny.gov/energy/47554.html (last visited June 8, 2013).

12. *Hearing on Innovations in Water Use for Hydraulic Fracturing Before the Tex. House Comm. on Natural Res.* (Feb. 13, 2013) (testimony of Texas A&M professor, Gerald North), *available at* http://www.legis.state.tx.us/tlodocs/83R/handouts/C3902013021314001/C3902013021314001.pdf (follow "A&M" hyperlink) (last visited June 2, 2013); *Eagle Ford Shale Water,* Eagle Ford Shale, http://eaglefordshale.com/water/ (last visited June 9, 2013).
13. John C. Ruple & Robert B. Keiter, *Water for Commercial Oil Shale Development in Utah: Allocating Scarce Resources and the Search for New Sources of Supply,* 30 J. Land Resources & Envtl. L. 95, 133–38 (2010) (noting that water rights law in Colorado and Wyoming are affecting potential reuse of produced water from CBM production).
14. Rassenfoss, *supra* note 11, at 49 (Produced water reuse saves many truck trips associated with water use and disposal). *See also* R.R. Comm'n of Tex. v. Tex. Citizens for a Safe Future and Clean Water, 336 S.W.3d 619, 621 (Tex. 2011) (In Texas, the state Supreme Court recently determined that public safety concerns with truck traffic could not be considered a "public interest" factor under a statute regulating underground injection wells used to dispose of oil and gas wastes, including produced water).
15. Zain Shauk, *Water Problem in Shale Drilling Starts to Draw Flood of Capital,* Hous. Chronicle, Sept. 20, 2012, at D2.
16. *Id.* at D1.
17. *Id.* at D2.
18. Al Pickett, *New Solutions Emerging to Treat and Recycle Water Used in Hydraulic Fracs,* Am. Oil & Gas Reporter, Mar. 2009, at 66, 68–73, *available at* http://www.aogr.com/index.php/magazine/cover-story/new-solutions-emerging-to-treat-and-recycle-water-used-in-hydraulic-fracs.
19. Fakhru-Razi Ahmadun et al., *Review of Technologies for Oil and Gas Produced Water Treatment,* 170 J. Hazardous Materials 530, 540 (2009).
20. *See* Discussion *infra* Part II.
21. Jeanne Kever, *Regulator Eases Rules to Encourage Frac Water Recycling*, FuelFix, http://fuelfix.com/blog/2013/03/27/commission-eases-rules-to-encourage-water-recycling/ (last visited Mar. 27, 2013).
22. For example, in Utah, recyclers may only be required to submit notice of recycling activities on a Sundry Notice form used with oil and gas operations. Utah Admin. Code §R649-8-10 (2013).
23. Louisiana, Texas, and Pennsylvania have specifically adopted rules related to produced and flowback water recycling. Texas adopted rules as early as 2006. *See* Discussion *infra* Part II.
24. Notice of Final 2010 Effluent Guidelines Program Plan, 76 Fed. Reg. 66286 (Oct. 21, 2011).
25. *Id.*
26. *See, e.g.,* Kirsten H. Engel, *Harnessing the Benefits of Dynamic Federalism in Environmental Law*, 56 Emory L.J. 159 (2006).
27. Jessica Bulman-Pozen & Heather K. Gerken, *Uncooperative Federalism,* 118 Yale L.J. 1256, 1263 (2009) (highlighting the productive forces of state dissent).

to encourage water reuse. Part III highlights EPA's proposal to regulate produced water treatment under the CWA. Part IV reviews some of the new perspectives on environmental federalism, providing insight into how federalism scholars would view EPA's proposed regulation of this sector. Finally, Part V analyzes produced water recycling as a case study in uncooperative federalism and, building from this case study, offers a predictive framework for other environmental challenges that would benefit from a similar approach. The paper concludes that technological innovation may be a key, underexplored benefit of uncooperative federalism and suggests that EPA should carefully consider states' roles when determining how to regulate this sector under the CWA and when contemplating heightened federal regulation in other areas with regional dynamics such as conservation of endangered species and climate change adaptation.

I. The New Emphasis on Produced Water Recycling

In the context of hydrocarbon development, states have taken the unusual role of lead environmental regulators for several legal and practical reasons. First, unlike most other industrial actors, oil and gas operators do not face federal hazardous waste regulations because EPA has ceded responsibility to the states in this area.[28] Second, the states face rapidly expanding practical challenges as domestic production of oil and gas grows, including concerns about water quality, the need to revise current, potentially inadequate regulation of discharges to surface waters, water rights, and scarcity issues.[29] The combination of the regulatory responsibility and these pressing physical constraints have pushed states to encourage produced- and flowback-water recycling and the development of technologies that enable this recycling.[30] This Part discusses these constraints, beginning with a description of the states' regulatory responsibilities under the Resource Conservation and Recovery Act and concluding with a discussion of water quality, rights, and scarcity issues

A. Resource Conservation and Recovery Act Exemption for Exploration and Production Wastes

One of the most important considerations underlying states' regulatory role in the management of produced water is the general exemption of oil and gas exploration and production ("E&P") waste from the hazardous waste portions of the Resource Conservation and Recovery Act ("RCRA").[31] RCRA is a statutory and regulatory scheme that regulates hazardous wastes from "cradle to grave," or from generation to disposal.[32] Under RCRA, "drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil, natural gas or geothermal energy" are not hazardous wastes.[33] As a general rule, E&P wastes originating "down hole" (from inside the drilled hydrocarbon well) are exempt under RCRA.[34] Further, wastes generated from the treatment of exempt waste are also exempt under EPA's "exempt in, exempt out" policy.[35] This policy means that wastes generated in the treatment of hydrocarbon wastewater, such as brine concentrate or solids removed from the water, are exempt under RCRA.

In 2010, the Natural Resources Defense Council ("NRDC") petitioned EPA to reconsider this exemption.[36] NRDC's petition claimed that oil and gas wastes were as harmful as other hazardous wastes and should be regulated as such.[37] The petition for reconsideration is still pending and any revocation of the exemption could pose a significant hurdle to promising recycling activities. While state law can be more restrictive than federal law,[38] only California has chosen to regulate produced water as hazardous waste.[39] Thus, the current exemption of E&P wastes under RCRA has enabled states to develop policies to allow treatment of produced water. Without the exemption, produced water would be considered potentially hazardous and would need to be carefully managed as a hazardous waste,[40] making recycling of produced water difficult if not impossible due to the complexity of meeting RCRA recycling rules.

As EPA continues to consider the NRDC petition, states will remain key actors controlling produced water disposal, and their role will become increasingly important due to the range of environmental- and water rights-based concerns that attach to the disposal process.

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28. Resource Conservation and Recovery Act ("RCRA"), 42 U.S.C. §6921(b)(2)(A)–(B) (West 2010). As discussed *infra*, oil and gas exploration wastes are exempt from federal RCRA regulation. However, states can choose to regulate these wastes more stringently.
29. *See, e.g.,* Michael Dillon, *Water Scarcity and Hydraulic Fracturing in Pennsylvania: Examining Pennsylvania Water Law and Water Shortage Issues Presented by Natural Gas Operations in the Marcellus Shale,* 84 Temp. L. Rev. 201, 201–03 (2011).
30. *See, e.g.,* N.D. Indus. Comm'n, Contract No. G-018-036, *available at* http://www.nd.gov/ndic/ogrp/info/g-018-036-summary.pdf (last visited June 8, 2013).
31. 42 U.S.C. §6921(b)(2).
32. John C. Chambers & Mary S. McCullough, *From the Cradle to the Grave: An Historical Perspective of RCRA,* 10 Nat. Resources & Env't. 21, 22 (1995) ("Congress also made hazardous wastes subject to a regulatory program, which is commonly referred to as 'cradle-to-grave' management.").
33. 40 C.F.R. §261.4(b)(5) (2009).
34. U.S. Envtl. Prot. Agency, Office of Solid Waste, Exemption of Oil and Gas Exploration and Production Wastes From Federal Hazardous Waste Regulations 8 (2002), *available at* http://epa.gov/osw/nonhaz/industrial/special/oil/oil-gas.pdf. The NRDC recently petitioned EPA to reconsider the exemption for oil and gas wastes under RCRA, and that petition is currently pending before EPA. NRDC's petition is *available at* http://docs.nrdc.org/energy/files/ene_10091301a.pdf (last visited Mar. 2012).
35. Letter from Don R. Clay, Assistant Administrator of U.S. Envtl. Prot. Agency, to Paul Bohannon (Apr. 2, 1991) (noting that "generally, wastes derived from exempt wastes remain exempt") (on file with author), *available at* http://yosemite.epa.gov/osw/rcra.nsf/0/8A995D3CAFED499C8525670F006BE565/$file/11595.pdf.
36. Petition from Natural Res. Def. Council to Lisa Jackson, Admin. of Envtl. Prot. Agency (Sept. 8, 2010) (on file with author), *available at* http://docs.nrdc.org/energy/files/ene_10091301a.pdf (last accessed March 2012).
37. *Id.*
38. 42 U.S.C. §6929 (West 2010).
39. Kelly Corcoran et al., *Selected Topics in State and Local Regulation of Oil and Gas Exploration and Production* 32–33 (2009) (unpublished report) (on file with JEEL), *available at* http://gov.uchastings.edu/public-law/docs/OGEP.pdf.
40. *See* 42 U.S.C. §6921(b) (West 2010).

B. Water Scarcity and Water Rights Issues

If produced water from oil and gas wells is to be recycled rather than disposed of, oil and gas operators must know who owns the water at each stage of the process and thus who is responsible if spills or other incidents occur during the recycling process.[41] Indeed, the DOE lists uncertainty regarding water rights as one of the major challenges to widespread deployment of produced water treatment technologies.[42] Texas, Colorado, and Pennsylvania provide illustrative examples of the legal complications involved in reuse of produced water. The unique water rights issues associated with oil and gas development in each state help explain why the regulation of produced water recycling is as varied as it is among states.

1. Texas

In Texas, the applicable law related to water rights and hydrocarbon production supports reuse. Groundwater is primarily regulated by groundwater conservation districts ("GCD") under Chapter 36 of the Texas Water Code.[43] Oil and gas wells used for E&P are expressly exempt from most GCD regulations under this statute.[44] The Texas Railroad Commission ("RRC") interprets this exemption to include well completion and stimulation, including HF operations.[45] However, the RRC's interpretation of a statute applicable to GCDs is not necessarily owed any particular deference, nor is it dispositive of this issue.[46] Nevertheless, GCDs have thus far been unable to impose groundwater restrictions on oil and gas operators.[47]

While landowners generally own the right to groundwater beneath their property in Texas, courts have long maintained that oil and gas lessees typically control the right to use all water necessary for drilling and exploration.[48] The lessee's right to use all water necessary to produce hydrocarbons likely includes reuse of produced water for secondary recovery because Texas courts have not distinguished between an oil and gas lessee's right to use freshwater or saltwater with oil and gas operations.[49] Still, oil and gas wastewaters are now potentially more valuable due to the recyclability of these wastes[50] and there is no clear Texas law regarding who owns produced water treated for beneficial reuses.[51]

2. Colorado

Similar water rights ambiguity exists in other states, including Colorado, where a recent court decision and statutory change address water rights issues associated with produced water.[52] In Colorado, water produced from a hydrocarbon well falls under the administrative purview of the State Engineer's Office and is either classified as nontributary or tributary water, depending on whether it is hydrologically connected to other water, and either coal bed methane ("CBM") or non-CBM water.[53] The status of the water as tributary or nontributary was the only factor considered when the state issued permits for the use of the water. This changed under *Vance v. Wolfe.*

Under the recent Colorado Supreme Court ruling in *Vance v. Wolfe*, any CBM well that produces ground water is putting groundwater to beneficial use.[54] This is an important ruling because in Colorado, a developer who puts groundwater to beneficial use must be issued a permit to use the water. Prior to this decision, only the water's status as tributary or nontributary affected whether a permit was required for its use. Now, after *Vance v. Wolfe*, a CBM well operator needs a water well permit from the State Engineer's Office simply for removing the water as part of CBM production.[55] For non-CBM wells, a well permit is also required for well operators putting tributary or nontributary ground water to a beneficial use.[56] However, in 2010 in response to *Vance v. Wolfe*, the Colorado Legislature created an important permit exemption for water beneficially used by non-CBM well operators within the same geologic basin where the ground water is removed, in order to encourage reuse.[57] Thus, unlike

41. *See Reporting Requirements: Oil Spills and Hazardous Substance Releases,* U.S. Envtl. Prot. Agency, http://www.epa.gov/oem/content/reporting/#haz (last visited June 22, 2013).
42. Nat'l Energy Tech. Lab., *Water*, U.S. Dep't of Energy, http://www.netl.doe.gov/technologies/oil-gas/EP_Technologies/Environmental/Env_Science/water.html (last accessed Mar. 2012).
43. Tex. Water Code Ann. §36.0015 (West 2001).
44. Tex. Water Code Ann. §36.117(b)(1) West 2011).
45. *See Water Use in Association With Oil and Gas Activities Regulated by the Railroad Commission of Texas,* Railroad Comm'n of Tex., http://www.rrc.state.tx.us/eagleford/wateruse.php (last visited March 2012).
46. The Texas Legislature has specifically noted that "[GCDs] are the state's preferred method of groundwater management through rules developed, adopted, and promulgated by a district in accordance with the provisions of this chapter." Tex. Water Code Ann. §36.0015.
47. Legislation proposed during the 2013 Texas legislative session, and supported by the GCDs, would have eliminated the exemption applicable to oil and gas use of groundwater and would have required operators to obtain a permit. *See* S. Bill 860, Tex. Leg., 83rd Reg. Sess. (Tex. 2013).
48. *See, e.g.,* Sun Oil Co. v. Whitaker, 483 S.W.2d 808, 811 (Tex. 1972) (holding that the implied grant of reasonable use for production of oil extends to and includes the right to use water from the leased premises in such amount as may be reasonably necessary to carry out the drilling operations).
49. *Id.*
50. *See* Pickett, *supra* note 18, at 66, 68–73.
51. A new law passed during the 2013 Texas legislative session seeks to clarify property ownership of produced water, at least for tort liability purposes. *See* H. Bill 2767, Tex. Leg., 83rd Reg. Sess. (Tex. 2013). The new law provides that the person holding produced water at any time (the transferee) is the owner of the waste and purports to exempt the transferor from tort liability related to the handling of the produced water. *Id.* The new law may not provide much benefit, however, because the law does not cover certain tort actions for personal injury and property damage, which presumably would be most tort suits. *Id.*
52. *See* Vance v. Wolfe, 205 P.3d 1165 (Colo. 2009) (declaring that produced water generated from coal-bed methane production is considered a beneficial use); C.R.S. Section 37-90-138(2) (West 2012) (amended in 2010 in response to Vance v. Wolfe to encourage produced water reuse with HF).
53. *See* Revised Memorandum from Kevin G. Rein, Assistant State Eng'r, Colo. Dep't of Natural Res., Division of Water Res. on Submittals to the Division of Water Resources for Approval of Substitute Water Supply Plans and Well Permits for Oil and Gas Wells that Produce Ground Water While Producing Oil and Gas, (Mar. 24, 2010). Tributary water is water that is hydologically connected to a water basin. *See* Colorado Extension Service, Glossary of Water Terminology (2012), *available at* http://www.ext.colostate.edu/pubs/crops/04717.html.
54. *Id.* (*citing* Vance v. Wolfe).
55. *Id.*
56. *Id.*
57. *Id.* (*citing* Colo. Rev. Stat. §37-90-138(3) (2012)).

other arid western states facing increased shale gas development, Colorado's legislature directly addressed the water rights issues associated with produced water recycling.[58] This is because the legislature was forced to clarify how the CBM case of *Vance v. Wolfe* should apply to HF.[59] But, as noted in the next section, even more could likely be done in Colorado to encourage recycling efforts.

3. Pennsylvania

Securing water for HF in Pennsylvania begins with approvals from various federal interstate river commissions, which are needed to secure water diversions. For example, oil and gas operators must first receive a permit for withdrawal from the regional Susquehanna River Basin Commission ("SRBC"), a federal interstate compact commission, for operations within that entity's geographic jurisdiction. Then operators must secure a permit for the injection of water for HF, which is a consumptive use regulated by the SRBC.[60] This means that oil and gas operators require both a permit for an initial withdrawal of the water and a consumptive use permit.[61] Oil and gas operators may obtain a consumptive use permit through an Approval by Rule process, which includes notice and public comment.[62] The SRBC also requires operators to report produced and flowback water quantities so that the agency can track the quantities of waters used (including freshwater and recycled flowback fluids), the sources of all freshwater and wastewater used, and destinations of wastewater and unused freshwater (i.e. whether the destination is to be a permitted treatment facility or reuse at another drilling pad).[63] When companies import produced water from one well to another well for ongoing operations there (in a "pad-to-pad" transfer), recycled wastewater is regulated as a water source under SRBC's Approval by Rule program.[64] However, a recent amendment to the SRBC rules notes that inter-basin transfers of flowback or production fluids to another drilling pad for HF or to an out-of-basin treatment facility will not be subject to separate review and approval.[65] This recent amendment also clarifies that facilities used to store produced water, including tanks or pits, should obtain consent to store the water prior to their use if they have not already been approved.[66] SRBC rules require that all projects certify that they will obtain all necessary state and federal permits and that all produced water will be treated or disposed of in accordance with applicable state and federal law. While the SRBC currently defers to the Pennsylvania Department of Environmental Protection to regulate water quality, other water commissions, such as the Delaware River Basin Commission ("DRBC"), may have specific water quality provisions that must also be satisfied.[67] The DRBC has initiated special rules for natural gas drilling, including regulations regarding the protection of "high value" waters, but has postponed several meetings in which it would finalize the rules.[68] The proposed guidelines have special provisions for produced water.[69] This brief summary of Texas, Colorado and Pennsylvania water law relating to oil and gas development illustrates the highly technical and regional nature of water rights issues associated with produced water.

Part II continues to explore how states are managing produced water, and examines the potential benefits that can arise from state variation.

II. State Regulatory Regimes for Recycling Produced Water

Although states have very different legal approaches to hydrocarbon wastewater, these varied regimes have, on the whole, substantially encouraged innovation in wastewater recycling.[70] This Part explores several state regimes that enable or require the recycling of hydrocarbon wastewater and the substantive progress that has resulted. This Part focuses on recycling provisions in Texas, Pennsylvania, New Mexico, Louisiana, Colorado, and Wyoming, because these states have experienced unusually high growth in drilling and HF activities and their varied approaches to recycling offer useful regulatory comparisons. Throughout its discussion of states' regimes, this Part shows how state recycling policies have evolved to meet local conditions.

Each state explored here has its own issues that contribute to novel schemes for regulating produced water. States employ widely divergent approaches, in part due to unique geological, climatic, hydrological, and other physical differences.[71] Both Texas and Pennsylvania, for example, have enacted specific rules to encourage hydrocarbon wastewater recycling, but their different approaches illustrate the "uncooperativeness" both between states and between states and the federal government.

58. For a discussion of some of the water rights challenges associated with produced water reuse in arid states, see Ruple & Keiter, *supra* note 10.
59. *Id.* at 135.
60. Review and Approval of Projects, 18 C.F.R. §806 (2012).
61. *Id.* at §806.4(a)(2); *see also Frequently Asked Questions: SRBC's Role in Regulating Natural Gas Dev.,* Susquehanna River Basin Comm'n (Mar. 16, 2012), http://www.srbc.net/programs/natural_gas_development_faq.htm.
62. *Id.*
63. Review and Approval of Projects, 18 C.F.R. §806.22 (2012); *see also* Susquehanna River Basin Commission, *supra* note 61.
64. Susquehanna River Basin Commission, *supra* note 61.
65. Review and Approval of Projects, 77 Fed. Reg. 8095 (2012) (codified at 18 C.F.R. §806.4(a)(3)(v)–(vi)) (effective Apr. 1, 2012).
66. *Id.*
67. *Authorities, Regulation and Guidance,* Delaware River Basin Comm'n, http://www.state.nj.us/drbc/about/regulations/index.html (last visited Mar., 2012).
68. *Draft Natural Gas Regulations,* Delaware River Basin Comm'n, http://www.state.nj.us/drbc/programs/natural/draft-regulations.html (last visited, June 9, 2013).
69. *See, e.g.,* Kevin J. Garber & Jean M. Mosites, *Water Sourcing and Wastewater Disposal for Marcellus Shale Development in Pennsylvania,* 32 Energy & Min. L. Inst. 340, 348–50 (2011).
70. *See* Pickett, *supra* note 18, at 66, 68–73.
71. And, of course, state regulatory schemes also vary as a result of state and local politics.

A. Regulating Hydrocarbon Wastewater Reuse Across Regions

1. Texas

The scheme used in the Eagle Ford Shale in Texas to recycle produced water[72] is an appropriate starting point for a review of how states are encouraging technological innovation for three reasons. First, this area is booming with new shale drilling, and is located in a part of Texas with relatively scarce water sources, particularly during the drought conditions that are currently affecting the region.[73] Second, Texas has specifically adopted produced water recycling rules aimed at encouraging the deployment of innovative mobile technologies seeking to recycle oil and gas wastewaters.[74] Third, the state's regulatory approach offers a useful contrast with states like Pennsylvania, which face different waste-based challenges and have substantially different rules.[75]

The Eagle Ford shale is located in one of the driest parts of Texas.[76] When water was more plentiful, oil and gas development did not attract intense scrutiny over its water use. Even today, water used in hydrocarbon operations only represents approximately 1% of the state's water resources.[77] Still, the recent drought in Texas has heightened tensions among all water users. Water rights for farmers have been curtailed, municipalities are under severe water restrictions, and even the state agency responsible for issuing water rights permits was temporarily enjoined from issuing new water permits in the Guadalupe and San Antonio River basins, a major source of water for development in the Eagle Ford shale.[78] The district court's injunction is stayed pending appeal.[79]

With increased demand on scarce water resources, Texas' regulation of water used with hydrocarbon has adapted. The RRC holds jurisdiction over oil and gas operations in Texas, including waste disposal from wells in the Eagle Ford and other shale production zones.[80] In 2006, the RRC was one of the first state agencies to adopt specific rules for the permitting of oil and gas waste recycling facilities, and permitted both "mobile" and "stationary" facilities.[81] More recently, the RRC updated its recycling rules in March 2013 to promote "non-commercial" "on-lease" mobile recycling facilities.[82] The intent of the rule was to further streamline the existing recycling regulations to now allow certain on-lease produced water recycling and reuse to occur without a permit.[83] While the RRC uses the term non-commercial recycling, it specifically contemplates the potential use of third-party contractors to conduct recycling operations under the control of the operator.[84] This allows for different water recycling contractors with different technologies meeting the recycling standards to compete for reuse jobs on-lease. This replaces the past RRC recycling rules, which specifically permitted one technology at the expense of others due to the costs of entry into the market (i.e. permitting) for each new technology.

The RRC retained the permit scheme for commercial on-lease recycling treatment services seeking to sell water to third-parties and stationary facilities that may require more initial investment.[85]

For stationary recycling facilities, specific siting information is required to show that the facility will not harm the environment.[86] Both mobile and stationary facilities must submit information regarding the following: the maximum volume of untreated and partially treated oil and gas waste to be stored at the facility; the estimated maximum volume and time that the recyclable product (or treated wastewater) will be stored at the facility; plans for keeping records of the source and volume of wastes accepted for recycling, including records of the source of waste received; a general description of the recycling process to be employed; a flow diagram showing the recycling process to be employed and identifying all equipment and chemicals or additives and the Material Safety Data Sheets for any chemical or additive; and a description of testing to be performed to demonstrate that the proposed processing will result in a recyclable product that meets the engineering and environmental standards for the proposed use of the treated water.[87] Minimum siting and design and construction requirements, including specific requirements applicable to each type of facility, are set out in the RRC rules.[88]

Recycling facilities must submit permit applications to the RRC in Austin and the local district office and then publish and provide notice to adjacent landowners and provide affected persons an opportunity for a public hearing.[89] If no hearing request is received and the Executive Director of the RRC does not determine that a hearing is in the pub-

72. *Eagle Ford Shale Water,* Eagle Ford Shale, http://eaglefordshale.com/water/ (last visited June 9, 2013).
73. *Id.*
74. *See generally* 16 Tex. Admin. Code, §§4.201 et seq. (2012).
75. *See* Rebecca Hammer & Jeanne VanBriesen, Nat. Resources Def. Council, In Fracking's Wake: New Rules Are Needed to Protect Our Health and Environment From Contaminated Waterwater 7–8, *available at* http://www.nrdc.org/energy/files/Fracking-Wastewater-FullReport.pdf (last visited June 9, 2013).
76. Tracy Idell Hamilton, *Drought Spurring Fracking Concerns,* San Antonio Express-News (July 2, 2011), http://www.mysanantonio.com/news/energy/article/Droughtspurringfrackingconcerns-1450808.php.
77. R.R. Comm'n, Eagle Ford Shale Task Force Report 38 (Mar. 2013), *available at* http://www.rrc.state.tx.us/commissioners/porter/reports/Eagle_Ford_Task_Force_Report-0313.pdf.
78. Kate Galbraith, *Texas' Water Rights System Gets Tested in Drought,* Tex. Trib. (Jan. 19, 2012), http://www.texastribune.org/texas-environmental-news/water-supply/texas-water-rights-system-gets-tested-drought/; Aransas Project v. Shaw, 2013 WL 943780, (S.D. Tex., Mar. 12, 2013).
79. *See* Katherine Rosenberg & David Sikes, *U.S. District Judge's Ruling on Hold as Appeals Court Grants Stay in Whooping Crane Case,* Corpus-Christi Caller Times (Mar. 26, 2013), http://www.caller.com/news/2013/mar/26/us-district-judges-ruling-on-hold-as-appeals-in/.
80. *Eagle Ford Information,* Railroad Comm'n of Tex. (June 7, 2013), https://www.rrc.state.tx.us/eagleford/.
81. *See generally* 16 Tex. Admin. Code, §§4.201 et seq. (2013).
82. *See* 16 Tex. Admin. Code §3.8(d); §§4.201 et seq.; 38 Tex. Reg. 2318 (Apr. 12, 2013).
83. 28 Tex. Reg. 2319 (Mar. 14, 2003).
84. *See id.* at 2321 ("Non-commercial fluid recycling as adopted in §3.8(a)(41) may be conducted by the generator of the waste or a contractor").
85. *See* 16 Tex. Admin. Code §§4.204 (defining commercial facility), §§4.230 et seq. (specifying requirements for stationary commercial facilities).
86. 16 Tex. Admin. Code §§4.246 et seq. (2013).
87. *Id.*
88. *Id.* at Ch. 4 Subch. B.
89. *Id.* at §4.246.

lic interest, the RRC can administratively approve the application.[90] A permit will only be issued if the RRC determines that: "(1) the storage, handling, treatment, and/or recycling of oil and gas wastes and other substances and materials will not result in the waste of oil, gas, or geothermal resources, the pollution of surface or subsurface water, a threat to public health and safety; and (2) the recyclable product can meet engineering and environmental standards the Commission establishes in the permit or in this subchapter for its intended use."[91]

The RRC has also used its general permitting authority to issue pilot project permits to mobile recycling facilities developing technical information to determine the feasibility of a recycling permit under RRC rules.[92] Several pilot project permits have been issued to deploy newer recycling technologies in the Eagle Ford Shale. This effort will establish the viability of particular technologies for recycling produced water that will be subsequently reused in lieu of fresh water in future HF operations.[93]

2. Pennsylvania

In comparison to Texas, two factors make the recycling of produced water in the Marcellus and Utica Shales in Pennsylvania unique. First, there is a relatively abundant supply of surface water in Pennsylvania for drilling and HF operations, which oil and gas operators typically use.[94] Operators obtain this surface water under permits issued by regional River Basin Commissions.[95] Second, produced water and flowback water was historically sent to publicly-owned treatment works ("POTW") for treatment and discharged back to surface water bodies.[96] POTWs accept waste from a variety of industrial sources, but this disposal is generally no longer available to oil and gas operators because of environmental concerns, including a perception that oilfield waste contaminants are not being adequately treated and are being passed through to drinking water supplies.[97] Recent amendments and changes to state rules specifically encourage the treatment of water and it is estimated that approximately 90% of produced water in Pennsylvania is currently being recycled.[98]

Specific produced water recycling permitting requirements in Pennsylvania are based on several unique factors affecting that region. First, unlike some states, the disposal of produced water via injection is not a common practice in Pennsylvania. EPA noted that Texas has more than 12,000 brine disposal wells, while Pennsylvania has eight, due to lack of suitable geological formations.[99] Second, the management of hydrocarbon wastewater in POTWs created specific environmental concerns (due to the potential intermingling of hydrocarbon wastes with drinking water sources) in Pennsylvania that are not as present in the more arid states that inject produced water into permitted disposal wells or use evaporation pits.[100] In April, 2011, the Pennsylvania Department of Environmental Protection ("DEP") asked Marcellus Shale natural gas drilling operators to cease sending wastewater from shale gas extraction to fifteen POTWs that were then still accepting the waste due to concerns about bromides in produced water treated at these wastewater facilities.[101]

In lieu of sending oil and gas wastewaters to POTWs, DEP has encouraged recycling and reuse of produced and flowback water.[102] The Division of Municipal and Residual Waste of DEP manages the reuse of produced water with some exceptions for mobile on-site retreatment, which is regulated by the Oil and Gas Management Program approval of "alternative waste management practices."[103] The Division of Municipal and Residual Waste has developed general permits for the reuse of produced water for beneficial uses; this effectively streamlines the permitting for recycling produced water.[104] In July of 2011, DEP issued Draft General Permit WMGR123, which consolidates General Permits WMGR119, WMGR121, and WMGR123 used for permitting the reuse and treatment of produced water.[105] The Draft General Permit was finalized in the spring of 2012.[106] Discharges into surface waters from the treatment of pro-

90. *Id.* at §4.206.
91. *Id.* at §4.208.
92. *Id.* at §4.205.
93. *See* R.R. Comm'n of Tex., Eagle Ford Shale Task Force Report 84 (2013), *available at* http://www.rrc.state.tx.us/commissioners/porter/reports/Eagle_Ford_Task_Force_Report-0313.pdf .
94. *See* Hannah Wiseman, *Risk and Response in Fracturing Policy,* 84 U. Colo. L. Rev. (forthcoming 2013), *available at* papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID2046539_code1331806.pdf?abstractid=2017104&mirid=1
95. *Id.*
96. *Id.*
97. *Id.* (discussing letters exchanged between EPA and the Pennsylvania DEP regarding environmental concerns associated with this practice, and EPA's request for disposal information from large shale gas operators in the state).
98. *See* Susan L. Brantley & Anna Meyendorff, *The Facts on Fracking*, N.Y. Times (Mar. 13, 2013), *available at* http://www.nytimes.com/2013/03/14/opinion/global/the-facts-on-fracking.html?pagewanted=all&_r=0.
99. *See* Rick McCurdy, Chesapeake Energy Corp., Underground Injection Wells for Produced Water Disposal, *available at* http://www2.epa.gov/sites/production/files/documents/21_McCurdy_-_UIC_Disposal_508.pdf.
100. *See* Press Release, Dep't of Envtl. Prot. (Apr. 19, 2011) (noting the need for revisions to current regulations due to the emergence of more definitive scientific data), *available at* http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=%2017071%20&typeid=1.
101. *See DEP Calls on Natural Gas Drillers to Stop Giving Treatment Facilities Wastewater,* Dep't Envtl Prot. (Apr. 19, 2011), http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=%2017071%20&typeid=1. While this has been couched by some as a voluntary measure, EPA Region III has asked for state confirmation that the 15 POTWs are prohibited from accepting produced water. New York has a de facto moratorium on drilling in the Marcellus Shale pending issuance of a final Supplemental Generic Environmental Impact Statement sometime 2012.
102. Dep't of Envtl. Prot., Pennsylvania Hydraulic Fracturing State Review 10 (2010).
103. *Residual Waste Program,* Dep't of Envtl. Prot., http://www.portal.state.pa.us/portal/server.pt/community/residual_waste/14093 (last visited June 2, 2013); *Act 13 Frequently Asked Questions,* Dep't of Envtl. Prot. http://www.portal.state.pa.us/portal/server.pt/community/act_13/20789/act_13_faq/1127392 (last visited June 2, 2013).
104. *List of Residual Waste Beneficial Use General Permits,* Dep't of Envtl. Prot., http://www.portal.state.pa.us/portal/server.pt?open=514&objID=589685&mode=2 (last visited June 2, 2013) (General permits WMGR119, WMGR121, and WMGR123).
105. Dep't of Envtl. Prot., General Permit WMGR123: Processing & Beneficial Use of Gas Well Wastewater From Hydraulic and Extraction of Natural Gas 2 (July 2011), *available at* http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-85009/WMGR123%20-%20Hydro%20Recovery%206-28.pdf.
106. *PA DEP Issues Revised General Permit for Gas Wastewater Processing Facilities,* PR Newswire (Mar. 21, 2012), http://www.prnewswire.com/news-releases/

duced water under these permits are not authorized and any wastes generated by treatment processes must be managed in accordance with general solid waste regulations.[107] However, wastewaters processed under the authority of these general permits are not considered a waste as defined in Section 287.1 of the Pennsylvania Administrative Code Title 25 after the processed fluids have been transported to a permitted well site and are beneficially used for fracturing a well[108] or after they meet levels for certain constituents and are stored to fracture a well.[109]

Newly-enacted legislation in Pennsylvania requires "water management plans" for all new shale gas development withdrawing or using water from a "water source" in Pennsylvania in addition to reports on quantity of waste produced and location and methods of offsite disposal.[110] Reports are required to be kept for 5 years.[111] However, to encourage reuse of treated produced water, a "water source" does not include flowback or produced waters that are "used for drilling or completing a well in a shale gas formation" and "are not discharged into waters of the state."[112]

As evident from a brief review of the produced water recycling regulations applicable in Texas and Pennsylvania, different motivating factors influence how Texas and Pennsylvania are managing the growing practice of produced water treatment. Both states took a proactive approach to developing regulations to encourage recycling. Correspondingly, the oil and gas industry has responded by reducing water consumption and produced water production. However, as discussed in the next section, states are also using other approaches to encourage reuse of this wastewater.

B. Regulating Commercial Versus Non-Commercial Operations

Another general distinction seen in many jurisdictions is different regulation of recycling enterprises depending on whether they are a commercial or centralized treatment facility, or a non-commercial treatment facility.[113] States frequently distinguish between an operator contracting with a treatment provider for reuse with its own wells and an operator using a commercial treatment facility that provides water recycling services for more than one operator.[114] The following examples demonstrate this unique approach to produced water management.

1. Colorado

In Colorado, non-commercial produced water operations may be permitted under Colorado Oil and Gas Conservation Commission ("COGCC") Series 900 requirements while centralized commercial facilities are permitted under more rigorous general solid waste recycling rules governed by the Colorado Department of Public Health and Environment ("CDPHE").[115] Under Rule 908, a non-commercial facility "means the operator [of a centralized E&P waste management facility] does not represent itself as providing E&P waste management services to third parties."[116] Rule 907 specifically encourages non-commercial operators to submit waste management plans to COGCC allowing for the recycling and reuse of wastewater for HF.[117] Rule 903 also encourages multi-well pits to hold oil and gas wastewaters that will be recycled or reused with another well site.[118] A November 2011 report notes that the COGCC and several operators are developing "waste sharing plans" to allow produced water and flowback fluids from one operator's wells to be reused and recycled by another operator.[119]

On the other hand, a centralized commercial recycling facility providing waste management services to third parties in Colorado will fall under the jurisdiction of CDPHE Solid Waste Regulations.[120] Changes to Section 8's recycling rules regarding pre-approved "beneficial uses" were adopted in February 2012.[121] While the changes do not specifically relate to oil and gas operations, the changes specify that recycling determinations not on the pre-approved list of beneficial uses will be made on a case-by-case basis.[122] It is to be determined whether Colorado's Series 900 and Section 8 rules will promote produced water. In many respects, it is similar to states such as Wyoming that require more intensive permitting for commercial treatment facilities.

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pa-dep-issues-revised-general-permit-for-gas-wastewater-processing-facilities-143690646.html.

107. Dep't of Envtl. Prot., *supra* note 105, at 3, 5.
108. Though, processed wastewater must still be managed in accordance with Section 78 regulations related to oil and gas wells.
109. *Id.* at 7.
110. H.B. 1950, Gen. Assemb., Sess. of 2011 (Pa. 2011) §3211(m).
111. *Id.*
112. *Id.*
113. Colo. Oil & Gas Conservation Comm'n, Rule §901(a) (2014) [hereinafter COGCC].
114. *See, e.g.,* §908; 16 Tex. Admin. Code §3.8(a)(42); La. Admin. Code Tit. 43 §313(j), Part 29 (2011).
115. COGCC, *supra* note 113, at Rule 909 (centralized E&P facilities).
116. *Id.*
117. *Id.*
118. *Id.*
119. Stronger, Colorado Hydraulic Fracturing State Review 25 (2011), *available at* http://www.strongerinc.org/documents/Colorado%20HF%20Review%202011.pdf. This report also notes that the reuse of produced water as a source of water for new wells may be subject to water rights determinations by the State Engineer. *Id.* at 31 ("Operators can use produced water; however, such water must either be 'non-tributary,' or if it is decreed tributary, then the operator must have an augmentation plan. A recent ruling in Colorado District 7 Water Court may result in changes to the requirements for operators to use and produce non-tributary water."). The District 7 Water Court ruling is *available at* http://www.courts.state.co.us/userfiles/file/Court_Probation/Water_Courts/Water%20Division%201/10CW89%20Final%20Judgment%20and%20Decree.pdf; *see also* Vance v. Wolfe, 205 P.3d 1165 (Colo. 2009) (holding that COGCC did not have exclusive authority over water wells used for CBM production). The COGCC notes that an exception to water use permitting requirements is under Colorado Revised Statutes Section 37-90-137(7), which allows non coal-bed methane and nontributary produced water to be used with well construction without a well permit. *See* Fact Sheet, COGCC, http://cogcc.state.co.us/Library/Oil_and_Gas_Water_Sources_Fact_Sheet.pdf (last visited March 2012).
120. Colo. Dep't of Pub. Health and Env't, Regulations Pertaining to Solid Waste Sites and Facilities 6 CCR §1007-2, Part 1 at 152, *available at* http://www.cdphe.state.co.us/regulations/solidwaste/100702part1SWRegs.pdf.
121. 6 CCR §1007-2, Part 1 at 164.2.
122. *Id.*

2. Wyoming

In Wyoming, the Wyoming Oil and Gas Conservation Commission ("WOGCC") is the agency responsible for permitting the operation of non-commercial produced water treatment and disposal facilities on-lease, while the Wyoming Department of Environmental Quality ("WDEQ") is involved if operations are for commercial, off-site disposal or discharges.[123] WOGCC rules define a "Commercial Disposal Well or Commercial Water Retention Pit" as one that is operated primarily for profit from the disposal of produced water, either for a fee or where none of its owners is an owner or operator in any of the oil and gas wells that produced the water to be disposed in the disposal well or pit.[124]

WDEQ guidance outlines the minimum requirements for commercial oilfield wastewater disposal facility chapter 3 construction permits. A commercial oilfield wastewater disposal facility is defined as "any facility that accepts oilfield E&P wastes from more than one producer."[125] Thus, Wyoming requires more onerous permits for these centralized, commercial facilities.

3. Louisiana

In 2010, Louisiana enacted special provisions related to reuse of produced water for HF in the Haynesville Shale.[126] Wastewater may be transferred offsite for use in HF at another well site in the Haynesville Shale Zone, provided that the original wells and receiving wells have the same operator and the residual waste generated as a result of treatment of processing of the water is disposed of on-site, in accordance with all applicable requirements for on-site (pits or injection wells) or offsite disposal.[127]

Recycling facilities in Louisiana not fitting within the Section 313J requirements will need a Chapter 5 commercial disposal facility permit issued by the Department of Natural Resources' (DNR's) environmental division.[128] While no commercial produced water recycling facility has been permitted in Louisiana to date, one is currently in the permit application process.

The approach by some states to distinguish between noncommercial recycling and commercial recycling appears to be a mechanism to reduce sham recycling operations. The fear with sham recycling is that a business purporting to recycle waste will claim to recycle wastewater but merely dispose of it inappropriately. If an operator actually needs the wastewater for its own HF operations to replace fresh water resources, it is unlikely to be as motivated to fraudulently act. This regulatory approach is thus encouraging legitimate recycling while also adding protections for the public and industry against sham recyclers.

C. Lack of Specific Rules Regulating Produced Water Recycling

Many states have never adopted rules specifically addressing produced water recycling.[129] This can work in favor of produced water recycling by allowing streamlined permitting, but can also be a potential obstacle to the successful deployment of innovative technologies if permitting is inconsistent and ad hoc.[130]

While New Mexico does not have specific regulations or permits addressing produced water recycling operations, regulations applicable to the management of oil and gas wastes generally apply.[131] Entities may negotiate with the Environmental Bureau of the Oil Conservation Division ("OCD") of the New Mexico Energy, Minerals, and Natural Resources Department to use the Section 34 permit process for the reuse of produced water in some instances.[132] In other cases, a commercial facility may be required to comply with a more onerous "dual permit" with both Section 36 permitting and a potential permit under the New Mexico Water Quality Control Commission.[133] The permit that applies to each facility must be negotiated for each fact-specific deployment of a produced water recycling operation.[134] The relatively *ad hoc* approach used by New Mexico (a state with significant hydrocarbon development in the Permian Basin and other areas) may establish unintentional regulatory obstacles to the diffusion of produced water recycling technologies.

D. State Encouragement of Reuse

States that take a proactive approach in regulating produced water recycling appear to be prompting the innovation of various produced water recycling technologies.[135] Whether it is the favorable treatment toward noncommercial recycling or the direct encouragement of on-lease treatment facilities, state policies promoting these technologies are clearly one reason why operators are making such significant investments in water reuse.[136]

State policies are also undoubtedly influencing the early adoption of new technologies. For instance, the Texas RRC's

123. *Memorandum of Agreement Between Wyoming Department of Environmental Quality,* Wyo. Oil & Gas Conservation Comm'n, http://wogcc.state.wy.us/craig/mou.htm (last visited March 2012).
124. Wyo. Oil and Gas Conservation Comm'n, Rules Chapter 1, Section 2(l) (2008), *available at* http://www.oilandgasbmps.org/laws/wyoming_law.php.
125. *Id.*
126. La. Admin. Code tit. 43, pt. 29, §313(j) (2011).
127. *Id.*
128. A facility receiving oil or gas wastewater outside the specifications of §313J is governed by the ordinary laws for receiving hazardous waste. *See* La. Admin. Code tit. 33, §109 (2007) (defining hazardous waste).
129. Hannah Jacobs Wiseman & Francis Gradijan, *Regulation of Shale Gas Development, Including Hydraulic Fracturing*, at Table 11f (University of Tulsa Legal Studies Research Paper No. 2011-11), *available at* http://ssrn.com/abstract=1953547.
130. *Id.* at 113–14 (describing, among other examples, the difficulties that arose in Pennsylvania when a permit system for disposal of HF water changed repeatedly under challenges.)
131. N.M. Code R. §19.15 (LexisNexis 2012).
132. *Id.* §§19.15.34.8-10.
133. *Id.* §19.15.36 (requiring OCD permits for all forms of waste storage and treatment in oil and gas operations); §20.6.2 (detailing circumstances under which Water Quality Control Commission permitting also applies, in particular when a part of the project is separate from the oil or gas well).
134. *Id.*
135. *See* Pickett, *supra* note 18, 68–73
136. *Id.*

use of pilot permits to allow water treatment technology companies to demonstrate water retreatment on particular wells is a key mechanism for new companies to establish the economic and technical viability of their technology.[137] In Pennsylvania, the mix of a state prohibition on discharges to POTWs and permit flexibility is having similar effects.[138] In Colorado, state legislative action specifically encouraging reuse of produced water from HF from a water-rights perspective has the potential to significantly expand produced water reuse.[139]

As discussed more fully in Part V, this Article posits that the produced water recycling is an example of the unique ability of states to flexibly manage local needs and regional conditions like water rights issues to drive innovation and diffusion of technologies.

III. CWA Regulation

State and federal permitting of water discharges under the CWA's National Pollutant Discharge Elimination System ("NPDES") influences the recycling of produced and flowback water.[140] NPDES permits, or similar state permits issued by delegated state agencies, are required for any discharge of pollutants from point sources to waters of the United States.[141] NPDES permits may require treatment of wastewater or may set specific limits for discharges into the receiving water.[142] Delegated state agencies have responsibility over issuing discharge permits, but EPA has the ability to review and object to specific permits or to issue the permits in non-delegated states.[143] EPA has not approved NPDES permitting authority for oil and gas in Texas, Oklahoma, New Mexico, or Alaska and still issues permits for hydrocarbon water discharges in those states.[144] As part of the permitting process, the responsible agency will set effluent limits to minimize pollution.[145]

NPDES permit limits are set on a case-by-case basis or under "general permits" for similar practices conducted by industry.[146] Permit limits are established by reference to EPA effluent limitation guidelines ("ELG") and pre-treatment standards.[147] EPA has codified national ELGs for the Oil and Gas Extraction Point Source Category, but the current ELGs effectively require zero discharge from onshore oil and gas facilities east of the 98th meridian[148] and EPA has not developed pretreatment standards for indirect discharges (i.e. discharges from facilities that treat produced water).[149] The lack of pretreatment standards does not prohibit the permitting of discharges from treatment facilities. Rather, when federal standards are absent, delegated states permit discharges under the "best-professional judgment" standard.[150] This results in differentiation between state approaches. For example, because of its need for alternative produced water disposal sources other than disposal wells, Pennsylvania allowed NPDES discharges from produced water treatment facilities.[151] Meanwhile, there is limited need for discharge permits in Texas due to disposal well availability.

In 2011, EPA initiated a review of effluent limit guidelines for CBM discharges and pre-treatment standards for shale gas operations as part of its bi-annual effluent guidelines review process.[152] However, on August 7, 2013, EPA announced that it was dropping consideration of new ELGs for the CBM sector.[153] Its primary motivation for removing the regulation was that CBM is a declining industry.[154] Still, EPA's rulemaking on pretreatment standards for indirect discharges from the shale gas sector has the potential to significantly affect operators recycling hydrocarbon wastewater to POTWs that ultimately discharge water to waters of the United States.[155] While EPA is specifically studying reuse practices by operators as part of its "study plan" for the proposed rulemaking,[156] whether it will address federalism issues as part of its analysis remains to be seen.

According to comments EPA received on its proposed study plan regarding regulation of produced water, EPA may consider comprehensive regulation of produced water

137. *See supra* notes 91–94 and accompanying text.
138. *See supra* notes 95–112 and accompanying text.
139. *See supra* notes 116–22 and accompanying text.
140. *See* 33 U.S.C. §1342(a)–(b) (2006).
141. *Id.*
142. *See* §1342(a)(1).
143. *See* §1342(b)–(c). Delegation is a state initiated mechanism when a state has sufficient regulations to implement the CWA. It is unclear why some states never obtained delegation from EPA for produced water discharges (both direct and indirect), but in states like Texas, it was likely because surface water discharges were never essential due to the wide use of injection wells for produced water disposal. EPA's general prohibition on direct discharges under national ELGs for the onshore oil and gas sector also likely creates a disincentive for states to obtain delegation authority for these discharges. With the increase in produced water treatment and potential discharges from treatment facilities, there may be a growing interest in states with significant hydrocarbon development to become CWA delegated states.
144. *See National Pollution Discharge Elimination System,* U.S. Envtl. Prot. Agency, http://cfpub.epa.gov/npdes/statestats.cfm (last visited June, 9 2013).
145. Because many oil and gas leases in the most arid states are on BLM lands, BLM regulations and practice should also be considered. BLM's 2007 "Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development" (commonly referred to as the "Gold Book") briefly addresses disposal of produced water and notes that "[p]roduced water from leasehold operations will be disposed of by subsurface injection, lined or unlined pits, surface discharge into channels or impoundments, or other methods, including beneficial use, acceptable to the authorized officer and in accordance with the requirements of Onshore Order No. 7, Disposal of Produced Water, and other Federal or State regulations . . . . Disposal or use of water produced from Federal wells must be approved by the BLM before such operations begin." This means that BLM will probably defer to state regulations for recycling of produced water. Bureau of Land Mgmt., Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, the Gold Book, 36 (4th Ed. 2007) *available at* http://www.blm.gov/bmp/GoldBook_Draft_v12.pdf.
146. Office of Wastewater Mgmt., *Water Permitting 101,* U.S Envtl. Prot. Agency, http://cfpub.epa.gov/npdes/home.cfm?program_id=45 (last visited Jan 4, 2014).
147. *See* 40 C.F.R. §435.32 (2010).
148. This important exception for onshore facilities west of the 98th meridian is for wastewater that "has a use in agriculture or wildlife propagation when discharged into navigable waters." 40 C.F.R. §435.50 (2010).
149. 40 C.F.R. §435.32 (2010).
150. *See Unconventional Extraction in the Oil and Gas Industry,* U.S. Envtl. Prot. Agency http://water.epa.gov/scitech/wastetech/guide/oilandgas/unconv.cfm (last visited Jan. 4, 2014)
151. These NPDES permits are vigorously challenged.
152. Notice of Final 2010 Effluent Guidelines Program Plan, 76 Fed. Reg. 66286-02, 66286 (Oct. 26, 2011).
153. Preliminary 2012 Effluent Guidelines Program Plan and 2011 Annual Effluent Guidelines Review Report, 78 Fed. Reg. 48160 (Aug. 7, 2013)
154. *Id.*
155. Notice of Final 2010 Effluent Guidelines Program Plan, 76 Fed. Reg. 66286-02, 66296-97.
156. *Id.* at 66286-02, 66296, 66298.

from shale gas using effluent limitation guidelines.[157] EPA, however, should tread carefully as it determines how it will regulate produced water because current state regulatory approaches appear to be motivating robust innovation in recycling technologies.[158] As discussed in Parts IV and V, the encouragement of technological innovation via state policy may be one underexplored benefit of what some scholars are calling "uncooperative federalism."[159]

IV. Harnessing Environmental Federalism

Even in the absence of a direct federal scheme to incentivize regulation of produced water, many states are regulating the recycling practice and choosing regimes that incentivize produced water reuse and recycling.[160] Indeed, federal inaction may be the very motivation behind many of these schemes.[161]

At least one scholar has argued that although states are starting to regulate the oil and gas and HF through "adaptive regulation," a federal regulatory floor may still be necessary to address environmental and human-health risks.[162] Still, Professor Wiseman, the preeminent legal scholar on HF, has also noted that analysis of these regulatory processes through the lens of "environmental federalism" would be valuable and appropriate to determine some of the advantages and disadvantages of federal regulation.[163]

This Part reviews recent legal scholarship in environmental federalism and analyzes the regulation of produced water as a case study in the potential benefits of uncooperative federalism.

A. *The Trend Toward Dynamic Federalism*

Previously dominant theories of federalism were based in economic theory and state sovereignty and focused on the competition between federal and state government over purportedly proper spheres of regulation.[164] The more recent trend in environmental federalism emphasizes the dynamic and overlapping nature of state and federal regulation as a descriptive and normative theory of state and federal intergovernmental relations.[165]

A dynamic theory of federalism has been advanced as a more apt description of how environmental regulation works in practice.[166] The approach attempts to recognize, if not celebrate, the "real-world overlap and dynamic relationship between state and federal authority."[167] As Professor Engel summarizes:

> [A]ccording to dynamic federalism, federal and state governments function as alternative centers of power and any matter is presumptively within the authority of both the federal and the state governments. Dynamic federalism rests upon and supports judicial doctrines that affirm the existence of the states and their independent lawmaking powers, but otherwise calls for a passive approach on the part of the courts, leaving the states to their own devices in terms of fending off attempts by the federal government to defeat state regulation.[168]

According to Professor Schapiro, "the goal is to find a functional balance of federal and state authority."[169] Authors adopting this "new federalism" approach suggest that the prior focus on which sphere, state or federal, should occupy a particular regulatory space has been "futile" because many regulatory regimes were not limited to one or the other.[170] Yet, as discussed below, it is clear that aspects of dual federalism are still relevant and that the theory of uncooperative federalism harmonizes aspects of both dual and dynamic federalism.

157. *See* Notice of Final 2010 Effluent Guidelines Program Plan, 76 Fed. Reg. 66286-02, 66293; Letter from Deborah Goldberg, EarthJustice, to Carey A. Johnson, Water Docket, Envtl. Prot. Agency, Re: Comments on Final 2008 Effluent Guidelines Program Plan and Suggestions for the 2009 Annual Review: Oil and Gas Exploration, Stimulation, and Extraction, Docket EPA-HQ-OW-2008-0517 (Apr. 7, 2009), *available at* http://www.regulations.gov/#!docketDetail;D=EPA-HQ-OW-2008-0517 (arguing that EPA should protect water quality nationwide by regulating all oil and gas extraction techniques (including HF) rather than focusing on revising effluent limitation guidelines for the CBM sector). EarthJustice asked the agency to set a pretreatment standard banning wastewater discharge to POTWs; create a new subpart to regulate centralized waste treatment plants; set zero discharge limits; gather and publish data on wastewater contents; and regulate the storage of effluents kept near the wellhead. *id.*
158. *See* Hannah Wiseman, *Regulatory Adaptation in Fractured Appalachia,* 21 Vill. Envtl. L.J. 229, 267 (2010).
159. Heather Gerken, *Our Federalism(s),* 53 Wm. & Mary L. Rev. 1549, 1560 (2012).
160. *Id.*
161. *See* Wiseman, *supra* note 158, at 291 (pointing out that "lack of federal regulation in some areas has left to the states much of the responsibility for meeting this challenge and states, to varying degrees, have stepped up to the plate"); *see also* Blake Hudson, *Reconstituting Land-Use Federalism to Address Transitory and Perpetual Disasters: The Bimodal Federalism Framework,* 2011 B.Y.U. L.Rev. 1991, 2059 (2011) (concluding that "[i]n the climate change context, federal inaction has spurred the creation of a number of [state] carbon cap-and-trade initiatives aimed at curbing carbon emissions.");
162. Wiseman, *supra* note 158, at 285–86 (2010) (noting that "state regulation of HF might sufficiently limit the potential environmental and human-health risks associated with fracking" but suggesting federal regulation may be necessary to set a floor).
163. *Id.* at 288.
164. *See* Kirsten Engel, *Harnessing the Benefits of Dynamic Federalism in Environmental Law,* 56 Emory L.J. 159, 166 (2006) (finding that "[r]esearchers have found a substantial degree of overlap in the types of environmental issues actually addressed by the states and the federal government.").
165. *See* Heather Gerken, *supra* note 159; Robert B. Ahdieh, *Foreign Affairs, International Law, and the New Federalism: Lessons From Coordination,* 73 Mo. L. Rev. 1185 (2008); Engel, *supra* note 166; Robert A. Schapiro, *Toward a Theory of Interactive Federalism,* 91 Iowa L. Rev. 243, 248 (2005); Renee Jones, *Dynamic Federalism: Competition, Cooperation and Securities Enforcement,* 11 Conn. Ins. L.J. 107 (2004).
166. Engel, *supra* note 164, at 167 (finding that "[r]esearchers have found a substantial degree of overlap in the types of environmental issues actually addressed by the states and the federal government.").
167. *Id.* at 176.
168. *Id.*
169. *See* Schapiro, *supra* note 165, 300 (2005). Professor Schapiro calls his version of dynamic or interactive federalism "polyphonic federalism" to account for the overlapping voices of the state and federal governments and courts.
170. *See* Robert B. Ahdieh, *Dialectical Regulation,* 38 Conn. L. Rev. 863, 926 (2006).

B. Persistent Remnants of Dual Federalism

Federalism scholars have noted that attempts to move beyond traditional "dual federalism" conceptions of proper federal and state jurisdiction have been unsuccessful.[171] For instance, Professor Schapiro recognizes that the states' "dissonance" is a key component of any new theory of federalism and his vision of a "polyphonic federalism" is perhaps the most descriptive of both the existing dynamic between state and federal actors and the dissension among the states in implementing federal regulation.[172] Others have argued that a "bimodal" framework that acknowledges the interaction between states and federal regulators but adopts remnants of the dual federalism is more representative.[173]

The irony of the movement to adopt a dynamic theory of federalism is that, while it purports to be a more accurate description of how federal state relations work in practice, it largely overlooks the substantial tension between state and federal actors in implementing environmental regulation. In the case of Professor Engel's approach, the benefits of dynamic federalism may only be successfully harnessed if a preemption presumption is adopted.[174] Professor Engel notes that the current preemption doctrines used by the courts must be changed if states are to have sufficiently "free reign to develop policy solutions."[175]

The fact remains that significant tension still exists between states and federal regulators in the arena of environmental regulation.[176] Even under pollution control laws presented as pillars of cooperative federalism, there has been significant discord in recent years between states and EPA over state flexibility to implement the Clean Air Act.[177] For example, Texas and Utah have both fiercely fought EPA approvals and disapprovals of state implementation plans in both the Fifth Circuit and Tenth Circuit.[178] This type of state dissent is one manifestation of what scholars have termed uncooperative federalism.

C. Uncooperative Federalism

Within the new environmental federalism field, there is increasing recognition that state dissonance is a powerful force worthy of further theoretical and practical exploration.[179] As Professors Bulman-Pozen and Gerken emphasize, states can resist federal policy changes even in traditionally cooperative federalism regimes in which states are "servants" implementing federal regulation and policy.[180] Imagining a continuum to describe the ongoing dialogue between states and the federal government over national policy, Professors Bulman-Pozen and Gerken explain the role of uncooperative federalism:

> At one end are the polite conversations and collaborative discussions that cooperative federalism champions. Uncooperative federalism occupies the remainder of this spectrum—from restrained disagreement to fighting words. Some state contestation is interstitial, occurring in the gaps left open, deliberately or accidentally, by federal policymakers. Other state challenges assume a stronger form, the institutional equivalent of civil disobedience.[181]

Proponents of uncooperative federalism have noted that there may be various benefits that stem from "state-centered" dissent.[182] These include promoting the "administrative safeguards of federalism," the state's agenda, and accountability.[183] But scholars also note that there is a need for more doctrinal and empirical analysis to more completely map out the value states play in resisting federal policy.[184] The following Part uses the regulation of produced water as a possible case study and posits a potential additional justification for state dissonance, particularly in the environmental field: the promotion of innovative technology.

V. Produced Water Regulation as a Case Study in Uncooperative Federalism and Promoting Technological Innovation

Theories of dual federalism frequently cite state policy innovation or conceive of states as "laboratories" as one motivation for state autonomy.[185] Dynamic federalist theorists also seek to explain why dynamic federalism is equally as adept at promoting policy "innovation."[186] But federalism theorists have generally not explored how federalism affects technological innovation.[187] As much as most environmental federalism literature appears to gloss over the importance of federalism in promoting technological innovation, legal

171. *See* Schapiro, *supra* note 165, at 248 (2005) (noting that "[s]cholars have attempted to develop coherent replacements for dualist visions of federalism, but have not succeeded.").
172. *Id.* at 249.
173. *See* Blake Hudson, *Reconstituting Land-Use Federalism to Address Transitory and Perpetual Disasters: The Bimodal Federalism Framework,* 2011 BYU L. Rev. 1991 (2011).
174. *See* Engel, *supra* note 164, at 162–63.
175. *Id.* at 163.
176. *Id.* at 180–81.
177. *Id.*
178. Texas v. U.S. Envtl. Prot. Agency, 690 F.3d 670, 670 (5th Cir. 2012) (example of a state successfully challenging a SIP disapproval on the grounds that EPA ignored discretion granted to Texas under its delegated authority under the CAA); U.S. Magnesium, LLC v. U.S. Envtl. Prot. Agency, 690 F.3d 1157, 1157 (10th Cir. 2012) (upholding EPA's disapproval of Utah's affirmative defense for shutdowns and maintenance).
179. Bulman-Pozen & Gerken, *supra* note 27, at 1263 (2009) (highlighting the productive forces of state dissent).
180. *Id.* at 1266–71 (listing dependence, integration, and the dual allegiance of states as three reasons why states might dissent in implementing federal policy).
181. *Id.* at 1271.
182. *Id.* at 1272.
183. *Id.* at 1285–91.
184. *Id.* at 1295.
185. *See* Schapiro, *supra* note 165, at 266–67 (reviewing dual federalism's traditional claim that it promotes "innovation" via the laboratories of the states).
186. *See* Engel, *supra* note 164, at 173 (explaining why interaction among governmental entities "has important benefits in terms of developing quality, responsive regulation, and spreading regulatory innovations."); Robert B. Ahdieh, *supra* note 170, at 921–22 (explaining how "countervailing divergence in perspective[s]" increases the exchange of policy ideas and "innovation").
187. One notable exception is David Adelman & Kirsten Engel, *Reorienting State Climate Change Policies to Induce Technological Change,* 50 Ariz. L. Rev. 835, 838 (2008) (noting that "[p]romoting technological change is a so far unrecognized rationale for state action on climate change.").

scholarship studying the impact of science on environmental regulation also appears to avoid much discussion of environmental federalism.[188]

This Part examines how regulation of produced water at the state level may be an example of why states may be reluctant to embrace EPA regulation of produced water recycling under the CWA. It concludes that produced water recycling may be an example of how uncooperative federalism may encourage promoting reuse technologies tailored to specific regions.

A. The State-Centered Dissent's Role in Technological Innovation and Diffusion

Because states have traditionally been viewed as the natural locus for policy innovation and diffusion,[189] states may also be the best entities for promoting technological innovation and diffusion—two core aspects of technological development.[190] Consistent with the theory of uncooperative federalism, however, it may be state dissent in the implementation of federal regulation that pushes innovation in and diffusion of environmental technology. Conversely, the desire to encourage technological innovation may be an additional motivation for states to reject federal intervention. Using the theoretical underpinnings of uncooperative federalism and the case study of produced water recycling, there are two key roles for the states in promoting technological innovation through uncooperative federalism: dissenting by deciding and promoting the state's agenda.[191]

1. Dissenting by Deciding, or Learning by Doing

As Professors Bulman-Pozen and Gerken note, uncooperative federalism imagines that states using their own regulatory schemes as a means to influence federal policy.[192] Indeed, dissent through decision is happening with states encouraging produced water recycling.[193] Using the flexibility currently afforded to states under EPA's hands-off regulation of produced water reuse, states are beginning to address oil and gas water management issues.[194] Indeed, Professor Wiseman has noted that states' new regulation of innovative HF technologies is a "regulatory adaptation."[195] This adaptation includes crafting state policies and incentives both to promote technological innovation and to adopt existing technologies.[196]

From an economic and technological demand perspective, produced water recycling is likely to generate technological innovation as a result of the significant costs that operators and producers of oil and gas internalize.[197] Still, Texas is an example of how states can promote technological innovation. For example, Texas's specific regulations oriented at mobile produced water recycling technologies have promoted the development of this technology.[198] When these regulations were adopted in 2006, the mobile produced water recycling sector was in its infancy.[199] However, Texas' rules were flexible in allowing operators to use pilot projects to demonstrate the viability of projects and in comparison to states that failed to address produced water recycling directly, Texas' specific rules encouraging new technologies provided necessary transparency to industry to allow for deployment of various technologies.[200] Now, because of its demonstrated application in Texas, hydrocarbon wastewater recycling is firmly established in many other parts of the U.S. and the world.[201] Further, Texas has adapted its regulations to promote on-lease recycling operations targeting the encouragement of reuse of water by operators in future HF operations, which is an emerging use of recycled water.

2. Diversity of State Approaches

Professors Adelman and Engel note that the ability of states to adopt tailored policies to their jurisdictions can promote technology innovation in the context of climate change policy.[202] For example, they note that different states have encouraged varying renewable energy innovation based on the particular renewably energy sources available in any given state. For example, California may encourage solar innovation, while Texas can focus on wind and West Virginia on clean coal.[203]

Similar variation in technological innovation in produced water recycling is currently occurring at the state level.[204] Wyoming regulations can specifically encourage technolo-

188. *See, e.g.,* Natalie M. Derzko, *Using Intellectual Property Law and Regulatory Processes to Foster the Innovation and Diffusion Of Environmental Technologies*, 20 Harv. Envtl. L. Rev. 3, 18–20 (1995) (criticizing some aspects of command-and-control statutes like the CAA and CWA for failing to incentivize technology); *see* Wendy Wagner & Lynn Blais, *Emerging Science, Adaptive Regulation, and The Problem of Rulemaking Ruts,* 86 Tex. L. Rev. 1701, 1717 (2008) (acknowledging that demand for new technologies to reduce pollutants is driven at least in part by regulation, but never specifically addressing federalism issues).

189. *See* Adam Jaffe et al., *A Tale of Two Market Failures: Technology and Environmental Policy,* 54 Ecol. Econ. 164, 164 (2005).

190. *Id.* at 166 (noting that "innovation" and "diffusion" are two key components for technology change to address environmental issues).

191. *See* Bulman-Pozen & Gerken, *supra* note 27.

192. *Id.* at 1294.

193. Wiseman, *supra* note 158, at 248.

194. *Id.* at 266.

195. *Id.* at 249–51.

196. *C.f.* Adelman & Engel, *supra* note 187, at 855–56 (concluding that the more promising role for states is in promotion of adoption of existing technologies versus technological innovation).

197. *See supra* note 189, noting water management can be up to $1.5 million of the $6 million costs to drill a hydraulically fractured well; Jaffe et al., *supra* note 189, at 170 (noting that the "demand pull" of internalized costs is a significant driver of technological innovation).

198. *Innovations in Water Use for Hydraulic Fracturing, supra* note 3.

199. 16 Tex. Admin. Code, §4.B (2012).

200. Kate Galbraith, *Recycling Fracking Water Is Gaining Interest*, Tex. Trib.(Mar. 21, 2013, 7:32 PM), http://www.mysanantonio.com/business/article/Recycling-fracking-water-is-gaining-interest-4374553.php.

201. Jim Fuquay, *Recycling of Fracking Water Is Still Rare, But It's Growing,* Columbia Dispatch (May 27, 2013, 5:26 AM), http://www.dispatch.com/content/stories/business/2013/05/27/recycling-of-fracking-water-is-still-rare-but-its-growing.html.

202. Adelman & Engel, *supra* note 187, at 852 (noting that the "case for state action on climate is bolstered further by the diseconomies of scale endemic to technological change.").

203. *Id.*

204. Melissa McEver, *Companies Developing Tech to Recycle Fracking Water,* Hous. Bus. J. (Aug. 19, 2011, 5:00 AM), http://www.bizjournals.com/houston/print-edition/2011/08/19/companies-developing-tech-to-recycle.html?page=all.

gies focusing on discharges for irrigation and agricultural use, while Pennsylvania's *de facto* zero discharge policy may encourage reuse in HF and Colorado can distinguish between CBM-produced water reuse and HF reuse with shale.[205] Indeed, Wyoming strongly resisted EPA's proposed development of ELGs for the CBM sector out of fear that regional determinations of best-professional judgment would be displaced by EPA national standards.[206] In produced water recycling context, local water rights issues, water availability, and potential reuses are paramount.[207] As Wyoming noted in response to EPA's plan to develop ELGs for CBM:

> For an effluent guideline to be appropriate and useful, the pollutant source must have some common pollutants or characteristics for which a standard treatment technology would always be effective and necessary. Our experience has been that CBM produced water quality varies greatly by location and depth to the coal seam. In some areas the water is relatively uncontaminated and may be discharged directly without treatment. In other areas there may only be a problem with iron which can be removed with aeration. Sometimes salinity or sodium are problems, in which case ion exchange or reverse osmosis treatment is appropriate treatment.[208]

Thus, local conditions may dictate which approach will be most useful to particular states, both in the CBM sector and broader shale extraction category. States are uniquely positioned to promote a variety of technology innovations tailored to particular regions.[209]

B. EPA and the Federal Role

The doctrine of uncooperative federalism assumes that states are diverging from their role as a servant of federal regulation.[210] Thus, the promotion of the states' ability to implement their own decisions and apply different regional approaches does not remove the need for federal regulation and oversight.[211] But it is unclear what uncooperative federalism would say about the role played by EPA. Using the case study of hydrocarbon wastewater recycling, EPA should embrace the following three roles: consistency, accountability, and encouragement of state technological innovation.[212]

1. Consistency

EPA's proposed 2013 and 2014 rulemakings to develop ELGs under the CWA for CBM and pretreatment standards for water discharges from shale gas extraction[213] suggest that EPA considers its role to be promoting national consistency. Whatever final approach EPA adopts, EPA may leave sufficient room for the state flexibility needed to promote technological innovation in this sector. Based on comments submitted by states like Wyoming, however, it is possible that EPA will replace a patchwork of locally-derived policies tailored to local conditions with a one-size fits all regime.

Though EPA should be able to promote state flexibility while maintaining watch over consistency and accountability in the burgeoning sector of produced water,[214] exactly how it will accomplish these goals while encouraging states' facilitation of technological innovation is yet to be seen. Of course, the obvious possibility is that EPA should resist proposing new ELGs for CBM and pretreatment standards for shale gas discharges sent to POTWs. But it also may be the case that, at least with regard to pretreatment standards, EPA regulation could merely be the federal equivalent of Pennsylvania's *de facto* zero discharge policy, which, by some estimates, has resulted in nearly 90% of all produced water in Pennsylvania being recycled.[215] Still, as noted above, there is no reason to believe Pennsylvania's, or any other state's approach, is necessarily a good fit for all other states in this sector.

2. Accountability

If EPA ultimately concludes that consistency may not be appropriate for the produced water recycling sector because it is so intertwined with local water rights and regional conditions, the agency will likely consider accountability a secondary goal. The appropriate avenue for EPA's accountability measures should be through its permitting authority, permit challenges, and enforcement.[216] EPA already plays a permitting role for discharge permits in Texas, where produced water recycling is common and its existing role has not appeared to be either an impediment to Texas's produced water recycling regulations or the source of substantial allegations of underregulation.[217] This may be partly because discharge permits related to produced water recycling or treatment facilities are

205. Kasia Klimasinska & Jim Efstathiou, *Drought Helps Fracking Foes Build Momentum for Recycling,* Bloomberg (July 23, 2012, 2:15 AM), *available at* http://www.bloomberg.com/news/2012-07-23/drought-helps-fracking-foes-build-momentum-for-recycling.html.
206. Letter from John Wagner, Wyo. Dep't of Envtl. Quality, to U.S. Envtl. Prot. Agency (Jan. 25, 2010), *available at* http://www.regulations.gov/contentStreamer?objectId=0900006480ec8d01&disposition=attachment&contentType=pdf.
207. Roberta F. Mann, *Like Water For Energy: The Water-Energy Nexus Through the Lens of Tax Policy,* 82 U. Colo. L. Rev. 505, 546 (2011) (noting that "water supply is significantly influenced by local and regional conditions.").
208. Letter from John Wagner, *supra* note 206.
209. McEver, *supra* note 204.
210. Bulman-Pozen & Gerken, *supra* note 27, 1263 (noting a need connect the "state's status as servant, insider, and ally" with its ability to be a "sometime dissenter, rival, and challenger.").
211. *Id.*
212. *Id.*
213. *Unconventional Extraction in the Oil and Gas Industry,* U.S. Envtl. Prot. Agency, http://water.epa.gov/scitech/wastetech/guide/oilandgas/unconv.cfm (last visited June 6, 2013).
214. *See generally* Nat'l Energy Tech. Lab., *Produced Water Management Information System,* U.S. Dep't Of Energy, http://www.netl.doe.gov/technologies/pwmis/regs/federal/epa/index.html (last visited June 6, 2013).
215. Susan L. Brantley & Anna Meyendorff, Op-Ed, *The Facts on Fracking,* N.Y. Times (Mar. 13, 2013), http://www.nytimes.com/2013/03/14/opinion/global/the-facts-on-fracking.html?pagewanted=all&_r=0.
216. *See generally EPA Requests Texas Issue Clean Water Act Permits,* U.S. Envtl. Prot. Agency (Dec. 2, 2010), http://yosemite.epa.gov/opa/admpress.nsf/0/bbc3b46e8ded1e28852577ed00731add?OpenDocument.
217. The same cannot be said to be true for water quality regulation and HF more generally; EPA is under intense scrutiny in all states to more closely examine how HF drilling operations affect water quality. But other than in Pennsylvania, where a unique lack of other disposal options contributed to POTWs accepting oil and gas wastes, water treatment issues have not been as significant a public concern.

not common in Texas.[218] Still, there is no reason why EPA's current permitting and enforcement authority, when applied in states such as Pennsylvania or Wyoming where discharges are more common,[219] would be insufficient compared with new comprehensive national standards.

Another means of federal accountability outside the administrative realm is in citizen suit and federal judicial enforcement of the CWA.[220] Federal courts have been willing to set boundaries on the oil and gas sector when water issues are brought before them.[221] For example, in *Northern Plains Resource Council v. Fidelity Exploration and Development Co.*, the Ninth Circuit struck down a Montana law exempting CBM water from CWA discharge permit requirements.[222] The Department of Justice could also increase enforcement of existing discharge regulations and permit requirements.[223] In at least one EPA enforcement case in Pennsylvania involving a spill of produced water, a settlement agreement mandated increased recycling of produced water.[224] Further, any funds planned for the development of EPA's proposed rulemaking could likely just as easily be slated for enforcement efforts.

3. Encouragement of State Technological Innovation

A final role EPA or other federal entities such as the DOE could play in produced water recycling is in promoting states' push for technological innovation. Subsidies, federal tax policy or grants, and loans to POTW operators are all ways in which the federal government could contribute to the encouragement of produced water recycling without adopting its currently-proposed approaches under the traditional components of the CWA.[225] One reason why the produced water recycling sector may require a more unique approach than EPA's traditional CWA regime lies in the relationship that this industry has with local water supply issues, an area traditionally governed by state and local entities.[226]

C. *Additional Environmental Arenas Where Uncooperative Federalism May Encourage Technological Innovation*

This Article examines produced water recycling as one example of where uncooperative federalism can prompt technological innovation. Drawing on the experience from the produced water recycling sector, there is a need for further exploration of other areas where this benefit could emerge. There may be three primary characteristics of an environmental issue where an uncooperative approach will encourage technological innovation: (1) a large number of similar sources; (2) where local conditions and legal issues predominate; and (3) where innovative technological solutions are economically incentivized.[227] Within the oil and gas sector, the regulation of air emissions from oil and gas sources may be an example of where an uncooperative federalism approach could yield technological innovation.[228]

VI. Conclusion

"The effect of environmental policies on the development and spread of new technologies may, in the long run, be among the most important determinants of success or failure in environmental protection."[229] The important role that technological innovation plays in environmental protection highlights why it is necessary to more closely examine the influence of federalism on technological innovation. The technological development and regulation of recycling produced water is an important example of this phenomenon.[230] Emerging technologies to recycle and reuse oil and gas wastewaters have prompted states to review relevant regulations to

218. *See EPA Requests Texas Issue Clean Water Act Permits*, U.S. Envtl. Prot. Agency (Dec. 02, 2010), *available at* http://yosemite.epa.gov/opa/admpress.nsf/e77fdd4f5afd88a3852576b3005a604f/bbc3b46e8ded1e28852577ed00731add%21OpenDocument.

219. *See generally* U.S. Fish and Wildlife Service, Region 6, Environmental Contaminants Program, Contaminants in Oil Field Produced Waters Discharged Into the Loch Katrine Wetland Complex, Park County, Wyoming and Their Bioconcentration in the Aquatic Bird Food Chain, *available at* http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1209&context=usfwspubs&sei-redir=1&referer=http%3A%2F%2Fwww.google.com%2Furl%3Fsa%3Dt%26rct%3Dj%26q%3Dwater%2520discharge%2520common%2520in%2520wyoming%26source%3Dweb%26cd%3D6%26ved%3D0CEUQFjAF%26url%3Dhttp%253A%252F%252Fdigitalcommons.unl.edu%252Fcgi%252Fviewcontent.cgi%253Farticle%253D1209%2526context%253Dusfwspubs%26ei%3D1Ri1UYeuKvDeyAGi3IDwAg%26usg%3DAFQjCNEDwIAM-ZmZJHW_MCeIDQ9HQLzung%26bvm%3Dbv.47534661%2Cd.aWc#search=%22water%20discharge%20common%20wyoming%22.

220. Barry Boyer & Errol Meidinger, *Privatizing Regulatory Enforcement: A Preliminary Assessment of Citizen Suits Under Federal Environmental Laws,* 34 Buff. L. Rev. 833 (1985).

221. *See* N. Plains Res. Council v. Fidelity Exploration and Dev. Co., 325 F.3d 1155, 1165 (9th Cir. 2003) (holding that CBM water was pollutant and not exempt under CWA).

222. *Id.*

223. *See* Elizabeth Mitchell, *Enforcement Actions Under Section 404 of the Clean Water Act,* W. Water Law (Jan. 24, 2012), http://www.westernwaterlaw.com/articles/RMMLFWetlands.htm.

224. *See* Notice of Lodging of Proposed Consent Decree Under the Clean Water Act, 78 Fed. Reg. 44599 (July 24, 2013).

225. *See, e.g.,* Roberta F. Mann, *supra* note 207, at 527–28; *see also* Jaffe et al., *supra* note 191, at 168–69.

226. *Id.* at 546 (noting that "water supply is significantly influenced by local and regional conditions").

227. *See* Discussion, *supra*, Parts V.A.2, V.B.1., V.B.3.

228. Though EPA has already adopted new source performance standards ("NSPS") for the oil and gas sector focusing on "green completions" in HF, states could potentially encourage reduction in air emissions from oil and gas sources through other regulatory approaches with direct benefits to local areas, as opposed to the global climate change benefits, arguably the target of the NSPS rule. EPA declined to "directly" regulate methane emissions under its recently promulgated NSPS for the oil and gas sector, but the benefits to climate change are highlighted in the rule. 77 Fed. Reg. 49490, 49493, 49535 (Aug. 16, 2012) (to be codified at 40 C.F.R. pts. 60, 63). In the Endangered Species Act arena, there may be instances where ecologically innovative practices aimed at recovery of species could be integrated into state and local recovery plans as part of a state's conservation of a threatened or endangered species. Indeed, in a forthcoming article written by the author, the author argues for the expansion of the federal recovery credit system to non-federal actors precisely because it may have innovation benefits for states and localities to use in conserving endangered species. Carlos R. Romo, *Rethinking the ESA's "Orderly Progression"—Recovery Credit Systems and Energy Development on Public Lands,* 49 Idaho L. Rev. 471, 474 (2013).

229. Jaffe et al., *supra* note 189, at 168–69.

230. *See* Wiseman, *supra* note 158, at 234.

encourage these promising new methods that reduce water consumption and oilfield wastes.[231]

Proposed EPA regulation of wastewater treatment from CBM and shale gas extraction under the CWA is premised in part under a theory of federalism, focusing on the lack of consistency and accountability in state regulatory frameworks for the management of produced water.[232] This Article suggests, however, that diverse state policies may have one underappreciated environmental advantage: encouragement of technological innovation. The continued exploration of this unconventional method of wastewater management highlights the potential environmental benefits of uncooperative federalism.

231. *See, e.g.,* Governor's Marcellus Shale Advisory Comm'n, Report 108 (July 22, 2011), *available at* http://marcellus.psu.edu/resources/PDFs/MSAC-FinalReport.pdf.

232. Wiseman, *supra* note 158, at 288–89.