



September 8, 2010

*By FedEx and e-mail*

The Honorable Lisa Jackson  
Administrator  
United States Environmental Protection Agency  
Ariel Rios Building  
1200 Pennsylvania Avenue, N.W.  
Washington, D.C. 20460

**Re: Petition for Rulemaking Pursuant to Section 6974(a) of the Resource Conservation and Recovery Act Concerning the Regulation of Wastes Associated with the Exploration, Development, or Production of Crude Oil or Natural Gas or Geothermal Energy.**

Dear Administrator Jackson:

To best protect human health, food sources, and our environment from the toxicity of contaminants found in wastes associated with the exploration, development and production of oil, gas, and geothermal energy, we believe it is appropriate for the Environmental Protection Agency (EPA) to reconsider its 1988 Regulatory Determination and regulate these wastes under Subtitle C of the Resource Conservation and Recovery Act (RCRA). The Natural Resources Defense Council (Petitioner) is submitting the attached rulemaking petition pursuant to Section 6974(a) of RCRA, 42 U.S.C. § 6974(a). In support of this petition, we identify numerous reports and data produced since the EPA's Regulatory Determination for Oil, Gas, and Geothermal Exploration, Development, and Production Wastes (July 6, 1988) which quantify the waste's toxicity, threats to human health and the environment, inadequate state regulatory programs, and readily available solutions.

The Natural Resources Defense Council (NRDC) is a nonprofit environmental action group established in 1970 by a group of law students and attorneys at the forefront of the environmental movement. The Natural Resources Defense Council's purpose is to safeguard the Earth: its people, its plants and animals and the natural systems on which all life depends. NRDC uses law, science and the support of 1.2 million members and online activists to protect the planet's wildlife and wild places and

to ensure a safe and healthy environment for all living things. NRDC has worked for many years to ensure the proper regulation of oil and gas exploration and production operations.

Section 6974(a) of RCRA allows any person to petition the Administrator of the EPA to promulgate an environmental regulation. Within a reasonable time following receipt of such petition, the Administrator shall take action with respect to such petition and shall publish notice of such action in the Federal Register, together with the reasons therefor. This petition asks the EPA to take specific actions and directs the EPA's attention to the ample documentation in the record, which provides full support for the designation of wastes associated with the exploration, development, or production of crude oil or natural gas or geothermal energy as hazardous waste under RCRA and provides a firm and compelling basis for the reconsideration of the EPA's July 1998 Regulatory Determination.

Thank you in advance for your consideration of this petition.

Respectfully submitted by:

A handwritten signature in cursive script that reads "Amy Mall".

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## **I. THE EPA SHOULD REGULATE WASTE FROM THE EXPLORATION, DEVELOPMENT AND PRODUCTION OF CRUDE OIL AND NATURAL GAS UNDER SUBTITLE C OF RCRA.**

We request that the U.S. Environmental Protection Agency (EPA) promulgate regulations that subject wastes associated with the exploration, development, or production of crude oil or natural gas or geothermal energy to the hazardous waste provisions of Subtitle C of the Resource Conservation and Recovery Act (RCRA). We submit this petition pursuant to 42 U.S.C. § 6974(a), seeking that EPA ensure safe management of these wastes throughout their life cycle from cradle to grave, including generation, transportation, treatment, storage and disposal. Reports concerning the toxicity of exploration, development and production wastes, their release into the environment, threats to human health, the increasing amount of these types of wastes being generated, the inadequacy of existing state regulations, enforcement and oversight, and the feasibility and economic benefits of using disposal techniques that are less harmful to the environment all support regulation under Subtitle C, as described in detail below.

### **A. The EPA Has Authority to Reconsider Its 1988 Regulatory Determination.**

Congress gave EPA the authority to prescribe necessary regulations to carry out its functions under RCRA.<sup>1</sup> Congress charged EPA with the task of “assuring that hazardous waste management practices are conducted in a manner which protects human health and the environment.”<sup>2</sup> Congress ensured that the public had a way to seek additional protections from hazardous wastes by allowing “[a]ny person . . . [to] petition the Administrator for the promulgation, amendment, or repeal of any regulation under” RCRA, and by requiring that “[w]ithin a reasonable time following receipt of such petition, the Administrator shall take action with respect to such petition and shall publish notice of such action in the Federal Register, together with the reasons therefor.”<sup>3</sup>

With these provisions, Congress expressed its intent that RCRA would adapt to changing hazardous waste management needs. Foreseeing the need to update regulations promulgated under RCRA to account for changing circumstances,<sup>4</sup> Congress provided the public a way to bring about EPA review of its regulations.<sup>5</sup> These provisions authorize EPA to reconsider its current treatment of wastes associated with the exploration, development, or production of oil and gas (E&P wastes).

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<sup>1</sup> 42 U.S.C. § 6912(a)(1).

<sup>2</sup> 42 U.S.C. § 6902(a)(4).

<sup>3</sup> 42 U.S.C. § 6912(a)(1).

<sup>4</sup> 42 U.S.C. § 6912(b).

<sup>5</sup> 42 U.S.C. § 6912(a)(1).

Congress passed RCRA in 1976 as an amendment to the Solid Waste Disposal Act of 1965 in an effort to enact more comprehensive waste disposal standards nationwide.<sup>6</sup> Through RCRA, Congress declared that the “disposal of solid waste . . . without careful planning and management [was] a danger to human health and the environment.”<sup>7</sup> Congress later amended RCRA with the Solid Waste Disposal Act Amendments of 1980.<sup>8</sup> One of the 1980 amendments, the so-called Bentsen Amendment, temporarily exempted “drilling fluids, produced waters, and other wastes associated with the exploration, development, or production of crude oil or natural gas” from regulation under RCRA.<sup>9</sup>

Under the Bentsen Amendment, Congress directed EPA to conduct a study to determine whether or not E&P wastes should be regulated as hazardous wastes under RCRA.<sup>10</sup> EPA completed the required study and submitted a Report to Congress on the Management of Waste from the Exploration, Development, and Production of Crude Oil, Natural Gas, and Geothermal Energy.<sup>11</sup> Shortly after submitting its report to Congress, EPA issued its Regulatory Determination for Oil, Gas, and Geothermal Exploration, Development, and Production Wastes, in which it decided that regulation of E&P wastes under Subtitle C of RCRA was unwarranted.<sup>12</sup>

In the more than twenty years that have passed since EPA issued its Regulatory Determination on E&P wastes, both the oil and gas industry and the risks associated with E&P wastes have expanded dramatically, making EPA’s 1988 Regulatory Determination unjustified. While E&P wastes have always been hazardous to human health and the environment, the recent expansion of drilling operations to more densely populated areas places even more people at risk. EPA’s reconsideration of its 1988 Regulatory Determination is especially necessary now that the basis for its Regulatory Determination no longer reflects current conditions. In its 1988 Regulatory Determination, EPA identified three factors as the basis for its decision not to regulate E&P wastes under Subtitle C. These factors included: (1) the infeasibility of implementing alternative regulations, (2) the adequacy of state regulations, and (3) the economic harm that would befall the oil and gas industry if additional regulatory controls were imposed.<sup>13</sup>

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<sup>6</sup> Joseph F. Scavetta, *RCRA 101: A Course in Compliance for Colleges and Universities*, 72 NOTRE DAME L. REV. 1647 (1997).

<sup>7</sup> Natasha Ernst, Note, *Flow Control Ordinances in a Post-Carbene World*, 13 PENN ST. ENVTL. L. REV. 53 (2004) (citing 42 U.S.C §§ 6901–6992k (2003)).

<sup>8</sup> Pub. L. 96-482; see also James R. Cox, *Revisiting RCRA’S Oilfield Waste Exemption as to Certain Hazardous Oilfield Exploration and Production Wastes*, 14 VILL. ENVTL. L.J. 1, 3 (2003).

<sup>9</sup> 42 U.S.C. § 6921(b)(2)(A).

<sup>10</sup> 42 U.S.C. § 6921(b)(2)(B).

<sup>11</sup> EPA, REPORT TO CONGRESS, MANAGEMENT OF WASTES FROM THE EXPLORATION, DEVELOPMENT, AND PRODUCTION OF CRUDE OIL, NATURAL GAS, AND GEOTHERMAL ENERGY, Vols. 1–3 EPA530-SW-88-003 (1987) [hereinafter REPORT TO CONGRESS].

<sup>12</sup> Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes, 53 Fed. Reg. 25446, 25447 (July 6, 1988).

<sup>13</sup> Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes, 53 Fed. Reg. at 25446.

As will be discussed at greater length below, new evidence clearly demonstrates that alternative disposal practices are feasible, state regulations remain inadequate, and the oil and gas industry is unlikely to be severely harmed by the imposition of more stringent waste disposal requirements. Because this evidence shows that the assumptions on which EPA's 1988 Regulatory Determination was based are no longer correct, EPA must revisit its decision.<sup>14</sup>

Nothing in RCRA prevents the EPA from reconsidering its 1988 Regulatory Determination. In *American Portland Cement Alliance*,<sup>15</sup> the court upheld EPA's authority to reconsider regulatory determinations made pursuant to the 1980 amendments to RCRA.<sup>16</sup> Moreover, statements made by EPA in its 1988 Regulatory Determination indicate that EPA never intended the Regulatory Determination to be its final word on E&P waste. Instead, EPA established a three-pronged plan and intended to take further action to fill in existing gaps in the regulations governing the disposal of E&P wastes.<sup>17</sup> To date this three-pronged plan has not been fulfilled. Gaps in the regulatory system governing E&P wastes have grown even wider and evidence of the substantial harm E&P wastes can cause to human health and the environment has continued to accumulate. EPA must revisit its 1988 Regulatory Determination to fulfill its obligations under the 1988 Regulatory Determination and protect human health and the environment from the significant risks posed by E&P wastes.

Unless EPA revisits its 1988 Regulatory Determination and recommends that E&P wastes be regulated under Subtitle C of RCRA, E&P wastes will continue to present substantial hazards to human health and the environment.<sup>18</sup>

## **B. EPA Should Regulate E&P Wastes Under Subtitle C of RCRA.**

In light of the documented toxicity of contaminants found in E&P waste, the failure of states to adequately regulate the disposal of E&P wastes, the dramatic increase in oil and gas production that has occurred since 1988, and the availability of safer cost-effective disposal alternatives, EPA must take action in order to prevent further harm to human health and the

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<sup>14</sup> EPA Region 8 itself stated that "EPA may need to revisit the continued validity of the exemption in light of the advancements in practices." EPA REGION 8, AN ASSESSMENT OF THE ENVIRONMENTAL IMPLICATIONS OF OIL AND GAS PRODUCTION: A REGIONAL CASE STUDY 3-14 (Working Draft 2008).

<sup>15</sup> 101 F.3d 772 (D.C. Cir. 1996).

<sup>16</sup> *Id.*

<sup>17</sup> Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes, 53 Fed. Reg. at 25,447.

<sup>18</sup> [This footnote intentionally deleted in corrected copy.]

environment. EPA should reconsider its 1988 Regulatory Determination and regulate E&P wastes under Subtitle C of RCRA. Regulation under Subtitle C is not only appropriate, given that E&P wastes fall within the regulatory criteria for characteristic hazardous waste,<sup>19</sup> but necessary because, without such action, the oil and gas industry will lack the incentives to implement safer techniques as quickly as is necessary.<sup>20</sup>

## 1. E&P Waste Is Toxic.

E&P waste that is exempt from regulation under Subtitle C includes: drilling fluids and cuttings, produced water, used hydraulic fracturing fluids, rigwash, workover wastes, tank bottom sludge, glycol-based dehydration wastes, amine-containing sweetening wastes, hydrocarbon-bearing soil, and many other individual waste products.<sup>21</sup> In its 1988 Regulatory Determination, EPA admitted that E&P wastes contain toxic substances that endanger both human health and the environment.<sup>22</sup> Despite noting that benzene, phenanthrene, lead, arsenic, barium, antimony, fluoride, and uranium found in E&P wastes were of major concern and present at “levels that exceed 100 times EPA’s health based standards,”<sup>23</sup> EPA declined to regulate these toxic substances under Subtitle C of RCRA. But EPA can no longer refuse to act: an ever-increasing amount of evidence demonstrates that E&P wastes are toxic, have had substantial negative effects on human health and the environment, and should be a major concern for EPA. Since 1988, numerous reports, studies, and cases have demonstrated that E&P wastes contain toxic substances that threaten both human health and the environment.

### a. Contaminants Found in Different Types of E&P Wastes

E&P wastes are generally divided into three categories: produced water, drilling fluids and cuttings, and associated wastes.<sup>24</sup> All of these wastes contain a variety of toxic substances that present substantial risks to human health and the environment. Despite these risks, these E&P wastes are currently exempt from regulation under Subtitle C.

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<sup>19</sup> See notes 282–313 *infra* and accompanying text.

<sup>20</sup> Closing Argument of the New Mexico Citizens for Clean Air and Water, Dec. 2007, OCD Document Image No. 14015\_648\_CF[1] at 9-10; see also AMY MALL, DRILLING DOWN: PROTECTING WESTERN COMMUNITIES FROM THE HEALTH AND ENVIRONMENTAL EFFECTS OF OIL AND GAS PRODUCTION vi (2007) [hereinafter “DRILLING DOWN”].

<sup>21</sup> See RAILROAD COMMISSION OF TEXAS, *Hazardous and Nonhazardous Oil and Gas Waste* 3–6, in WASTE MINIMIZATION IN THE OIL FIELD (2001).

<sup>22</sup> Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes, 53 Fed. Reg. at 25448.

<sup>23</sup> *Id.*; see also Cox, *supra* note 8, at 9.

<sup>24</sup> CLAUDIA ZAGREAN NAGY, CALIFORNIA DEP’T OF TOXIC SUBSTANCES CONTROL, OIL EXPLORATION AND PRODUCTION WASTES INITIATIVE 6 (2002).

*i. Produced Water & Hydraulic Fracturing Wastewater*

Produced water, also known as brine, is generally—but erroneously—considered to be “relatively clean” and contain less contaminants than other E&P waste.<sup>25</sup> Despite this common misconception, a study sponsored by the U.S. Department of Energy demonstrated that oil production yields “environmentally hazardous” produced water.<sup>26</sup> The West Virginia Department of Environmental Protection (WVDEP) found many contaminants of concern present in oil and gas wastewaters,<sup>27</sup> including arsenic, lead, and hexavalent chromium, while EPA Region 8 identified the presence of barium, chloride, sodium, sulfates, and other minerals,<sup>28</sup> and the Oklahoma Corporation Commission Oil and Gas Conservation Division stated that produced water can contain high levels of boron.<sup>29</sup> In 2009, the Colorado Oil and Gas Conservation Commission (COCG) documented multiple spills of produced water containing benzene levels exceeding the state’s water quality standards, at least one of which was confirmed to have impacted groundwater.<sup>30</sup>

Knowledge of the hazardous nature of produced water is not new. In 1972, Chevron Oil Field Research Company found that “oil field produced waters contain dissolved organic compounds that are toxic to marine life.”<sup>31</sup> More than a decade later, the U.S. General Accounting Office (GAO) acknowledged that “[b]rines associated with oil and gas production contain very high levels of chlorides . . . . Brines may also contain . . . petroleum hydrocarbons and additives, such as corrosion inhibitors, . . . and other radioactive materials.”<sup>32</sup> EPA was aware of these hazardous constituents when it issued its 1988 Regulatory Determination. In its 1987 Report to Congress, EPA knew that “PAHs [polycyclic aromatic hydrocarbons] are a typical component of some produced waters,” that “very low concentrations . . . of PAH are lethal to some forms of aquatic wildlife,” and that the practice of disposing of “produced water in

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<sup>25</sup> KELLY CORCORAN, KATHERINE JOSEPH, ELIZABETH LAPOSATA, & ERIC SCOT, UC HASTINGS COLLEGE OF THE LAW’S PUBLIC LAW RESEARCH INSTITUTE, SELECTED TOPICS IN STATE AND LOCAL REGULATION OF OIL AND GAS EXPLORATION AND PRODUCTION 31–32.

<sup>26</sup> C. TSOURIS, OAK RIDGE NATIONAL LABORATORY, EMERGING APPLICATIONS OF GAS HYDRATES 7.

<sup>27</sup> The contaminants of concern included: “sulfate, chloride, arsenic, titanium, cobalt, nickel, silver, zinc, vanadium, tin, cadmium, lead, chromium, hexavalent chromium, copper, fluoranthene, cyanide, mercury, selenium, antimony, beryllium, barium, ammonia nitrogen, fluoride, nitrite nitrogen, nitrate nitrogen, oil and grease, total suspended solids, iron, aluminum, chloroform, benzene, phthalate esters, strontium, strontium-90, boron, lithium, gross alpha radiation, gross beta radiation, radium 226+ [and] radium 228.” Letter from West Virginia Department of Environmental Protection to William Goodwin, Superintendent Clarksburg Sanitary Board, July 23, 2009.

<sup>28</sup> EPA REGION 8, AN ASSESSMENT OF THE ENVIRONMENTAL IMPLICATIONS OF OIL AND GAS PRODUCTION: A REGIONAL CASE STUDY, WORKING DRAFT 3-11 (2008).

<sup>29</sup> OKLAHOMA CORPORATION COMMISSION OIL AND GAS CONSERVATION DIVISION, GUIDELINES FOR RESPONDING TO AND REMEDIATING NEW OR HISTORIC BRINE SPILLS 2 (2009).

<sup>30</sup> COLORADO OIL AND GAS CONSERVATION COMMISSION, INSPECTION/INCIDENT INQUIRY, SPILL REPORTS, DOC. NOS. 1631502, 1631508 (groundwater impact confirmed).

<sup>31</sup> A.H. BEYER, CHEVRON OIL FIELD RESEARCH CO., TECHNICAL MEMORANDUM, PURIFICATION OF PRODUCED WATER, PART 1—REMOVAL OF VOLATILE DISSOLVED OIL BY STRIPPING 1 (1972).

<sup>32</sup> U.S. GENERAL ACCOUNTING OFFICE, RCED-89-97, SAFEGUARDS ARE NOT PREVENTING CONTAMINATION FROM INJECTED OIL AND GAS WELLS 11 (1989).

unlined percolation pits [allows] PAHs and other constituents to migrate into and accumulate in soils.”<sup>33</sup>

In addition to containing dangerous contaminants, produced water can also be radioactive. This problem first attracted national attention 1988 in southern and Gulf Coast states.<sup>34</sup> Shortly thereafter, GAO’s 1989 report openly acknowledged the hazard.<sup>35</sup> A more recent analysis of normally occurring radioactive materials (NORM) levels in produced waters from the Marcellus Shale indicates that the dangers may be greater than initially thought.<sup>36</sup> Samples of produced water in the Marcellus Shale analyzed by the New York State Department of Environmental Conservation (NYSDEC) were reported to contain “levels of radium 226, a derivative of uranium, as high as 267 times the limit safe for people to drink.”<sup>37</sup>

Despite knowledge of these risks, the data currently available may underestimate the actual radiation levels in produced water. A common method used by industry and EPA to measure radiation levels in produced water has been criticized because of its tendency to underestimate actual radiation levels. In the late 1980s, Exxon Mobil, along with Rogers and Associates Engineers (RAE) and the American Petroleum Institute (API), formulated correlations that could be used to estimate NORM in levels of equipment used to hold produced water.<sup>38</sup> The external measurement process chosen by RAE to measure the NORM levels has since been challenged as “seriously flawed” and has resulted in the reporting of a “greatly reduced radioactivity concentration of 480 pCi/gm.”<sup>39</sup> Accurate testing could reveal that the NORM levels in produced water are even higher than currently being reported.

Wastewaters from hydraulic fracturing, largely composed of used fracturing fluids, are also toxic. Common substances found in these wastewaters include: surfactants, friction reducing chemicals, biocides, scale inhibitors, polymers, cross linkers, pH control agents, gel breakers, clay control agents and propping agents.<sup>40</sup> Many of these substances are possible and probable carcinogens.<sup>41</sup> Analysis of fracturing fluid flowback waters from Pennsylvania and West Virginia found the known carcinogen benzene present in nearly half of all fracturing fluid flowback waters at average concentrations nearly one hundred times the maximum acceptable

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<sup>33</sup> EPA, REPORT TO CONGRESS, *supra* note 11, at II-44.

<sup>34</sup> Keith Schneider, *Radiation Danger Found in Oilfields Across the Nation*, N.Y. TIMES, Dec. 3, 1990, at A1.

<sup>35</sup> GAO, RCED-89-97, *supra* note 32.

<sup>36</sup> N.Y. DEP’T OF ENVTL. CONSERVATION, DRAFT SUPPLEMENTAL GENERIC ENVIRONMENTAL IMPACT STATEMENT ON THE OIL, GAS AND SOLUTION MINING REGULATORY PROGRAM 6-130 (2009) [hereinafter DRAFT SGEIS].

<sup>37</sup> Abraham Lustgarten, ProPublica, *Natural Gas Drilling Produces Radioactive Wastewater*, SCIENTIFIC AMERICAN, Nov. 9, 2009; *see also* DRAFT SGEIS, *supra* note 36, at app. 13.

<sup>38</sup> Motion in Limine to Exclude Rogers and Associates Engineering Reports, *Lester v. Exxon Mobil Corp.*, No. 630-402 (La. 24th Jud. Dist. Ct. 2009), at 6–7.

<sup>39</sup> *Id.* at 7-8.

<sup>40</sup> Wilma Subra, Louisiana Environmental Action Network, Comments on Hydraulic Fracturing to the Louisiana Senate Environmental Quality Committee, Mar. 11, 2010.

<sup>41</sup> *Id.*

contaminant levels established by EPA.<sup>42</sup> While this information demonstrates that these wastes contain toxic compounds, the true extent of the risks associated with hydraulic fracturing wastewaters is currently unknown as many of the compounds used in fracturing fluids and returned in the wastewaters are not publically disclosed.<sup>43</sup>

ii. *Drilling Fluids and Drill Cuttings*

Drilling fluids and cuttings make up two to four percent of oil and gas wastes.<sup>44</sup> They include rock removed during drilling (drill cuttings) and drilling muds, also known as drilling fluids, which can be either water or oil-based and often contain various additives.<sup>45</sup> A joint EPA/API survey found drilling fluids in reserve pits to contain “chromium, lead and pentachlorophenol at hazardous levels.”<sup>46</sup> The survey also found that “oil-based fluids may contain benzene”<sup>47</sup> and that when oil-based fluids are used, “potentially toxic hydrocarbons” will be present in greater quantities.<sup>48</sup> Drilling muds may also contain other “potentially hazardous substances including . . . cadmium, arsenic . . . mercury, copper . . . diesel oil; grease; and various other hydrocarbons and organic compounds (e.g., methanol, chlorinated phenols, formaldehyde, benzene, toluene, ethyl benzene, xylene, and acrylamide),” as well as additives including acids and caustics, corrosion inhibitors, bactericides and biocides, surfactants, defoamers, emulsifiers, filtrater

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<sup>42</sup> Susan Riha et al, *Comments on the Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program*, Jan. 2010, at 5; see also N.Y. DEP’T OF ENVTL. CONSERVATION, DRAFT SGEIS 5-104 (2009).

<sup>43</sup> Wilma Subra, *Comments on Hydraulic Fracturing*, *supra* note 40. See also DRAFT SGEIS, *supra* note 36, at 5-51 (stating that the fracturing fluid additives list “[c]hemical constituents are not linked to product names in Table 5.6 because a significant number of product composition and formulas have been justified as trade secrets as defined [under New York law] . . .”).

<sup>44</sup> U.S. CONGRESS, OFFICE OF TECHNOLOGY ASSESSMENT, MANAGING INDUSTRIAL SOLID WASTES FROM MANUFACTURING, MINING, OIL AND GAS PRODUCTION, AND UTILITY COAL COMBUSTION—BACKGROUND PAPER 67 (1992).

<sup>45</sup> *Id.*; see also U.S. FISH & WILDLIFE SERV., REGION 6, ENVTL. CONTAMINANTS PROGRAM, RESERVE PIT MANAGEMENT: RISKS TO MIGRATORY BIRDS 4–5 (2009).

“Water-based drilling muds can contain glycols, chromium, zinc, polypropylene glycol, and acrylamide copolymers. Synthetic-based muds contain mineral oil and oil-based muds can contain diesel oil, although diesel oil is being replaced by a palm oil derivative or hydrated castor [*sic*] oil. Other additives typically used in drilling fluids include: polymers (partially hydrolyzed polyacrylamide (PHPA) and polyanionic cellulose (PAC)); drilling detergents; and sodium carbonate (soda ash). PHPA is used to increase viscosity of fluid and inhibit clay and shale from swelling and sticking. PAC is used to increase the stability of the borehole in unconsolidated formations. Drilling detergents or surfactants are used with bentonite drilling fluids to decrease the surface tension of the drill cuttings. Soda ash is used to raise the pH of the water and precipitate calcium out of the water.” *Id.* (internal citations omitted).

<sup>46</sup> U.S. CONGRESS, OFFICE OF TECHNOLOGY ASSESSMENT, MANAGING INDUSTRIAL SOLID WASTES FROM MANUFACTURING, MINING, OIL AND GAS PRODUCTION, AND UTILITY COAL COMBUSTION—BACKGROUND PAPER 5 (1992).

<sup>47</sup> *Id.*

<sup>48</sup> OIL & GAS ACCOUNTABILITY PROJECT, PIT POLLUTION—BACKGROUNDER ON THE ISSUES, WITH A NEW MEXICO CASE STUDY 6 (2004).

reducers, shale control inhibitors, thinners and dispersants, weighing materials, bentonite clay, and acrylamide.<sup>49</sup>

The use of these additives increases the risks associated with E&P waste, as many are hazardous compounds themselves.<sup>50</sup> EPA has already classified at least one additive, flocculant acrylamide, as a probable carcinogen.<sup>51</sup> Another frequently used additive, barite weighting agent, can contain cadmium and mercury.<sup>52</sup> When Greenpeace analyzed the heavy metal contents of one drilling fluid additive, SOLTEX<sup>®</sup> (a scale inhibitor used in both on- and off-shore drilling muds), it identified the presence of antimony, arsenic, barium, cadmium, chromium, cobalt, copper, fluoride, lead, mercury, nickel, vanadium, and zinc.<sup>53</sup> These reports alone create cause for concern; yet, the full extent of the risk these chemicals present is unknown, as the additives' formulas, and thus the concentrations of the various chemicals, are proprietary information and undisclosed by oil and gas companies.<sup>54</sup>

### *iii. Associated Wastes*

Associated wastes include oily sludges, workover wastes, well completion and abandonment wastes and other small volume wastes associated with oil or gas production.<sup>55</sup> Oily sludges consist of “oily sands and untreatable emulsions segregated from the production stream, and sediment accumulated on the bottom of crude oil and water storage tanks.”<sup>56</sup> Workover wastes include foam treatment wastes and stimulation fluids.<sup>57</sup> Of all the E&P wastes, associated wastes are generated in the lowest volume;<sup>58</sup> however, this does not mean that they are safe or that current regulations ensure they are disposed of properly. Indeed, “[a]lthough associated wastes constitute a relatively small proportion of total wastes, they are most likely to contain a range of chemicals and naturally occurring materials that are of concern to health and safety.”<sup>59</sup> Several associated wastes identified in Colorado have the “potential to be ignitable” while others “can exhibit toxicity for heavy metals such as lead.”<sup>60</sup>

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

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

<sup>51</sup> U.S. EPA, *Technology Transfer Air Toxics: Acrylamide*.

<sup>52</sup> T.A. Kassim, *Waste Minimization and Molecular Nanotechnology: Toward Total Environmental Sustainability*, in 3 ENVIRONMENTAL IMPACT ASSESSMENT OF RECYCLED WASTES ON SURFACE AND GROUND WATERS: ENGINEERING MODELING AND SUSTAINABILITY 191, 204 (Tarek A. Kassim ed., 2005); Texas Railroad Commission, *Waste Minimization in Drilling Operations*.

<sup>53</sup> JONATHAN WILLS, *MUDDIED WATERS, A SURVEY OF OFFSHORE OILFIELD DRILLING WASTES AND DISPOSAL TECHNIQUES TO REDUCE THE ECOLOGICAL IMPACT OF SEA DUMPING* (2000).

<sup>54</sup> OIL & GAS ACCOUNTABILITY PROJECT, *supra* note 48, at 6–7.

<sup>55</sup> NAGY, *supra* note 24, at 6.

<sup>56</sup> *Id.* at 13.

<sup>57</sup> *Id.* at 14.

<sup>58</sup> *Id.* at 6; American Petroleum Institute, *Waste Management*.

<sup>59</sup> Dara O'Rourke & Sarah Connolly, *Just Oil? The Distribution of Environmental and Social Impacts of Oil Production and Consumption*, 28 ANNUAL REV. ENVTL. RESOURCES 587, 595 (2003).

<sup>60</sup> Testimony of Margaret A. Ash, OGCC Envtl. Supervisor, *In the Matter of Changes to the Rules and Regulations of the Oil and Gas Conservation Commission of the State of Colorado*, at 15.

## b. Contaminants Found in Specific E&P Waste Disposal Sites

The hazardous contaminants used in oil and gas exploration and production and whose presence has been identified in E&P wastes end up being disposed of in a variety of methods. Pits, burial, land application, and injection wells are the methods most frequently used to dispose of E&P wastes. Wastewater treatment facilities are also increasing in use. Studies of some of these different types of common E&P waste disposal sites provide further evidence of the toxicity of E&P wastes.

Pits are a common E&P waste disposal method used both to store drilling muds and cuttings brought to the surface in drilling operations and to hold produced water, production fluids, used hydraulic fracturing fluid, and other wastes.<sup>61</sup> Numerous studies have found pits to contain toxic levels of many hazardous compounds. In 2007, an industry committee of oil and gas companies in New Mexico sponsored a sampling and analysis program of waste pits in the San Juan Basin.<sup>62</sup> Forty-two substances, including the “BTEX” chemicals<sup>63</sup> (benzene, toluene, ethylbenzene, and xylene), acetone, arsenic, barium, mercury, and radium were found in the samples.<sup>64</sup> Eleven of the chemicals were present at concentration levels above state limits.<sup>65</sup> A more recent sampling of an oilfield pit in Texas identified the presence of high levels of mercury and chromium.<sup>66</sup> Dirt removed from a pit in Oklahoma was contaminated with “high levels of arsenic, dioxins and total petroleum hydrocarbons.”<sup>67</sup>

Analysis of land application sites, another method for disposing of E&P wastes, provides further evidence illustrating the hazards of E&P wastes. A study of landfarms conducted by the Arkansas Department of Environmental Quality (ADEQ) found that the substances in E&P wastes that were being land applied exceeded Arkansas’ acceptable limits for chloride concentrations in most of the facilities it tested.<sup>68</sup> In addition, “[n]ine out of eleven facilities had

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<sup>61</sup> CORCORAN ET AL., *supra* note 25, at 20–21.

<sup>62</sup> The Endocrine Disruption Exchange, Potential Health Effects of Residues in 6 New Mexico Oil and Gas Drilling Reserve Pits Based on Compounds Detected in at Least One Sample, Nov. 15, 2007.

<sup>63</sup> SHANNON D. WILLIAMS, DAVID E. LADD & JAMES J. FARMER, U.S. GEOLOGICAL SURVEY, FATE AND TRANSPORT OF PETROLEUM HYDROCARBONS IN SOIL AND GROUND WATER AT BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA, TENNESSEE AND KENTUCKY, 2002–2003 10 (2006) (“The BTEX compounds . . . appear on The Clean Water Act Priority Pollutant list of 126 chemical substances (Office of the Federal Register, 2002).”). Testing obtained by individuals residing near the pits has also confirmed the presence of dangerous contaminants. DRILLING DOWN, *supra* note 20, at 26 n.156.

<sup>64</sup> The Endocrine Disruption Exchange, *supra* note 62.

<sup>65</sup> The Endocrine Disruption Exchange, Number of Chemicals Detected in Reserve Pits for 6 Wells in New Mexico That Appear on National Toxic Chemicals Lists: Amended Document, Nov. 15, 2007.

<sup>66</sup> Letter from Roy Staiger, District Office Cleanup Coordinator, Texas Railroad Commission, to Exxon Mobil Corporation, Dec. 31, 2009.

<sup>67</sup> OIL & GAS ACCOUNTABILITY PROJECT, SPRING/SUMMER 2006 REPORT (2006).

<sup>68</sup> Arkansas Dep’t of Env’tl. Quality, Report on Landfarms (“Four facilities had pond chlorides greater than 3,000 mg/L and the ponds were full . . . Eight out of eleven facilities had soil concentrations greater than 1,000 mg/Kg on at least one application area. Most were several times higher than 1,000 mg/Kg . . .”).

TPH concentrations that would indicate the application of [oil-based drilling fluids] had taken place.”<sup>69</sup> Analysis of soil samples taken from a residential property in Texas, where pit sludge had been land applied less than 300 feet from a residence, “confirmed the presence of numerous hydrocarbons identified as Recognized and Suspected human carcinogens and neurotoxins (1, 2, 4 Trimethylbenzene, 1, 3, 5 Trimethylbenzene, 4-Isopropyltoluene, Acetone, Benzene, Carbon disulfide, Ethylbenzene, Isopropylbenzene, m&m Xylene, n-Butylbenzene, n-Propylbenzene, o-Xylene, sec-Butylbenzene, tert-Butylbenzene, Toluene).”<sup>70</sup> The residents of this property all reported skin rashes after the waste was applied to their land.<sup>71</sup>

c. The risks associated with these contaminants

i. *Substances in E&P Wastes Endanger Human Health.*

Many of these substances identified in E&P wastes are known carcinogens.<sup>72</sup> The most prevalent contaminants found in E&P wastes are the “BTEX” chemicals:<sup>73</sup> benzene,<sup>74</sup> toluene,<sup>75</sup> ethylbenzene,<sup>76</sup> and xylene.<sup>77</sup> Exposure to benzene has been “associated with an increased risk of leukemia in industrial workers”<sup>78</sup> and other serious health conditions, exposure to toluene can cause nervous system damage,<sup>79</sup> while xylenes can “cause dizziness, headaches and loss of balance among other problems.”<sup>80</sup> Many of the other chemicals found in E&P waste, including

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<sup>69</sup> *Id.*

<sup>70</sup> WOLF EAGLE ENVIRONMENTAL, ENVIRONMENTAL STUDIES: FUGITIVE AIR EMISSIONS TESTING, IMPACTED SOIL TESTING, MR. AND MRS. TIMOTHY RUGGIERO (2010).

<sup>71</sup> Eric Griffey, *Toxic drilling waste is getting spread all over Texas farmland*, FORT WORTH WEEKLY, May 12, 2010.

<sup>72</sup> See Cox, *supra* note 8, at 4.

<sup>73</sup> CORCORAN ET AL., *supra* note 25, at 21.; see also WILLIAMS ET AL., *supra* note 63, at 10 (“The BTEX compounds . . . appear on The Clean Water Act Priority Pollutant list of 126 chemical substances (Office of the Federal Register, 2002).”); U.S.G.S., TOXIC SUBSTANCE HYDROLOGY PROGRAM: BTEX.

<sup>74</sup> “Benzene is a known human carcinogen and causes leukemia.” DRILLING DOWN, *supra* note 20, at vi; see also WILLIAMS ET AL., *supra* note 63, at 26. (“Because of the high degree of toxicity and mobility of benzene (compared to other petroleum hydrocarbons), it is commonly the main ground-water contaminant of concern at petroleum release sites.”).

<sup>75</sup> “Toluene can cause fatigue, confusion, weakness, memory loss, nausea, hearing loss, central nervous system damage, and may cause kidney damage. It is also known to cause birth defects and reproductive harm.” DRILLING DOWN, *supra* note 20, at vi (footnotes omitted).

<sup>76</sup> “Ethylbenzene can cause dizziness, throat and eye irritation, respiratory problems, fatigue, and headaches. It has been linked to tumors and birth defects in animals, as well as to damage in the nervous system, liver, and kidneys.” *Id.* (footnote omitted).

<sup>77</sup> “Xylene can cause headaches; dizziness; confusion; balance changes; irritation of the skin, eyes, nose and throat; breathing difficulty; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys.” *Id.* (footnote omitted).

<sup>78</sup> N.Y. DEP’T OF ENVTL. CONSERVATION, *supra* note 36, at 5-62 (2009).

<sup>79</sup> CORCORAN ET AL., *supra* note 25, at 21.

<sup>80</sup> *Id.*

acetone,<sup>81</sup> arsenic,<sup>82</sup> barium,<sup>83</sup> mercury,<sup>84</sup> and radium,<sup>85</sup> all found in E&P waste samples, also raise serious concerns for human health.

The impacts of these contaminants have been documented. In a 1997 Louisiana case against U.S. Liquids & Exxon, plaintiffs reported that shortly after the dumping of more than fifty million gallons of E&P waste containing benzene, toluene, and lead occurred at a facility located less than 500 feet from the nearest resident's home, "[a] strange smell blew over the community and . . . [m]any people in the area felt sick . . . For nearly three weeks, most residents, including children, suffered from stomach pains, sinus problems and other ailments."<sup>86</sup> Other evidence demonstrates that exposure to contaminants in E&P wastes can result in delayed and long-term health effects. One study conducted in the Amazon Basin of Ecuador found that pregnant women who resided in areas where there was discharge of untreated oilfield wastes into the environment experienced higher levels of spontaneous abortion.<sup>87</sup> Another epidemiological study in the same area showed "significantly higher incidence of cancer for all sites combined in both men and women living in proximity to oil fields . . . [specifically,] [s]ignificantly higher incidences were observed for cancers of the stomach, rectum skin melanoma, soft tissue and

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<sup>81</sup> Acetone can cause nose, throat, lung and eye irritation, respiratory problems, fatigue and headaches. *See* AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY, U.S. DEP'T OF HEALTH & HUMAN SERVS., TOXFAQS FOR ACETONE (1995); DRILLING DOWN, *supra* note 20, at vi (footnote omitted).

<sup>82</sup> "Chronic arsenic exposure can cause damage to blood vessels, a sensation of 'pins and needles' in hands and feet, darkening and thickening of the skin, and skin redness. It is a known human carcinogen and can cause cancer of the skin, lung, bladder, liver, kidney, and prostate." DRILLING DOWN, *supra* note 20, at vi (footnote omitted); *see also* AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY, U.S. DEP'T OF HEALTH & HUMAN SERVS., TOXFAQS FOR ARSENIC (2007) ("Exposure to lower levels can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm . . ."); SCIENCELAB.COM, CHEMICALS & LABORATORY EQUIPMENT, MATERIAL SAFETY DATA SHEET: ARSENIC MSDS 1 (2008), ("[Arsenic is] toxic to kidneys, lungs, the nervous system, mucous membranes.")

<sup>83</sup> "Ingesting drinking water containing levels of barium above the EPA drinking water guidelines for relatively short periods of time can cause gastrointestinal disturbances and muscle weakness. Ingesting high levels for a long time can damage the kidneys . . . Some people who eat or drink amounts of barium above background levels found in food and water for a short period may experience vomiting, abdominal cramps, diarrhea, difficulties in breathing, increased or decreased blood pressure, numbness around the face, and muscle weakness. Eating or drinking very large amounts of barium compounds that easily dissolve can cause changes in heart rhythm or paralysis and possibly death. Animals that drank barium over long periods had damage to the kidneys, decreases in body weight, and some died." AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY, U.S. DEP'T OF HEALTH & HUMAN SERVS., TOXFAQS FOR BARIUM (2007).

<sup>84</sup> "Mercury can permanently damage the brain, kidneys, and developing fetus and may result in tremors, changes in vision or hearing, and memory problems. Even in low doses, mercury may affect an infant's development, delaying walking and talking, shortening attention 'span,' and causing learning disabilities." DRILLING DOWN, *supra* note 20, at vi (footnote omitted).

<sup>85</sup> "Radium is a known human carcinogen, causing bone, liver, and breast cancer." *Id.* (footnote omitted); *see also* AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY, U.S. DEP'T OF HEALTH & HUMAN SERVS., TOXFAQS FOR RADIUM (1999).

<sup>86</sup> Chris Gray, *Pits Cause Stink in Lafourche*, TIMES-PICAYUNE, July 14, 1997, at A1.

<sup>87</sup> Miguel San Sebastian, Ben Armstrong, & Carolyn Stephens, *Outcomes of Pregnancy among Women Living in the Proximity of Oil Fields in the Amazon Basin of Ecuador*, 8 INTL. J. OF OCCUPATIONAL AND ECON. HEALTH 312 (2002).

kidney in men and for cancers of the cervix and lymph nodes in women.<sup>88</sup> As reports and first-hand accounts indicate, the risks posed by the contaminants found in E&P waste are not merely speculative. And the risks will not decrease anytime soon. As many pits containing E&P wastes are buried and forgotten, the buried E&P wastes have the potential to threaten future generations who will be unaware of the hazards just below the surface.

Human health can also be harmed by exposure to radiation in NORM-contaminated E&P wastes. Exposure can occur through inhalation of radium-bearing particles, through direct contact with NORM-contaminated soils and water, or through ingestion of radium-barium particles found in plants or animals exposed to NORM-contaminated soils or water.<sup>89</sup> Exposure to radium can result “in an increased risk of bone, liver, and breast cancer . . . [it] has been shown to cause effects on the blood (anemia) and eyes (cataracts). It also has been shown to affect the teeth, causing an increase in broken teeth and cavities.”<sup>90</sup> And the risks associated with NORM-contaminated soils and waters can persist for decades. In particular, land contaminated by radium 226, such as that found in produced water from the Marcellus Shale,<sup>91</sup> can pose a threat to “many generations of individuals living or working on NORM-contaminated land for a period covering nearing 20,000 years.”<sup>92</sup>

*ii. Substances in E&P Wastes Endanger Wildlife and Livestock.*

In addition to harming human health, exposure to contaminants in E&P waste can sicken and kill wildlife. A recent report prepared by the U.S. Fish and Wildlife Service (USFWS) indicates that pits present significant risks to wildlife. Pits can “entrap and kill migratory birds and other wildlife . . . . Birds are attracted to reserve pits by mistaking them for bodies of water. . . . The sticky nature of oil entraps birds in the pits and they die from exposure and exhaustion.”<sup>93</sup> In 2009, ExxonMobil pled guilty to violating the Migratory Bird Treaty Act,<sup>94</sup> after numerous birds (including mallard ducks, grebes, white-faced ibis, gadwell ducks, owls, Wilson phalaropes, Northern Shoveler ducks, avocets, curlew, a green-winged teal, a Cassin’s sparrow, a purple

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<sup>88</sup> Anna-Karin Hurtig & Miguel San Sebastian, *Geographical Differences in Cancer Incidence in the Amazon Basin of Ecuador in Relation to Residence near Oil Fields*, 31 INT’L J. OF EPIDEMIOLOGY 1021, 1025 (2002).

<sup>89</sup> Henry Spitz, Kenneth Lovins & Christopher Becker, *Evaluation of Residual Soil Contamination From Commercial Oil Well Drilling Activities and Its Impact on the Naturally Occurring Background Radiation Environment*, 6 SOIL & SEDIMENT CONTAMINATION: AN INT’L J. 37, 43 (1997).

<sup>90</sup> AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY, *supra* note 85.

<sup>91</sup> *See supra* note 37.

<sup>92</sup> Henry Spitz, Kenneth Lovins & Christopher Becker, *Evaluation of Residual Soil Contamination From Commercial Oil Well Drilling Activities and Its Impact on the Naturally Occurring Background Radiation Environment*, 6 SOIL & SEDIMENT CONTAMINATION: AN INT’L J. 37, 41 (1997).

<sup>93</sup> U.S. FISH & WILDLIFE SERV., REGION 6, ENVTL. CONTAMINANTS PROGRAM, RESERVE PIT MANAGEMENT: RISKS TO MIGRATORY BIRDS i (2009).

<sup>94</sup> 16 U.S.C. §§ 703-708.

martin, and a hawk) were found sick and dead after being exposed to pit contents, including hydrocarbons, in multiple states.<sup>95</sup>

E&P wastes have the potential to destroy lands upon which wildlife depend, disrupt food chains, and prevent wildlife from reproducing.<sup>96</sup> The New Mexico Department of Game & Fish has expressed concern about the hazards of hydrocarbon toxicity to wildlife including “acute and chronic ingestion or absorption toxicity, loss of thermal stability from oiling of fur or feathers, and reproductive failure due to absorption of chemicals from the maternal bird body through the shell of eggs.”<sup>97</sup> Other researchers are concerned about the bioaccumulation of E&P wastes in wildlife, a process that would cause their harmful effects to magnify as they progress up the food chain.<sup>98</sup> Wildlife habitat may also be harmed by E&P waste. The New Mexico Department of Game and Fish has stated that it “is concerned that chloride contamination of the soil vadose zone may permanently impact the ability of a closed pit location to support vegetation necessary for productive wildlife habitat.”<sup>99</sup> Just as E&P wastes can harm humans in ways that are not immediately apparent but can cause harm to future generations, so too can they harm successive generations of wildlife.

Domesticated animals are also harmed by E&P wastes. The Pennsylvania Department of Agriculture quarantined cattle after they came into contact with hydraulic fracturing wastewater being stored in a pit that leaked into an adjacent field. The owners of the property where the pit was located noticed seepage from the pit for as long as two months prior to the leak. The Department stated that wastewater “contains dangerous chemicals and metals.” Tests of the wastewater found that it contained strontium as well as other substances.<sup>100</sup> E&P waste is sometimes disposed of on land used for cattle grazing.<sup>101</sup> Residents of the Barnett Shale have reported seeing cattle drinking from sludge pits.<sup>102</sup> Cattle have been lost due to exposure to E&P waste in New Mexico<sup>103</sup> and 54 out of 56 hair samples from sick cattle analyzed by the Texas Veterinary Medical Diagnostic Laboratory contained petroleum.<sup>104</sup>

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<sup>95</sup> Joint Factual Statement, *U.S. v. Exxon Mobil Corp.*, ¶¶ 10–27 (D.Col. 2009).

<sup>96</sup> BRYAN M. CLARK, *DIRTY DRILLING: THE THREAT OF OIL AND GAS DRILLING IN LAKE ERIE* 25 (2002).

<sup>97</sup> Letter from Lisa Kirkpatrick, Chief, New Mexico Dep’t of Game & Fish, Conservation Services Division, to Florene Davidson, Commission Secretary, EMNRD Oil Conservation Division (Jan. 20, 2006); *see also* Letter from Lisa Kirkpatrick, Chief, New Mexico Dep’t of Game & Fish, Conservation Services Division, to Florene Davidson, Commission Secretary, EMNRD Oil Conservation Division (Mar. 7, 2006).

<sup>98</sup> BRYAN M. CLARK, *supra* note 96, at 25.

<sup>99</sup> Letter from Lisa Kirkpatrick, Chief, New Mexico Dep’t of Game & Fish, Conservation Services Division, to EMNRD Oil Conservation Division (Feb. 2, 2007).

<sup>100</sup> Press Release, Pa. Dep’t of Env’tl. Prot., *Cattle from Tioga County Farm Quarantined after Coming in Contact with Natural Gas Drilling Wastewater* (July 1, 2010).

<sup>101</sup> *See e.g.*, Amended Complaint, *Sweet Lake Land and Oil Co. v. Exxon Mobil Corp.*, No. 209CV01100, at ¶ 32 (W.D. La. filed Sept. 14, 2009), 2009 WL 4701364.

<sup>102</sup> *Bluedaze: Drilling Reform for Texas* blog (July 25, 2008).

<sup>103</sup> *DRILLING DOWN*, *supra* note 20, at 26.

<sup>104</sup> Test results from Veterinary Medical Diagnostic Laboratory on July 26, 2005, August 18, 2005, and September 6, 2005; *DRILLING DOWN*, *supra* note 20, at 26.

In response to occurrences like these, cattle ranchers and others whose animals are at risk have sought to prevent E&P waste disposal facilities from opening near their properties.<sup>105</sup> Protecting cattle and other domesticated animals from exposure to E&P wastes is particularly important as the hazardous contaminants of E&P wastes have the potential to bioaccumulate in these animals and potentially make their way into the human food chain.<sup>106</sup>

## **2. Current State Regulations and Enforcement Are Inadequate and Allow E&P Waste to Be Released into the Environment.**

Waste produced in E&P operations is disposed of in a variety of ways, with underground injection and burial of waste historically being the most widely used methods.<sup>107</sup> Wastewater treatment facilities are another growing disposal method. Even before EPA made its 1988 Regulatory Determination, data indicated that commonly used disposal practices failed to prevent E&P wastes from contaminating soil and groundwater.<sup>108</sup> A 1987 report documented “the migration of leachate 400 feet from reserve pits buried in . . . North Dakota and reported groundwater contamination 50 feet below the buried reserve pits.”<sup>109</sup> Incidences of soil and groundwater contamination have continued to occur since then.

E&P wastes may leak, spill, or evaporate into the air, allowing the chemicals used in oil and gas operations to be released into the environment. These releases occur in large part because many states’ regulations do not adequately account for all of these potential modes of contamination, despite the fact that releases are occurring with alarming regularity, or are not vigorously enforced. The regulations of the Railroad Commission (RRC) of Texas have been described as providing only weak assurance that the “quality of waters (and land) will not be impacted by a gas operator’s activity.”<sup>110</sup> Assurances are similarly minimal in other states where regulations provide virtually useless oversight of E&P waste disposal because they fail to “clearly indicate acceptable disposal practices for all drilling wastes.”<sup>111</sup>

An Ohio resident with 23 years of experience in drilling oil and gas wells testified before the state legislature that existing regulations are inadequate and cannot be appropriately enforced: “. . . the [Ohio Department of Natural Resources] has a serious lack of ability to enforce their own regulations due to the way the current law and this bill are written.”<sup>112</sup> A review of Tennessee oil

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<sup>105</sup> Susan Hylton, *Drilling Waste Feud, Neighbors of Maverick Energy Services Think Water is Being Polluted*, TULSA WORLD, Mar. 21, 2010, at A11

<sup>106</sup> DRILLING DOWN, *supra* note 20, at 26.

<sup>107</sup> See E&P FORUM, EXPLORATION AND PRODUCTION (E&P) WASTE MANAGEMENT GUIDELINES 5 (Report No. 2.58/196, 1993).

<sup>108</sup> U.S. FISH & WILDLIFE SERV., *supra* note 93, at 4.

<sup>109</sup> *Id.*

<sup>110</sup> League of Women Voters of Tarrant County, *Gas Drilling Waste-Water Disposal* (2008).

<sup>111</sup> BRYAN M. CLARK, *supra* note 96, at 35.

<sup>112</sup> Testimony of James E. McCartney to the 128<sup>th</sup> General Assembly, Ohio Senate Environmental and Natural Resources Committee. Opponent Testimony on Senate Bill 165, Oct. 28, 2009.

and gas regulations found that the state does not have technical criteria for E&P waste management practices or any certification for E&P haulers.<sup>113</sup> Although all pits must be lined in Tennessee, pits are not considered or tracked through the permitting process and there are no security or wildlife protection measures.<sup>114</sup>

A 2009 letter from the EPA to the RRC of Texas states that the Commission should have “more rigorous evaluation” of conditions for waste disposal wells.<sup>115</sup> Texas also “allows companies to hire their own environmental consultants to check for contamination.”<sup>116</sup> These regulatory failures existed when EPA issued its 1988 Regulatory Determination, and have been exacerbated in the wake of EPA’s decision not to regulate E&P wastes under Subtitle C of RCRA.

a. Pits

Pit construction requirements vary greatly across the country. While a few states, such as New Mexico and Colorado, have recently adopted stricter rules governing the disposal of E&P wastes in pits, other states have minimal regulations and often do not even require the use of pit liners.<sup>117</sup>

The open design of pits, combined with the often minimal regulatory requirements governing their construction and use, present greater opportunities for their dangerous contents to be released into the environment. Reports indicate that the release of E&P wastes from pits is far too common.

In September 2008, New Mexico compiled its data on cases where pit substances contaminated New Mexico’s groundwater.<sup>118</sup> The numbers were staggering: More than 700 incidents of groundwater contamination by oilfield wastes or products were documented.<sup>119</sup> Elsewhere, in 2001, E&P wastes from the Black Mountain disposal facility in Colorado contaminated nearby soil and groundwater when its clay lined pits began to leak.<sup>120</sup> Since then, many more releases of E&P wastes have occurred in Colorado. The Colorado Oil and Gas Conservation Commission (COGCC) documented several pits at the same pad site in Garfield

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<sup>113</sup> TENNESSEE DEP’T OF ENV’T & CONSERVATION, STATE REVIEW OF OIL AND NATURAL GAS ENVIRONMENTAL REGULATIONS, INC., TENNESSEE STATE REVIEW 13, 19, 22, 24 (2007).

<sup>114</sup> *Id.* at 30.

<sup>115</sup> FY2008 EPA Region 6 End-of-year Evaluation of the Railroad Commission of Texas Underground Injection Control Program, with transmittal letter from Bill Luthans, Acting Director, Water Quality Protection Division, Region 6 to Tommie Seitz, Director, Oil and Gas Division (June 19, 2009).

<sup>116</sup> Joe Carroll, *Exxon’s Oozing Texas Oil Pits Haunt Residents as XTO Deal Nears*, Bloomberg Businessweek, April 16, 2010.

<sup>117</sup> See *infra* notes 146–160 and accompanying text; see also OKLA. ADMIN. CODE § 165:10-7-16(b)(1)(B)(iii), (2)(b).

<sup>118</sup> NEW MEXICO ENERGY, MINERALS AND NATURAL RES. DEP’T, OIL CONSERVATION DIV., CASES WHERE PIT SUBSTANCES CONTAMINATED NEW MEXICO’S GROUND WATER (2008).

<sup>119</sup> Oil & Gas Accountability Project, Groundwater Contamination.

<sup>120</sup> Kim Weber, Regarding Support of HB 1414—Evaporative Waste Facilities Regulations.

County whose liners had torn and allowed wastes to be released on multiple occasions between April and August 2008.<sup>121</sup> The reports indicated that the pits were located on rocky terrain and that some of the liners had been torn by rocks on the site.<sup>122</sup> In total, more than 6,000 barrels of pit contents escaped the pits because of the tears.<sup>123</sup> In La Plata County, a landowner reported the possible contamination of his well by an unlined reserve pit located a mere 350 feet uphill from his well.<sup>124</sup> The COGCC eventually concluded that “it appear[ed] that fluids from the unlined reserve pit infiltrated into the shallow groundwater, flowed downhill and impacted the Thomson water well.”<sup>125</sup> The COGCC has documented numerous other incidents where pits have leaked,<sup>126</sup> overflowed,<sup>127</sup> or been unlined,<sup>128</sup> thereby allowing their contents to be absorbed by unprotected ground.

In May, 2008, a Colorado citizen drank water from his spring and fell ill. The COGCC found benzene in the groundwater that exceeded standards by 32 times and benzene in faucet water that exceeded standards by 13 times, as well as elevated levels of toluene and xylenes. Although the COGCC began investigating this complaint in June, 2008, it wasn’t until October, 2008, that the operator stated that it became aware that the production pit was never permitted. The state appears to have been unaware that the pit was never permitted even though it was investigating the pit as a possible source of groundwater contamination. In July, 2010, the COGCC found that the operator failed to properly permit, construct, maintain, and repair the pit, leading to a release or releases of E&P waste that impacted groundwater. The agency found that the liner had been stretched over rocks and had improperly sealed seams.<sup>129</sup>

In addition to the reports from New Mexico and Colorado, there have been many complaints by citizens of contamination reportedly caused by E&P wastes in other states. NYSDEC has received numerous reports of E&P waste releases, many of which have contaminated soil and

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<sup>121</sup> COLORADO OIL AND GAS CONSERVATION COMMISSION, INSPECTION/INCIDENT INQUIRY, SPILL REPORTS, DOC. NOS. 1630424, 1630426, 1630427, 1630428, 1630429, 1630430.

<sup>122</sup> COLORADO OIL AND GAS CONSERVATION COMMISSION, INSPECTION/INCIDENT INQUIRY, SPILL REPORTS, DOC. NO. 1630428.

<sup>123</sup> COLORADO OIL AND GAS CONSERVATION COMMISSION, INSPECTION/INCIDENT INQUIRY, SPILL REPORTS, DOC. NOS. 1630424 (714 bbls), 1630426 (2000 bbls), 1630427 (500 bbls), 1630428 (1250 bbls), 1630429 (204 bbls), 1630430 (2017 bbls).

<sup>124</sup> Oil & Gas Accountability Project, Contamination Incidents Related to Oil and Gas Development, Maralex Drilling Fluids in Drinking Water; COLORADO OIL AND GAS CONSERVATION COMMISSION, INSPECTION/INCIDENT INQUIRY, SPILL REPORT, DOC. NO. 1953000.

<sup>125</sup> COLORADO OIL AND GAS CONSERVATION COMMISSION, INSPECTION/INCIDENT INQUIRY, NOAV REPORT, DOC. NO. 200085988; *see also* Oil & Gas Accountability Project, Contamination Incidents Related to Oil and Gas Development, Maralex Drilling Fluids in Drinking Water.

<sup>126</sup> COLORADO OIL AND GAS CONSERVATION COMMISSION, INSPECTION/INCIDENT INQUIRY, SPILL REPORTS, DOC. NOS. 1631518, 1631599, 2605176, 2605847.

<sup>127</sup> COLORADO OIL AND GAS CONSERVATION COMMISSION, INSPECTION/INCIDENT INQUIRY, SPILL REPORTS, DOC. NOS. 200225543, 200225547, 200225546.

<sup>128</sup> COLORADO OIL AND GAS CONSERVATION COMMISSION, INSPECTION/INCIDENT INQUIRY, SPILL REPORTS, DOC. NO.1632846.

<sup>129</sup> Colorado Oil and Gas Conservation Commission, Cause No. 1V, Order No. 1V, Docket No. 1008-OV-06

groundwater.<sup>130</sup> In June 1987, in West Seneca, N.Y., product from an open pit containing oil and other solvents was found running from the pit towards a nearby creek.<sup>131</sup> In November 1996, in Reading, N.Y., a produced water pit overflowed and spilled approximately two hundred gallons of produced water into a creek feeding into Seneca Lake.<sup>132</sup> NYSDEC determined that no cleanup was possible.<sup>133</sup> When a property owner in Bolivar, N.Y., called in June 2002 to report leaking oil wells, NYSDEC inspectors also found unlined leaking containment ponds.<sup>134</sup>

E&P wastes in pits have been released into the environment in other states as well. Pennsylvania's Department of Environmental Protection (PADEP) has documented several incidents of dangerous E&P waste releases into the environment. Notably, at two of Atlas Resources LLC's well sites in Pennsylvania, "compromised" pit liners allowed fracturing flowback fluids to escape.<sup>135</sup> In Ohio, a fracturing flowback pit was cut with a track hoe in 2010, causing more than 1.5 million gallons of fluid were spilled into the environment.<sup>136</sup> In 2008, the back wall of a pit in Ohio gave way, causing pit contents to spill and flow towards a creek.<sup>137</sup>

In addition to releases caused by torn liners and overflows, pits allow the hazardous contaminants in E&P wastes to be released into the environment through evaporation into the air. E&P wastes such as produced water stored in open pits can "release methane, toxic volatile organic chemicals and sulfur based compounds into the air."<sup>138</sup> Rocky Mountain Clean Air Action collected data showing that wastewater evaporation pits in Garfield County, Colorado are "major sources of air pollution and pose greater threats to human health than previously reported."<sup>139</sup> The data indicated that high levels of hydrocarbons and other hazardous air pollutants were being released into the air.<sup>140</sup> Also in Garfield County, beginning in October 2005, a resident repeatedly notified the COGCC that severe odors were emanating from an E&P waste pit located close to her home.<sup>141</sup> In early December 2005, the resident reported smelling "a different sort of stench . . . the 'Benzene smell'" to the COGCC and requested that the agency

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<sup>130</sup> TOXICS TARGETING, INC., HAZARDOUS MATERIALS SPILLS INFORMATION REQUEST (2009).

<sup>131</sup> TOXICS TARGETING, INC., HAZARDOUS MATERIALS SPILLS INFORMATION REQUEST 37 (2009) (Spill Number: 8702469).

<sup>132</sup> TOXICS TARGETING, INC., HAZARDOUS MATERIALS SPILLS INFORMATION REQUEST 53 (2009) (Spill Number: 9610217).

<sup>133</sup> *Id.*

<sup>134</sup> TOXICS TARGETING, INC., HAZARDOUS MATERIALS SPILLS INFORMATION REQUEST 124-25 (2009) (Spill Number: 0275147).

<sup>135</sup> Consent Assessment of Civil Penalty, In re Atlas Resources LLC, Dancho-Brown 4, ¶¶ AV-AZ, Groves 8, ¶¶ BA-BE.

<sup>136</sup> Ohio Department of Natural Resources, Notice of Violation No. 1278508985, June 21, 2010.

<sup>137</sup> Ohio Department of Natural Resources, Notice of Violation No. 2016754140, May 16, 2008.

<sup>138</sup> Subra, *supra* note 43.

<sup>139</sup> Phillip Yates, *Clean Air Group Contends Evaporation Ponds in Garfield County More Dangerous than Previously Believed*, POST INDEPENDENT, Jan. 9, 2008.

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

<sup>141</sup> Oil & Gas Accountability Project, Contamination Incidents Related to Oil and Gas Development.

install full-time air monitoring equipment.<sup>142</sup> At the end of the month, the resident learned that sampling of the air fairly close to the pit “showed that benzene and xylenes exceeded the [EPA’s] ‘non-cancer risk levels’ for these compounds – at 67 µg/m<sup>3</sup>, benzene was present at more than double the risk level. Other detectable compounds included acetone, toluene and ethylbenzene.”<sup>143</sup>

While some incidents are effectively reported and prosecuted by state authorities, many more incidents occur that are not addressed adequately by state officials. In these cases, the citizens affected by such releases into the environment have instead turned to the judicial system in order to hold the oil and gas companies accountable. John Preston Stephenson, Jr. sued Chevron U.S.A. alleging that waste from Chevron oil pits contaminated his property with “hazardous toxic and carcinogenic chemicals.”<sup>144</sup> Similarly, the Sweet Lake Land and Oil Company sued multiple defendants, including Exxon, Noble Energy, Inc., and Texas Eastern Skyline Oil Company, for contamination of “the soil and groundwater with produced water, oil, drilling muds, technologically enhanced naturally occurring radioactive materials (sometimes referred to as ‘TENORM’), hydrocarbons, metals, and other toxic and/or hazardous substances, wastes and pollutants,” claiming that the defendants knew the pits contents would contaminate the plaintiff’s surface and subsurface soil and water.<sup>145</sup> Sweet Lake Land and Oil Company further alleged that “[t]he presence of the pits, substances and scrap on and under the Property constitutes a nuisance.”<sup>146</sup> These claims are only a handful of many more by citizens who have been harmed by E&P wastes released from pits.<sup>147</sup>

These reports of contamination are at least partially attributable to inadequate state efforts to regulate E&P waste disposal in pits. Despite the fact that pit contents have been found to contain hazardous contaminants,<sup>148</sup> many states fail to require operators to use the most basic of precautions. Tennessee, for example, does not even take pits into account in its permitting process, thereby “making their management and disposal difficult to track” and increasing the

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<sup>142</sup> COLORADO OIL AND GAS CONSERVATION COMMISSION, INSPECTION/INCIDENT INQUIRY, COMPLAINT REPORT, DOC. NO. 200081602.

<sup>143</sup> Oil & Gas Accountability Project, *supra* note 141.

<sup>144</sup> Amended Complaint at ¶ 9, *Stephenson v. Chevron U.S.A., Inc.*, No. 209CV01454, (W.D. La. filed Sept. 11, 2009), 2009 WL 4701406.

<sup>145</sup> *Sweet Lake Land and Oil Co. v. Exxon Mobil Corp.*, *supra* note 101, at ¶ 10.

<sup>146</sup> *Id.* at ¶ 27.

<sup>147</sup> *See also* Petition for Damages, *Brownell Land Corp., LLC v. Honey Well Int’l.*, No. 08CV04988, ¶¶ 11-12 (E.D. La. filed Nov. 21, 2008), 2008 WL 5366168; *Rice Agricult. Corp., Inc. v. HEC Petroleum Inc.*, 2006 WL 2032688 (E.D. La.); Petition for Damages, *Tensas Poppadoc, Inc. v. Chevron U.S.A., Inc.*, No. 040769, ¶ 8 (7th Judicial Court La. filed Sept. 21, 2005), 2005 WL 6289654; Petition for Damages to School Lands, *Louisiana v. Shell Oil Co.*, No. CV04-2224 L-O, (W.D. La. filed Oct. 29, 2004), 2004 WL 2891505 (where the State of Louisiana and the Vermilion Parish School Board made similar allegations against Shell Oil, claiming they had contaminated school property. In July 2006, the case was remanded to state court).

<sup>148</sup> *See* notes 62–67 *supra*.

likelihood that the locations of the wastes will be forgotten in the future.<sup>149</sup> In addition, Tennessee has no freeboard or liner integrity requirements,<sup>150</sup> does not require testing or tracking of pit wastes,<sup>151</sup> and fails to require oil to be removed from pits.<sup>152</sup> Kentucky similarly turns a blind eye to the risks E&P wastes present to the public through its failure to require testing of E&P waste characteristics and its treatment of all E&P wastes except production brines and drilling muds as solid wastes, subject to less stringent disposal requirements “irrespective of the risk posed to human health or the environment from the waste.”<sup>153</sup>

States also fail to take other simple steps that would dramatically decrease the likelihood of E&P wastes being released into the environment, for example, requiring pits to be lined with impermeable barriers. In Oklahoma, neither emergency pits nor pits holding water-based drilling fluids are required to have any lining.<sup>154</sup> This failure to require the use of a liner in pits holding water-based drilling fluids increases the risk that the “barite, clays, lignosulfonate, lignite, caustic soda and other specialty additives” found in water-based muds will contaminate the environment.<sup>155</sup> Kentucky’s liner requirements are also inadequate. Kentucky does not require the use of liners in drilling pits that are used for less than thirty day storage and has “minimal liner requirements for holding pits” for storage over thirty days.<sup>156</sup>

Wildlife protection devices are another important and too often underused safety measure. Tennessee,<sup>157</sup> Louisiana,<sup>158</sup> and Kentucky all fail to require any “fencing, flagging or netting of pits,” thereby increasing the risks the pits present to wildlife and domestic animals.<sup>159</sup> And according to a recent report prepared by Region 6 of the U.S. Fish & Wildlife Service, these three states are not alone.<sup>160</sup> As reported by Region 6, only thirteen states require pits or open tanks to be screened or netted to prevent wildlife from coming into contact with E&P wastes.<sup>161</sup> The failure to require pit operators to use even the most basic protection devices such as fencing or netting greatly increases the likelihood that wildlife will come into contact with E&P waste and suffer significant harm.

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<sup>149</sup> TENNESSEE DEP’T OF ENV’T & CONSERVATION, *supra* note 113, at 30.

<sup>150</sup> *Id.*

<sup>151</sup> *Id.* at 32.

<sup>152</sup> *Id.* at 31.

<sup>153</sup> STATE REVIEW OF OIL AND NATURAL GAS ENVIRONMENTAL REGULATIONS, INC., KENTUCKY STATE REVIEW 50–51 (2006).

<sup>154</sup> OKLA. ADMIN. CODE § 165:10-7-16(b)(1)(B)(iii), (2)(b).

<sup>155</sup> CORCORAN ET AL., *supra* note 25, at 20; *see also* U.S. FISH & WILDLIFE SERV., *supra* note 93, at 4–5 (“Water-based drilling muds can contain glycols, chromium, zinc, polypropylene glycol, and acrylamide copolymers.”).

<sup>156</sup> KENTUCKY STATE REVIEW, *supra* note 153, at 54.

<sup>157</sup> TENNESSEE DEP’T OF ENV’T & CONSERVATION, *supra* note 113, at 30.

<sup>158</sup> STATE REVIEW OF OIL AND NATURAL GAS ENVIRONMENTAL REGULATIONS, INC., LOUISIANA STATE REVIEW 29 (2004).

<sup>159</sup> *Id.*

<sup>160</sup> U.S. FISH & WILDLIFE SERVICE, *supra* note 93, at 13 fig. 15.

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

States also fail to regulate where pits may be located, allowing them to be placed near residences, schools, and other areas frequently used by the public. In some cases, homes are located so close to pits that residents have been forced indoors because of the foul odors and health symptoms emanating from the pits. One Pennsylvania family reported severe headaches caused by fumes from a pit less than 200 feet from their home.<sup>162</sup> As of 2005, when STRONGER, Inc. conducted a review of Indiana's E&P waste disposal practices and regulations, Indiana regulations had no requirements regarding "specifications for the location, orientation and construction of drilling pits. There [were] no required setbacks of minimum distances from buildings, homes or other structures for drilling pits." Since then, although Indiana has adopted a new rule requiring pits to be located at least one hundred feet from streams, rivers, lakes and drainage ways, it still does not specifically require pits to be setback from other structures.<sup>163</sup> By allowing pits to be sited close to where people live and children attend school, state regulators are bringing health risks literally closer to the citizens across the country.

#### b. Land application

EPA has stated that hazards also exist with land application of E&P wastes, finding that hydrocarbons, salts, and metals can all cause contamination when E&P wastes are land applied.<sup>164</sup> The Oil Industry International Exploration and Production Forum (E&P Forum), an international industry association, has also issued warnings, stating that land application may result in contaminants accumulating "in the soil [at] a level that renders the land unfit for further use."<sup>165</sup> New York State allows waste to be disposed of in municipal landfills.<sup>166</sup> Land where only oil and gas waste is applied is often called a "landfarm." Studies of landfarm conditions confirm that these hazards are real. When the Arkansas Department of Environmental Quality conducted a study of landfarms in Arkansas, it found that "all 11 sites that land applied fluids at some point had improperly discharged the fluids so as to cause runoff into the waters of the state."<sup>167</sup>

Land application sites outside of Arkansas are sources of similar concerns. Near Holdenville, Oklahoma, residents protested the opening of a landfarm because they were worried about

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<sup>162</sup> Christie Campbell, *Foul Odor from Impoundment Upsets Hopewell Woman*, OBSERVER-REPORTER, Apr. 14, 2010. June Chappel, who lives near a pit, stated that the odor "reminded her of a hair perm. It smelled like ammonia . . . [and] 'took your breath away.'" *Id.* Other times the fumes have smelled like gasoline, diesel fuel, and sewage. *Id.*

<sup>163</sup> 312 IND. ADMIN. CODE 16-5-13 (2010).

<sup>164</sup> EPA OFFICE OF COMPLIANCE SECTOR NOTEBOOK PROJECT, PROFILE OF THE OIL AND GAS EXTRACTION INDUSTRY, EPA/310-R-99-006, at 49 (2000).

<sup>165</sup> E&P FORUM, *supra* note 107, at 17.

<sup>166</sup> Letter from Gary M. Maslanka, New York State Division of Solid & Hazardous Materials, to Joseph Boyles, Casella (April 27, 2010).

<sup>167</sup> Press Release, Arkansas Dep't of Env'tl. Quality, ADEQ Releases Landfarm Study Report (Apr. 20, 2009).

potential “water contamination and land spoilage.”<sup>168</sup> After the residents lost two appeals in which they tried to prevent its opening, the landfarm finally began operations and made the residents’ fears a reality. Claudia Olivo, who owns a cattle ranch adjacent to the landfarm, filed a complaint with EPA after she noticed “strange glistening spots in the water” on her property.<sup>169</sup> In response, EPA issued a cease-and-desist order against the landfarm after finding that it had made unauthorized discharges of drilling mud into a creek that ran through Olivo’s property, in violation of the Clean Water Act.<sup>170</sup> The Crouch Mesa landfarm in Aztec, New Mexico, is located directly across the street from a residential area and is the source of considerable visible dust observed blowing toward homes.<sup>171</sup>

Despite these risks, many states inadequately regulate land application. In Oklahoma, one-time land applications may occur as close as one hundred feet from any perennial stream, freshwater pond, lake or wetland.<sup>172</sup> Tennessee regulations fail to provide any explicit guidance regarding the use of land applications.<sup>173</sup> Meanwhile, Kentucky has no siting criteria for land application specific to E&P wastes.<sup>174</sup>

These lax regulations result in E&P wastes being land applied near, and in some cases, on residential property, increasing the likelihood that humans will be exposed to E&P waste’s toxic compounds.<sup>175</sup> In Martha, Kentucky, produced water and tank bottoms were land applied on farmland near where a family of two adults and two children lived.<sup>176</sup> The family grew the majority of the vegetables and meat they consumed on the farm,<sup>177</sup> and the portion of the family’s land used for storing E&P waste disposal was located a mere 100 feet from a small creek which “drains into a marsh, which then drains into a larger creek” from which the farm’s cattle drank.<sup>178</sup> The family no longer drinks from its well, which has been contaminated with benzene.<sup>179</sup> Lead and arsenic were found in soil samples.<sup>180</sup> In addition, areas of the farm where E&P wastes had been disposed were found to be NORM-contaminated sites which “will remain radioactive for many thousands of years,” “creating many opportunities for radium to enter the soil and be taken up by plants or cattle grazing on the land,” and threatening “[f]uture inhabitants or workers on the NORM-contaminated land [who] may also be directly exposed to ionizing

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<sup>168</sup> Susan Hylton, *supra* note 105, at A11.

<sup>169</sup> *Id.*

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

<sup>171</sup> DRILLING DOWN, *supra* note 20, at 22.

<sup>172</sup> OKLA. ADMIN. CODE § 165:10-7-26(c)(6) (2009).

<sup>173</sup> TENNESSEE DEP’T OF ENV’T & CONSERVATION, *supra* note 113, at 32.

<sup>174</sup> KENTUCKY STATE REVIEW, *supra* note 153, at 50.

<sup>175</sup> See WOLF EAGLE ENVIRONMENTAL, *supra* note 70.

<sup>176</sup> Spitz et al., *supra* note 92, at 45.

<sup>177</sup> *Id.* at 46.

<sup>178</sup> *Id.* at 45.

<sup>179</sup> *Id.*

<sup>180</sup> *Id.* at 55.

radiation or inhale radium-bearing particles.”<sup>181</sup> As demonstrated by the contamination that occurred in Martha, Kentucky, inadequate state regulations too frequently fail to protect the public and the environment from the hazards associated with land application of E&P wastes.

A Texas resident lives fifty feet away from a 100-acre land farm, where the Texas Railroad Commission issued 22 minor permits for 22 different operations that are all located on one property. A second land farm is located just down the road.<sup>182</sup>

### c. Injection Wells

Underground injection, the most widely used disposal method,<sup>183</sup> also poses concerns. If the formation into which E&P wastes are injected does not meet certain levels of permeability, porosity, and low reservoir pressure, the formations can form a poor seal around the E&P wastes and threaten nearby aquifers.<sup>184</sup> Under the Underground Injection Control (UIC) Program, E&P wastes may be injected in Class II wells, while wastes designated as hazardous under RCRA can only be disposed of in the more strictly regulated Class I wells.<sup>185</sup>

The lower standards applicable to Class II wells have proven inadequate to prevent E&P wastes from contaminating groundwater. In 1988, GAO released a report, *Safeguards Are Not Preventing Contamination from Injected Oil and Gas Wells*, which examined the effectiveness of EPA’s UIC program.<sup>186</sup> Although GAO speculated that it was likely that more incidents had occurred, it reported that the EPA was aware of at least 23 cases across the country where Class II injection wells had contaminated drinking water supplies.<sup>187</sup> Since then more incidences of concern have occurred.

In September 2007, a state inspector in Texas inspected an underground injection disposal well site outside of Fort Worth and found no problems. Yet a resident complained of “spilled oil, overflowing dikes and green-colored fluid in standing puddles.” Inspectors returned and found that “oil-stained soil” had seeped several inches into the ground, that the “containment dike will not hold estimated capacity,” and that standing water had oil in it. State records showed that the well site was not being used, when in fact it was actively being injected with oil and gas waste.<sup>188</sup>

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<sup>181</sup> *Id.* at 57.

<sup>182</sup> See Griffey, *supra* note 71

<sup>183</sup> M.G. PUDER & J.A. VEIL, ARGONNE NATIONAL LABORATORY, OFFSITE COMMERCIAL DISPOSAL OF OIL AND GAS EXPLORATION AND PRODUCTION WASTE: AVAILABILITY, OPTIONS, AND COSTS, S-2 (2006) (“By far, the most common commercial disposal method for produced water is injection.”).

<sup>184</sup> See E&P FORUM, *supra* note 107, at 15.

<sup>185</sup> DRILLING DOWN, *supra* note 20, at 17; see also 42 U.S.C § 300h-4; 42 U.S.C § 300h(b); 42 U.S.C. § 300(h)-1(c).

<sup>186</sup> U.S. GENERAL ACCOUNTING OFFICE, *supra* note 32, at 2.

<sup>187</sup> *Id.* at 3.

<sup>188</sup> Abrahm Lustgarten, *State Oil and Gas Regulators Are Spread Too Thin to Do Their Jobs*, ProPublica, December 30, 2009.

Residents in DeBerry, Panola County, Texas, first began complaining that their groundwater was contaminated in 1996.<sup>189</sup> An underground injection disposal facility began operations one-eighth of a mile away from the community in 1987, injecting produced water into the ground at depths between 1,080 and 1,110 feet.<sup>190</sup> In 1996, while the well was still in operation, DeBerry residents told an EPA Region 6 employee that their water was discolored, was staining their kitchen and bath fixtures, and that they were experiencing gastrointestinal problems.<sup>191</sup> The residents of DeBerry ultimately stopped using their drinking water and instead began to obtain water from other sources.<sup>192</sup> No government agency tested DeBerry's drinking water for several years after residents first complained. Not until 2002 did the site operator of the injection wells in DeBerry, Basic Energy, sample the drinking water.<sup>193</sup> When it did, the residents' suspicions were confirmed. The results showed the presence of contaminants above the EPA's maximum contaminant levels.<sup>194</sup> In 2003, the Texas RRC found benzene, barium, arsenic, cadmium, lead and mercury in wells at levels exceeding the state's drinking water standards.<sup>195</sup> Because the Texas RRC never completed a full assessment of the contamination, the source of the contamination is not definitively known; however, residents strongly believe the injection wells were the cause of the contamination, and EPA has been unable to rule this possibility out conclusively.<sup>196</sup>

Also in Texas, an underground injection disposal facility in Daisetta is linked to contamination of a fresh water aquifer. The EPA found a lack of compliance reviews, inappropriate monitoring, and incomplete record-keeping, as well as a lack of evidence that all problems were ever remedied. This problematic facility led to a surface collapse and a large sinkhole.<sup>197</sup>

The likelihood that similar incidents will continue to occur exists as long as underground injection associated with oil and gas exploration, production, and development only has to meet the requirements for Class II wells and states fail to require better monitoring.

In addition, a vast amount of E&P waste is being injected underground without any UIC regulation whatsoever. Used hydraulic fracturing fluid—perhaps millions of gallons per each

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<sup>189</sup> EPA OFFICE OF THE INSPECTOR GENERAL, COMPLETE ASSESSMENT NEEDED TO ENSURE RURAL TEXAS COMMUNITY HAS SAFE DRINKING WATER, NO. 2007-P-00034 2 (2007).

<sup>190</sup> *Id.* at 3.

<sup>191</sup> *Id.* at 2.

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

<sup>193</sup> *Id.*

<sup>194</sup> *Id.*

<sup>195</sup> *Hearing Before the Subcomm. on Superfund and Environmental Health of the S. Comm. on Environment and Public Works* 12–13 (2007) (statement of Robert D. Bullard, Dir. Environmental Justice Resource Center).

<sup>196</sup> EPA, OFFICE OF THE INSPECTOR GENERAL, *supra* note 189, at 3.

<sup>197</sup> EPA, *supra* note 115.

well—remain underground permanently. It has been estimated that up to 90% of hydraulic fracturing fluids used in the Marcellus shale formation remain underground.<sup>198</sup> Yet this waste disposal and storage activity is not subject to any federal underground injection regulations.

#### d. Wastewater Treatment Facilities

In regions where underground injection is not readily available, hydraulic fracturing wastewater and produced water may be sent to wastewater treatment plants prior to release to surface water. The plants may be publicly owned treatment works (POTWs) that typically process municipal sewage or centralized wastewater treatment (CWT) facilities that process industrial wastes. None of the POTWs and few of the CWT plants currently in operation have the capacity to reduce to safe levels all of the chemical contaminants commonly found in E&P waste. As a result, toxins are released to surface water, with adverse impacts on drinking water quality. The very high concentrations of total dissolved solids (TDS)—principally salts—that are common in hydraulic fracturing wastewater and produced water present a particular problem for wastewater treatment facilities.

Without adequate pretreatment, pollutants in oil and gas waste will pass through a POTW into the receiving stream, and they may interfere with ordinary sewage treatment systems.<sup>199</sup> Even with pretreatment, POTWs are not effective in removing salts from those wastes.<sup>200</sup> The use of POTWs for treatment of E&P waste in western Pennsylvania produced TDS levels in the Monongahela River in excess of drinking water standards, forcing the Commonwealth to limit the waste to one percent of influent at nine plants along the river.<sup>201</sup> Unauthorized discharges of pollutants, including fecal matter, from a POTW into the Susquehanna River were attributed to the plant's acceptance of oil and gas wastes.<sup>202</sup> Even CWT plants rarely have the evaporation and crystallization technologies needed to reduce extremely high levels of TDS in hydraulic fracturing wastewater and produced water (up to 300,000 mg/l) to levels consistent with water quality standards (500 mg/l). There is not a single CWT facility with that capacity in all of New York or Pennsylvania.<sup>203</sup>

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<sup>198</sup> PROCHEMTECH INTERNATIONAL, INC., MARCELLUS GAS WELL HYDROFRACTURE WASTEWATER DISPOSAL BY RECYCLE TREATMENT PROCESS.

<sup>199</sup> N.Y. State Water Res. Inst., *Waste Management of Cuttings, Drilling Fluids, Hydrofrack Water and Produced Water*; Oh. Env'tl. Prot. Agency, *Marcellus Shale Gas Well Production Wastewater*.

<sup>200</sup> *Id.*

<sup>201</sup> Joaquin Sapien, *With Natural Gas Drilling Boom, Pennsylvania Faces an Onslaught of Wastewater*, ProPublica, Oct. 4, 2009; *Municipal Authorities' Perspective: Marcellus Shale Natural Gas Wastewater Treatment, Hearing Before the S. Comm. on Env'tl. Res. & Energy* (Pa. 2010) (statement of Peter Slack, Pennsylvania Municipal Authorities Ass'n).

<sup>202</sup> Press Release, Pa. Dep't Env'tl. Prot., DEP Says Jersey Shore Borough Exceeds Wastewater Permit Limits (June 23, 2009).

<sup>203</sup> N.Y. State Water Res. Inst., *supra* note 199; Joaquin Sapien, *supra* note 201.

e. Other spills, leaks, and intentional dumping

In addition to those releases that commonly occur when these common E&P waste disposal methods are being used properly, many other spills and releases occur before E&P wastes reach these storage or disposal sites. These other releases can be the result of equipment failure, accidents, negligence, or intentional dumping. Consistent federal regulations for waste management, storage and disposal would help prevent them in the future.

For example, in Pennsylvania, Atlas Resources LLC “discharged residual and industrial waste, including diesel and production fluids, onto the ground at seven of the 13 well sites.”<sup>204</sup> At three of the wells Atlas allowed produced water to be released into the environment.<sup>205</sup> Pennsylvania records also show that pipes used to transport waste, sometimes for miles, have leaked. In October, 2009, a pipe carrying diluted wastewater spilled about 10,500 gallons into a high-quality stream, killing about 170 small fish and salamanders. In December, 2009, a pipe failed in five places, spilling an estimated 67,000 total gallons of fluid, tests of which found elevated levels of salts, barium and strontium.<sup>206</sup>

NYSDEC has documented numerous other examples of releases. In October 1997, a produced water tank in Willing, New York, containing produced water from natural gas extraction overflowed and contaminated the surrounding soil and a nearby creek from which cows drank with fifteen thousand gallons of produced water.<sup>207</sup> The produced water killed vegetation in its path.<sup>208</sup> More recently, in September 2005, eight hundred gallons of production brine from another tank in Pine City, New York, overflowed when it was not emptied on schedule, causing an impact on nearby streams.<sup>209</sup> In July 1996, crude oil tank bottoms were dumped into a pit and set on fire.<sup>210</sup> In March 2003, a property owner in Ithaca, New York, called to report that a driller was dumping mud on his property.<sup>211</sup> In May 2007, NYSDEC received an anonymous tip indicating that produced water from a natural gas well was being

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<sup>204</sup> Press Release, Pa. Dep’t Env’tl. Prot., DEP Fines Atlas \$85,000 for Violations at 13 Well Sites, Jan. 7, 2010.

<sup>205</sup> Consent Assessment of Civil Penalty, *In re Atlas Resources LLC*, Pevarnik 8, ¶¶ Z-AD, Willis 18, ¶¶ AE-AI, Thompson 33 ¶¶ AP-AU.

<sup>206</sup> Laura Legere, *Massive Use of Water in Gas Drilling Presents Myriad Chances for Pollution*, SCRANTON TIMES-TRIBUNE, June 22, 2010.

<sup>207</sup> TOXICS TARGETING, INC., HAZARDOUS MATERIALS SPILLS INFORMATION REQUEST 3 (2009) (Spill Number: 9707892).

<sup>208</sup> TOXICS TARGETING, INC., HAZARDOUS MATERIALS SPILLS INFORMATION REQUEST 4 (2009) (Spill Number: 9707892).

<sup>209</sup> TOXICS TARGETING, INC., HAZARDOUS MATERIALS SPILLS INFORMATION REQUEST 8 (2009) (Spill Number: 0507041).

<sup>210</sup> TOXICS TARGETING, INC., HAZARDOUS MATERIALS SPILLS INFORMATION REQUEST 23 (2009) (Spill Number: 9604701).

<sup>211</sup> TOXICS TARGETING, INC., HAZARDOUS MATERIALS SPILLS INFORMATION REQUEST 68 (2009) (Spill Number: 0212276).

dumped on the ground near Cayuga Creek in Sheldon, New York.<sup>212</sup> In May 2009, eight hundred gallons of produced water contaminated soils in Westfield, New York, after equipment failed and allowed the fluids to be released into the environment a mere 1200 yards away from nearby homes.<sup>213</sup>

The COGCC has also documented incidents where tanks have been improperly sealed<sup>214</sup> or allowed to overflow,<sup>215</sup> where corroded equipment allowed produced water to contaminate the ground,<sup>216</sup> and where equipment failure has allowed produced water to escape from underground injection wells.<sup>217</sup> Between June 2002 and June 2006, 555 produced water spills were reported to the COGCC.<sup>218</sup>

In Texas, between 2001 and 2006, thirty percent of spill complaints were inspected “either late or not at all.”<sup>219</sup> Most recently in the Texas town of Flower Mound, the Texas RRC sent out a notification stating that approximately 3,000 gallons of “flowback water containing fracturing fluid and associated additives” spilled out of gas well pad site.<sup>220</sup> To date, the RRC has not publically released either the cause of the spill or the exact contents of the flowback water.<sup>221</sup>

The mayor of West Union, West Virginia, wrote a letter to the WVDEP in October 2009 to express his concern over WVDEP’s failure to notify the town until two months after a spill occurred.<sup>222</sup> The mayor was even more concerned about WVDEP’s failure to have any emergency notification system in place, stating that the continued failure to establish such a system “will only result in less time for the water system to react [to future spills] and [result in] a greater chance of catastrophe.”<sup>223</sup> Elsewhere in West Virginia, Luanne McConnell Fatora reported a release of between fifty and seventy barrels of some type of oil and gas waste in a

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<sup>212</sup> TOXICS TARGETING, INC., HAZARDOUS MATERIALS SPILLS INFORMATION REQUEST 159 (2009) (Spill Number: 0750225).

<sup>213</sup> TOXICS TARGETING, INC., HAZARDOUS MATERIALS SPILLS INFORMATION REQUEST 143 (2009) (Spill Number: 0902327).

<sup>214</sup> COLO. OIL & GAS CONSERVATION COMM’N, INSPECTION/INCIDENT INQUIRY, SPILL REPORT, DOC. NO. 1630697.

<sup>215</sup> COLO. OIL & GAS CONSERVATION COMM’N, INSPECTION/INCIDENT INQUIRY, SPILL REPORTS, DOC. NOS. 1631155, 1631831, 1631794, 1632853.

<sup>216</sup> COLO. OIL & GAS CONSERVATION COMM’N, INSPECTION/INCIDENT INQUIRY, SPILL REPORTS, DOC. NOS. 1630885, 1631496, 1631519, 1632057, 2605191, 1632995.

<sup>217</sup> COLO. OIL & GAS CONSERVATION COMM’N, INSPECTION/INCIDENT INQUIRY, SPILL REPORTS, DOC. NOS. 200226284, 200225725, 2605709.

<sup>218</sup> OIL & GAS ACCOUNTABILITY PROJECT, COLORADO OIL AND GAS INDUSTRY SPILLS: A REVIEW OF COGCC DATA (JUNE 2002-JUNE 2006) 1-2 (2006).

<sup>219</sup> Lustgarten, *supra* note 188.

<sup>220</sup> *Frac Fluid Spill Reported in Flower Mound*, CROSS TIMBERS GAZETTE, Mar. 17, 2010.

<sup>221</sup> *Id.*

<sup>222</sup> Letter from Robert F. Fetty, Mayor, Town of West Union, to Barbara Taylor, Director, WVBPH/Office of Environmental Health Services, Oct. 28, 2009.

<sup>223</sup> *Id.*

stream in Doddridge County.<sup>224</sup> Fatora's son discovered the spill when he tried to go fishing in the stream in late August 2009 and found the water to be "acrid" and covered with a "red/orange gel" that had an oily smell which got on his hands and did not "go away for some time despite repeated washing."<sup>225</sup> Although the Chief of the West Virginia Oil and Gas Office stated that the fluids were consistent with oil and gas waste, more than a month after the spill the WVDEP remained uncertain about what caused the release.<sup>226</sup>

These releases, and the undoubtedly numerous other unreported incidents, demonstrate that current regulations and regulatory enforcement is inadequate to prevent E&P wastes from being released into the environment.

### **3. Oil & Gas Production Has Increased Dramatically Since 1988.**

When EPA released its 1988 Regulatory Determination, the domestic oil and natural gas industry was struggling. Since then, oil and natural gas production in the United States has increased dramatically. Tens of thousands of new oil wells have been drilled. According to the U.S. Energy Information Administration (US EIA), between 1989 and 2008 the number of producing gas wells nationwide almost doubled, increasing from roughly 262,000 to 479,000 wells.<sup>227</sup>

Bureau of Land Management (BLM) statistics also demonstrate the growth in oil and gas operations under its jurisdiction. In most years during the 1990s, there were less than four thousand applications for permits to drill (APDs) filed with the BLM.<sup>228</sup> BLM has stated that "[s]ince 1996, the number of new APDs has risen dramatically."<sup>229</sup> BLM received more than ten thousand APDs in 2006.<sup>230</sup> Although BLM projects that the number of APDs will decline by 2010,<sup>231</sup> BLM still expects to receive a staggering number, approximately 7,000, of APDs in 2010. Furthermore, BLM attributes this projected decrease to the fact that a larger percentage of proposed drilling is expected to occur on existing leases and not to a decrease in drilling.<sup>232</sup>

State agency statistics also demonstrate an increase in the amount of domestic drilling: one example is Texas, where the number of permits issued by the RRC for drilling in the Barnett

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<sup>224</sup> Ken Ward Jr., *What Caused Big Fracking Fluid Spill in Doddridge County?*, SUSTAINED OUTRAGE: A GAZETTE WATCHDOG BLOG (Oct. 2, 2009); *see also* Letter from Louanne McConnell Fatora to Gov. Manchin, West Highlands Conservancy (Aug. 30, 2009).

<sup>225</sup> Letter from Louanne McConnell Fatora to Gov. Manchin, (Aug. 30, 2009).

<sup>226</sup> Ward Jr., *supra* note 224.

<sup>227</sup> U.S. ENERGY INFO. ADMIN., NUMBER OF PRODUCING GAS WELLS (2009).

<sup>228</sup> BUREAU OF LAND MGT., BLM FY 2010 BUDGET JUSTIFICATIONS III-120 (2010).

<sup>229</sup> *Id.* at III-119.

<sup>230</sup> *Id.* at III-120.

<sup>231</sup> *Id.*

<sup>232</sup> *Id.* at III-122.

Shale increased from 273 in 2000 to 3,653 in 2007,<sup>233</sup> and 4,145 in 2008.<sup>234</sup> Industry-wide, API statistics confirm that these increases are not isolated incidents. The API reported that 2006 was a record year for gas drilling, in which more than 29,000 new wells were drilled.<sup>235</sup> The API expected that this trend would continue and it did: a new 21-year record was reached when 11,771 wells were drilled in the first-quarter of 2007.<sup>236</sup>

Along with this increase in drilling, there has been an associated increase in the amount of E&P waste produced. In Utah's Uintah County the amount of produced water generated from oil and gas operations increased from approximately 800,000 barrels per month in January 1999 to over 1,600,000 barrels per month in January 2007.<sup>237</sup> Even though some techniques have been implemented to reduce the amount of produced water generated from oil and gas extraction activities, EPA's Region 8 noted an overall two percent increase in the amount of produced water generated from 2002 to 2008.<sup>238</sup> The increases in both drilling and E&P waste that have occurred since 1988 indicate that the risks associated with E&P wastes have become even more substantial and that EPA must revisit its Regulatory Determination in light of these developments.

#### **4. Regulation Under Subtitle C of RCRA Would Not Harm the Oil & Gas Industry.**

In its 1988 Regulatory Determination, EPA placed significant weight on the potential harm that increased regulation of E&P waste could cause the oil and natural gas industry in making its determination not to regulate E&P wastes under Subtitle C of RCRA. EPA claimed that regulating E&P wastes under Subtitle C would be "extremely costly" for industry.<sup>239</sup> EPA also asserted that "[a]ny program to improve management of oil and gas wastes in the near term will be based largely on technologies and practices in current use."<sup>240</sup> While in 1988 EPA did not believe that the oil and gas industry would develop new waste management technologies, its belief has proved to be incorrect.

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<sup>233</sup> Hannah Wiseman, *Untested Waters: The Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation*, 20 FORDHAM ENVTL. L. REV. 115, 124 (2009) (citing Texas Railroad Commission, Newark, East (Barnett Shale), Drilling Permits Issued (1993–2007)).

<sup>234</sup> Texas Railroad Commission, Newark, East (Barnett Shale) Field, Drilling Permits Issued (1993–2009).

<sup>235</sup> Daniel Cusick, *Industry Sets Record for Drilling, Well Completions*, LAND LETTER, Jan. 18, 2007.

<sup>236</sup> Am. Petroleum Inst., "U.S. Q1 drilling & completion estimates at 21-year high—API," Apr. 26, 2007.

<sup>237</sup> DIV. OF OIL, GAS AND MINING, UTAH DEP'T OF NATURAL RES., PRODUCED WATER DISPOSAL, graph slide 6 (2007).

<sup>238</sup> EPA REGION 8, *supra* note 28, at fig. 3-9.

<sup>239</sup> 53 FED. REG. at 25446-01, 25456.

<sup>240</sup> *Id.* at 25,451. EPA's Report to Congress indicates that EPA did not truly believe this assertion that it made in the 1988 Regulatory Determination: "Long-term improvements in waste management need not rely, however, purely on increasing the use of better existing technology. The Agency does foresee the possibility of significant technical improvements in future technologies and practices." EPA, REPORT TO CONGRESS, MANAGEMENT OF WASTES FROM THE EXPLORATION, DEVELOPMENT, AND PRODUCTION OF CRUDE OIL, NATURAL GAS, AND GEOTHERMAL ENERGY III-2 (1987)

Evidence since 1988 demonstrates that new technologies and practices are available and that the use of these safer practices often results in significant cost savings. In 2008, EPA itself stated that “It has been 20 years since the RCRA exemption for oil and gas exploration and production was implemented, and many practices and chemicals used have changed during that time,”<sup>241</sup> and has noted that many safer drilling fluids have been developed<sup>242</sup> and the use of alternatives to pits has become increasingly practical.<sup>243</sup> In addition to the savings that can result from the use of these new disposal methods, companies using safer disposal practices also obtain cost benefits by preventing pollution in the first place, as opposed to being allowed to use “cheaper” practices and later required to clean up the damage they create.<sup>244</sup> The State of New Mexico found that drilling activity more than doubled in the year immediately following establishment of more protective rules for oil and gas waste pits.<sup>245</sup>

It is time for EPA to require oil and gas companies to use these new, safer technologies.

a. New Waste Disposal Technologies

Safer disposal methods for E&P wastes have been developed since 1988. Although EPA acknowledged that such developments were likely in its 1987 Report to Congress, it chose not to require the use of then-emerging safer technologies because it believed that requiring their use would be prohibitively expensive for the oil and gas industry. Recent cost analyses indicate that those fears were unfounded; in many instances, the use of more environmentally sound disposal practices actually saves oil and gas companies money. For example, a study conducted in New Mexico found that eliminating pits, traditionally considered the cheapest disposal method, is actually more cost-effective than their continued use.<sup>246</sup>

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<sup>241</sup> EPA REGION 8, *supra* note 28, at 3–13.

<sup>242</sup> EPA OFFICE OF COMPLIANCE SECTOR NOTEBOOK PROJECT, PROFILE OF THE OIL AND GAS EXTRACTION INDUSTRY, EPA/310-R-99-006, at 29 (2000).

<sup>243</sup> EPA, REGION 8, OIL AND GAS ENVIRONMENTAL ASSESSMENT REPORT 1996–2002 13 (2003).

<sup>244</sup>

[W]e’ve had testimony through here that the costs of remediation are, you know, in the hundreds of thousands to, typically millions of dollars. And there’s a huge cost benefit to business to prevent pollution versus us allowing them to pollute water and then come back and require them to clean it up. I think that’s really a disservice to industry, not to help them prevent that from occurring.

Statement of Commissioner William Olson before the New Mexico Oil Conservation Division, Apr. 16, 2008, OCD Document Image 14015\_657\_CF[1] at 30.

<sup>245</sup> Press Release, State of New Mexico, Governor Bill Richardson Announces Oil and Gas Drilling Activity in New Mexico Is Strong: Environmental regulations are not driving business away (May 19, 2010).

<sup>246</sup> DORSEY ROGERS, GARY FOUT & WILLIAM A. PIPER, NEW INNOVATIVE PROCESS ALLOWS DRILLING WITHOUT PITS IN NEW MEXICO (2006).

An Oil and Gas Accountability Project (OGAP) analysis demonstrates that closed-loop drilling systems, which use storage tanks and other equipment instead of pits, are cost-effective and can save money compared to conventional waste management with pits.<sup>247</sup> Mary Ellen Denomy, an expert in petroleum accounting, testified before the New Mexico Oil Conservation Division and reported her findings that the costs associated with a typical closed loop drilling system, also known as a pitless drilling system, are only 3.58% of total drilling costs, a significant reduction from the costs associated with typical on-site pit burial (6.58% of total drilling costs) and digging up and hauling wastes to a centralized facility (9.38% of total drilling costs).<sup>248</sup> While initial costs may be higher, closed-loop drilling systems create long-term savings because there is no need to construct pits, drilling waste can be dramatically reduced, water use can be reduced by as much as eighty percent, truck traffic is reduced by as much as seventy-five percent, and tanks can be reused.<sup>249</sup> Comparisons have found closed-loop drilling can result in a cost savings of up to \$180,000 per pit,<sup>250</sup> and a project in New Mexico found that:

[T]he average cost of using a pit and hauling the waste elsewhere for disposal is about 45% more compared to following the same process without a reserve pit. Moreover, the analysis showed that burying the waste on-site costs about 24% more when using a reserve pit as opposed to employing the closed-loop system.<sup>251</sup>

Individual case studies provide further support for these conclusions. A survey of Prima Energy Corporation's closed-loop system in Colorado indicated that closed-loop drilling could be more cost effective than conventional rotary drilling with reserve pits.<sup>252</sup> Prima Energy Corporation drilled over 68 wells in Colorado using closed-loop systems and compared their costs to the costs of using conventional rotary drilling with reserve pits.<sup>253</sup> The closed-loop drilling systems' average cost was \$15,600 compared to conventional rotary drilling's cost of \$17,020.<sup>254</sup> The study further demonstrated that closed-loop drilling systems result in significant waste minimization. Conventional rotary drilling was found to generate 5,200 barrels more barrels of produced water than closed-loop drilling.<sup>255</sup>

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<sup>247</sup> Oil & Gas Accountability Project, Alternatives to Pits.

<sup>248</sup> Oil & Gas Accountability Project, Closing Argument and Proposed Changes to Proposed Rule 50, *Case 14015: Application of New Mexico Oil Conservation Division for Repeal of Existing Rule 50 Concerning Pits, etc.*, Dec. 10, 2007, at 10.

<sup>249</sup> Oil & Gas Accountability Project, *supra* note 247.

<sup>250</sup> *Id.*; see also ROGERS ET AL., *supra* note 246, at 4–5.

<sup>251</sup> Dorsey Rogers, Dee Smith, Gary Fout & Will Marchbanks, *Closed-loop drilling system: A Viable Alternative to Reserve Waste Pits*, WORLD OIL, Dec. 2008, at 46.

<sup>252</sup> See Oil & Gas Accountability Project, *supra* note 247.

<sup>253</sup> Exhibit 8, Closed-Loop Drilling Case Studies, *Re: Case 14015: Application of New Mexico Oil Conservation Division for Repeal of Existing Rule 50 Concerning Pits, etc.*, OCD Document Image No. 14015\_637\_[CF]1.

<sup>254</sup> *Id.*

<sup>255</sup> *Id.*

Similarly a study of two wells drilled two hundred feet apart in Matagorda County, Texas provides further support for assertions that closed-loop drilling systems can provide cost savings.<sup>256</sup> In Matagorda County, two wells were drilled two hundred feet apart “through the same formations, using the same rig crew, mud company and bit program.”<sup>257</sup> One well used a closed-loop system while the other used traditional solids-control equipment. The closed-loop system “resulted in some significant savings” including: a forty-three percent savings in drilling fluid costs, twenty-three percent fewer rotating hours, fewer days to drill the wells to comparable depths, a thirty-seven percent reduction in bits used, and up to thirty-nine percent improvement in penetration rates.<sup>258</sup>

EPA’s own studies confirm that closed-loop drilling systems are a safer and cost-saving waste disposal process.<sup>259</sup> Because of these types of findings, EPA has promoted the use of closed-loop drilling systems in Region 8.<sup>260</sup> The RRC of Texas has confirmed that closed-loop systems can result in significant cost savings,<sup>261</sup> and many other government agencies also support the use of closed-loop drilling systems.<sup>262</sup> In addition to the already demonstrated economic advantages of closed-loop systems, there is a great likelihood that the costs of constructing closed-loop systems will decrease even more in the future “as economies of scale and innovations in operations” continue to occur.<sup>263</sup> If these systems are manufactured in the United States, they add the benefit of new job creation in addition to lower environmental risk.

Although safer and economical, even closed loop systems can leak or spill. Strong regulations are required to govern the storage and transport of toxic waste. In some cases, waste may be transported via pipeline to storage or disposal sites. Yet in Texas, State officials declared at a public meeting that the state has no “rule-making authority” over such pipelines.<sup>264</sup>

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<sup>256</sup> *Id.*

<sup>257</sup> *Id.*

<sup>258</sup> *Id.*

<sup>259</sup> EPA OFFICE OF COMPLIANCE SECTOR NOTEBOOK PROJECT, PROFILE OF THE OIL AND GAS EXTRACTION INDUSTRY, EPA/310-R-99-006, at 69 (2000).

<sup>260</sup> EPA REGION 8, AN ASSESSMENT OF THE ENVIRONMENTAL IMPLICATIONS OF OIL AND GAS PRODUCTION: A REGIONAL CASE STUDY 4-4 (Working Draft 2008).

<sup>261</sup> Abrahm Lustgarten, *Underused Drilling Practices Could Avoid Pollution*, PROPUBLICA, Dec. 14, 2009.

<sup>262</sup> U.S. Fish & Wildlife Serv., *Wildlife Mortality Risk in Oil Field Waste Pits*, U.S. FWS CONTAMINANTS INFORMATION BULLETIN (2000) (recommending the use of closed loop containment systems and elimination of open pits and ponds); BUREAU OF LAND MGT, THE GOLD BOOK: SURFACE OPERATING STANDARDS AND GUIDELINES FOR OIL AND GAS EXPLORATION AND DEVELOPMENT (4th ed. 2007). “To prevent contamination of ground water and soils . . . it is recommended that operators use a closed-loop drilling system or line reserve pits with an impermeable liner.” *Id.* at 17.

<sup>263</sup> Controlled Recovery Inc.’s Written Closing Argument, *Re: Case 14015: Application of New Mexico Oil Conservation Division for Repeal of Existing Rule 50 Concerning Pits, etc.*, Dec. 10, 2007, at 3.

<sup>264</sup> Lowell Brown, *Officials Give Few Answers to Argyle*, DENTON RECORD-CHRONICLE, Jan. 30, 2010.

b. Waste Minimization, Reuse, and Recycling Techniques

Waste minimization, reuse and recycling techniques also can be economical for companies. According to the RRC of Texas, “[w]aste minimization has been proven to be an effective and beneficial operating procedure,” while recycling “is becoming a big business and more recycling options are available every day.”<sup>265</sup> Both serve to reduce the total amount of E&P wastes that must be disposed and thereby decrease the risks associated with E&P wastes. In its manual *Waste Minimization in the Oilfield*, the RRC of Texas offers oil and gas companies more than one hundred ways to minimize wastes.<sup>266</sup> This manual, along with reports from individual companies implementing various waste minimization and recycling techniques, demonstrates that improved practices are possible.

Studies by the E&P Forum attest to the benefits of waste recycling<sup>267</sup> and identify several ways industry can reduce waste, “through process and procedure modifications . . . [For example,] improved solids control equipment and new technology can reduce the volumes [of drilling fluids] discharged to the environment, . . . more effective drillbits can reduce the need for chemical additions, [and] gravel packs and screens may reduce the volume of formation solids/sludge produced.”<sup>268</sup> An analysis by OGAP found that the use of closed-loop drilling systems, in addition to providing cost benefits, maximizes the ability to reuse and recycle drilling fluids.<sup>269</sup> And waste reduction is not just beneficial from an environmental perspective. It can provide further opportunities for the oil and gas industry to save money. A study on land owned by the U.S. Army Corps of Engineers in Oklahoma found that a reduction in “wastes by close to 1.5 million pounds” resulted in “[a] material and disposal cost savings of \$12,700.”<sup>270</sup>

Both the government and industry are aware of the cost saving opportunities associated with the use of waste minimizing technologies and recycling and reuse projects. For example, STW Resources has developed a technology for use in the Barnett Shale that can reclaim approximately seventy percent of the flowback water produced by hydraulic fracturing operations in the region and thereby reduce the total amount of waste associated with hydraulic fracturing while also enabling the wastes to be reused.<sup>271</sup> And in July of 2008, the RRC of Texas approved Devon Energy’s “third pilot program to treat and reuse frac fluid . . . . As a result of its water recycling efforts, Devon is the industry leader in water recycling and now used recycled

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<sup>265</sup> Railroad Commission of Texas, *supra* note 52.

<sup>266</sup> DRILLING DOWN, *supra* note 20, at 29.

<sup>267</sup> E&P FORUM, *supra* note 107, at 14 (“There are potential benefits in the sale of recovered hydrocarbons. All hydrocarbon wastes should be returned to the production stream where possible.”).

<sup>268</sup> UNEP E&P FORUM, ENVIRONMENTAL MANAGEMENT IN OIL AND GAS EXPLORATION AND PRODUCTION: AN OVERVIEW OF ISSUES AND MANAGEMENT APPROACHES 54 (1997).

<sup>269</sup> Oil & Gas Accountability Project, *supra* note 247.

<sup>270</sup> Exhibit 8, Closed-Loop Drilling Case Studies, *Re: Case 14015: Application of New Mexico Oil Conservation Division for Repeal of Existing Rule 50 Concerning Pits, etc.*, OCD Document Image No. 14015\_637\_[CF]1.

<sup>271</sup> STW RES., INC., CONTAMINATED WASTE WATER RECLAMATION OPPORTUNITIES 2–3.

frac water at one out of every 10 frac jobs in its Barnett Shale operations.”<sup>272</sup> Devon’s wastewater recycling program “is projected to produce 75 percent reusable fracture fluid and 25 percent high concentrate and solids. The concentrate will be used as a drilling fluid or disposed of in an authorized facility.”<sup>273</sup> Devon Energy Production Central Division’s vice president estimated that “[a]t full treatment capacity, up to 85 percent of [the] water [Devon] recover[s] from fracture completions in the Barnett Shale could be reused.”<sup>274</sup> And Devon Energy is not alone: Fountain Quail Water Management, DTE Gas Resources Inc., Burlington Resources, and Stroud Energy have all engaged in reuse and recycling efforts.<sup>275</sup>

New projects are underway at the national level: the U.S. Department of Energy’s National Energy Technology Laboratory launched nine new projects in October 2009 focused on developing new technologies “to improve management of water resources, water usage, and water disposal.”<sup>276</sup> These projects add to the fifteen already underway that are focused on “assess[ing] options and technologies for handling, cleaning, and reuse of produced and flowback water” in the Barnett and Appalachian shale plays.<sup>277</sup> When combined with pitless drilling through a closed-loop system, recycling of waste is clearly an effective, available, and economical way to manage E&P waste more safely and allow for compliance with stronger regulations.

c. New Substitutes for Toxic Materials

Studies indicate that the use of less toxic drilling and hydraulic fracturing fluids can both reduce the risks associated with E&P wastes and also reduce oil and gas companies’ liability, thus potentially saving them money in the long run.<sup>278</sup> Other agencies confirm EPA’s findings on the benefits of using safer cost effective alternatives. Numerous agencies encourage operators “to substitute less toxic, yet equally effective products for conventional drilling products.”<sup>279</sup> And most recently, ExxonMobil announced that it “‘supports the disclosure of the identity of the ingredients being used in fracturing fluids.’”<sup>280</sup> OGAP sees ExxonMobil’s statement as a “significant step” and believes that “[o]nce the chemicals are widely known . . . companies will

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<sup>272</sup> News Release, Railroad Commission of Texas, Commissioners Approve of Devon Water Recycling Project for the Barnett Shale, July 29, 2008.

<sup>273</sup> *Id.*

<sup>274</sup> *Energy Companies Strive to Reuse Water*, WEATHERFORD TELEGRAM, July 25, 2007, at 3C.

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

<sup>276</sup> U.S. Dep’t of Energy, National Energy Technology Lab, *Nine New Projects*, OIL & GAS PROGRAM NEWSLETTER (Dep’t), Winter 2009, at 8.

<sup>277</sup> *Id.* at 6.

<sup>278</sup> EPA OFFICE OF COMPLIANCE SECTOR NOTEBOOK PROJECT, PROFILE OF THE OIL AND GAS EXTRACTION INDUSTRY, EPA/310-R-99-006 (2000).

<sup>279</sup> BUREAU OF LAND MGT, THE GOLD BOOK: SURFACE OPERATING STANDARDS AND GUIDELINES FOR OIL AND GAS EXPLORATION AND DEVELOPMENT, at 39 (4th ed. 2007).

<sup>280</sup> Katie Burford, *ExxonMobil Favors Fracing Disclosure, Environmental Group Welcomes Position from Oil Industry Giant*, DURANGO HERALD, Apr. 19, 2010.

be more likely to use green alternatives” which will result in “a lessening of the toxicity of the fluids” over time.<sup>281</sup>

In addition, the search for chemicals with lower potential environmental impacts has “result[ed] in the generation of less toxic wastes . . . . [For] example . . . mud and additives that do not contain significant levels of biologically available heavy metals or toxic compounds.”<sup>282</sup> These types of new synthetic drilling fluids already have been developed and are less toxic, “free of polynuclear aromatic hydrocarbons and have . . . faster biodegradability and lower bioaccumulation potential.”<sup>283</sup> Safer alternatives to current drilling fluids are available—all that remains is for the oil and gas industry to adopt widespread use of them.

Industry has already proven itself to be capable of switching to less hazardous compounds in the past. In the 1990s many drilling companies voluntarily phased out the use of benzene in their operations.<sup>284</sup> EnCana stopped using a chemical, 2-Butoxyethanol, linked with reproductive problems in animals, while BJ Services, “one of the largest fracturing service providers in the world, has discontinued the use of fluorocarbons, a family of compounds that are persistent environmental pollutants.”<sup>285</sup> Schlumberger has developed “GreenSlurry,” which the company claims is “earth-friendly.”<sup>286</sup> Antero Resources Corporation pledged to use only “green frac” materials in the communities of Rifle, Silt and New Castle in western Colorado.<sup>287</sup> Yet these reported less toxic fluids are not used everywhere. While the oil and gas industry clearly has the capability to adapt its operations to safer technologies, most companies have been reluctant to make such changes. EPA should thus act and require the oil and gas industry to expand the use of the safer, less toxic drilling fluids that are currently available.

## **5. Oil and Gas Waste Meets the Statutory and Regulatory Criteria for Hazardous Waste.**

Absent their special exclusion from RCRA, E&P wastes would properly be regulated under Subtitle C of RCRA. Congress defined hazardous wastes under RCRA as:

[A] solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristic may—

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

<sup>282</sup> E&P FORUM, *supra* note 107, at 12-23.

<sup>283</sup> Drilling Waste Management Information System, Drilling Waste Management Fact Sheet: Using Muds and Additives with Lower Environmental Impacts.

<sup>284</sup> Susan Riha et al., *supra* note 42, at 6.

<sup>285</sup> Lustgarten, *supra* note 261.

<sup>286</sup> Schlumberger, “Earth-friendly GreenSlurry system for uniform marine performance,” March, 2003.

<sup>287</sup> The Rifle, Silt, New Castle Community Development Plan, Jan. 1, 2006.

- (A) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or
- (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.<sup>288</sup>

Under RCRA, Congress instructed EPA to “define hazardous waste using two different mechanisms: by listing certain specific solid wastes as hazardous . . . and by identifying characteristics . . . which, when exhibited by a solid waste, make it hazardous.”<sup>289</sup> Under RCRA, “[c]haracteristic wastes are wastes that exhibit measurable properties which indicate that a waste poses enough of a threat to warrant regulation as a hazardous waste.”<sup>290</sup> The four technical criteria EPA uses to determine if a waste is a characteristic waste include:<sup>291</sup> ignitability, corrosivity, reactivity, and toxicity.<sup>292</sup> Waste will be considered hazardous if it exhibits *any* of the four characteristics.<sup>293</sup> Because various types of E&P wastes exhibit several of these characteristics, E&P wastes should properly be regulated under Subtitle C of RCRA as characteristic hazardous wastes.

a. Ignitability

Ignitability is a criterion used to identify wastes that “can readily catch fire and sustain combustion.”<sup>294</sup> A substance’s flashpoint is indicative of its ignitability.<sup>295</sup> A waste’s flash point is “the lowest temperature at which the fumes above a waste will ignite when exposed to flame.”<sup>296</sup> Eleven percent of oily sludges sampled in California had a flash point exceeding the regulatory threshold.<sup>297</sup>

The risks associated with E&P wastes having hazardous flashpoints under RCRA’s criteria have been demonstrated in the past decade. In January 2003, a fire occurred when hydrocarbon vapor from basic sediment and water, a type of E&P waste, ignited at a Texas open area collection pit.<sup>298</sup> Three people were killed in the fire and four others were severely burned.<sup>299</sup> In

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<sup>288</sup> 42 U.S.C. § 6903(5).

<sup>289</sup> EPA, RCRA ORIENTATION MANUAL, CHAPTER III: RCRA SUBTITLE C—MANAGING HAZARDOUS WASTE, at III-17.

<sup>290</sup> *Id.* at III-22.

<sup>291</sup> Hazardous Waste Treatment Council v. U.S. EPA, 861 F.2d 277, 279 (D.C. Cir. 1988).

<sup>292</sup> See 40 CFR § 261.20 et seq.

<sup>293</sup> *Id.*

<sup>294</sup> EPA, *supra* note 2899, at III-22.

<sup>295</sup> NAGY, *supra* note 24, at 36.

<sup>296</sup> EPA, *supra* note 2899, at III-23.

<sup>297</sup> NAGY, *supra* note 24, at 31.

<sup>298</sup> U.S. Dep’t. of Labor, Occupational Safety & Health Admin., Potential Flammability Hazard Associated with Bulk Transportation of Oilfield Exploration and Production (E&P) Waste Liquids, SHIB-03-24-2008.

<sup>299</sup> *Id.*

May 2006, a natural gas condensate tank and pit caught on fire in Colorado.<sup>300</sup> Nearby residents were described as “‘terrified’ by the 200-foot flames.”<sup>301</sup> Residents were also concerned because they were not able to learn what potential health impacts they were exposed to from the burning waste “‘since neither the company nor local or state authorities bothered taking air quality samples during the blaze.’”<sup>302</sup>

More recently, a wastewater impoundment pond in Washington County, Pennsylvania caught fire.<sup>303</sup> George Zimmerman reported seeing “‘flames shooting 100 feet in the air’” at the fire that occurred at the hydraulic fracturing site located on his property.<sup>304</sup> A state police fire marshal determined that the fire was an accident caused by “‘a malfunction [that] ignited fumes [most likely in the frac tank] and caused \$375,000 in damages.’”<sup>305</sup> The fire also “‘badly damaged’” the frac pit liner, causing a spokeswoman from the Pennsylvania DEP to be concerned that the pit’s contents might escape.<sup>306</sup> Instances such as these fires and the sampling data from California indicate that E&P wastes are ignitable, and that this characteristic of E&P wastes has resulted in serious harm. E&P wastes with these flash points would appropriately be regulated as characteristic hazardous wastes under Subtitle C of RCRA. Such regulation is necessary to prevent future incidents similar to the January 2003 and March 2010 fires.

#### b. Corrosivity

Waste is corrosive if “‘it is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5’” or if “[i]t is a liquid and corrodes steel . . . at a rate greater than 6.35 mm per year.”<sup>307</sup> Drilling wastes sampled in California had elevated pH levels approaching the 12.5 regulatory limit.<sup>308</sup> In addition, corrosive chemicals are frequently found in E&P wastes. For example, hydrogen sulfide is a corrosive and “‘toxic gas occurring naturally in some oil and gas reservoirs.’”<sup>309</sup> The corrosive characteristics of E&P wastes have already been responsible for many incidents where E&P wastes have been improperly released. On numerous occasions, spills of E&P wastes have been reported as originating from corroded equipment that had begun to leak because of corrosion attributed to the substances the equipment contained.<sup>310</sup> Again, because a waste is properly regulated under Subtitle C of RCRA when it exhibits *any* of the four

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<sup>300</sup> OIL & GAS ACCOUNTABILITY PROJECT, SPRING/SUMMER 2006 REPORT (2006).

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

<sup>302</sup> *Id.*

<sup>303</sup> Janice Crompton, *Residents Reported Gas Odors Before Explosion*, PITTSBURGH POST-GAZETTE, Apr. 1, 2010, at B-1.

<sup>304</sup> Kathie O. Warco, *Fumes Ignite at Gas Well*, OBSERVER-REPORTER, Apr. 1, 2010.

<sup>305</sup> *Id.*

<sup>306</sup> *Id.*

<sup>307</sup> 40 CFR § 261.22.

<sup>308</sup> NAGY, *supra* note 24, at 37.

<sup>309</sup> E&P FORUM, *supra* note 107, at 28.

<sup>310</sup> *See supra* note 216 and accompanying text.

criteria of characteristic hazardous wastes, corrosive E&P wastes should be regulated under Subtitle C.

c. Reactivity

A waste is reactive if “(1) it is normally unstable and readily undergoes violent change without detonating, (2) [i]t reacts violently with water, (3) [i]t forms potentially explosive mixtures with water, (4) [w]hen mixed with water, it generates toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment, (5) [i]t is a cyanide or sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment, (6) [i]t is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement, (7) [i]t is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure, [or] (8) [i]t is a forbidden explosive . . . .”<sup>311</sup>

Out of the four criteria for determining characteristic hazardous wastes, reactivity is the most difficult to test: “In many cases, there is no reliable test method to evaluate a waste’s potential to explode, react violently, or release toxic gas under common waste handling conditions.”<sup>312</sup> In some cases, a waste’s reactivity can be evaluated by a releasable sulfide test.<sup>313</sup> Although no regulatory threshold valuable for releasable sulfides has been established, EPA established an interim guidance value.<sup>314</sup> Testing of E&P wastes in California found samples of sludge and tank bottoms exceeding EPA’s interim guidance value.<sup>315</sup>

d. Toxicity

The Code of Federal Regulations describes the specific levels/concentrations at which various chemicals will be considered toxic for the purposes of RCRA. To determine whether a chemical meets the required level, EPA uses the Toxicity Characteristic Leaching Procedure (TCLP). Many E&P wastes would be considered toxic under this test. The New Mexico Oil Conservation Division (OCD) found that several samples taken from E&P waste disposal pits in the state contained levels of chemicals that failed the TCLP test.<sup>316</sup> Specifically, the OCD found pits that contained levels of arsenic, lead, mercury, 2,4-Dinitrotoluene, and 2-Methylnaphthalene that exceeded TCLP levels.<sup>317</sup> Its report indicated that the levels of lead they found alone would have allowed the wastes to be considered characteristically hazardous if not for the RCRA

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<sup>311</sup> 40 CFR § 261.23.

<sup>312</sup> EPA, *supra* note 2899, at III-23.

<sup>313</sup> NAGY, *supra* note 24, at 38.

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

<sup>315</sup> *Id.* at 38–39.

<sup>316</sup> See Earthworks, OCD’s 2007 Pit Sampling Program: What Is in that Pit?, at 31.

<sup>317</sup> *Id.* at 34.

exemption.<sup>318</sup> Analysis of E&P waste in California determined that both produced water and oily sludge met the federal toxicity characteristic and would be considered hazardous, again, if not for the RCRA exemption.<sup>319</sup> Because of this evidence, and the multitude of evidence discussed above indicating that E&P wastes have caused, and present substantial risk of continuing to cause, hazards to human health and the environment, EPA should reconsider its 1988 Regulatory Determination and regulate E&P wastes under Subtitle C of RCRA, as would be proper given the fact that they frequently exhibit the same traits as characteristic hazardous wastes.

## **II. REQUEST FOR PROMULGATION OF REGULATIONS**

The Petitioner, the Natural Resources Defense Council, respectfully requests that the EPA promulgate regulations classifying wastes from the exploration, development and production of oil and natural gas as hazardous waste subject to provisions of Subtitle C of RCRA. This request is based on overwhelming evidence that waste from the exploration, development and production of oil and natural gas is hazardous, taking into account its toxicity, corrosivity, and ignitability, that it is released into the environment where it can cause harm, that state regulations are inadequate, and that there are numerous methods available to manage it as hazardous waste. As set forth in this Petition, evidence exists for EPA to document that, because of its quantity, concentration, and chemical characteristics, E&P waste may cause or significantly contribute to an increase in mortality and serious incapacitating illness and that it may pose a substantial present or potential hazard to wildlife and the environment when improperly treated, transported or disposed of, or otherwise managed, as is occurring throughout the U.S. in the absence of sufficient mandatory federal oversight. *See* 42 U.S.C. § 6902(4)-(5).

The Petitioner requests that the EPA consider the relevant statutory and regulatory factors, as well as the factors set forth in the July 1988 Regulatory Determination, and promulgate regulations applying to wastes from the exploration, development and production of oil and natural gas under Subtitle C of RCRA.

Respectfully submitted this 8th day of September, 2010.

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<sup>318</sup> *Id.* at 35.

<sup>319</sup> NAGY, *supra* note 24, at 40.

## List of References

1. Joseph F. Scavetta, *RCRA 101: A Course in Compliance for Colleges and Universities*, 72 Notre Dame Law Review (1997)
2. Natasha Ernst, Note, *Flow Control Ordinances in a Post-Carbene World*, 13 Penn State Environmental Law Review (2004)
3. James R. Cox, *Revisiting RCRA'S Oilfield Waste Exemption as to Certain Hazardous Oilfield Exploration and Production Wastes*, 14 Villanova Environmental Law Journal (2003)
4. EPA, Report to Congress, Management of Wastes from the Exploration, Development, and Production of Crude Oil, Natural Gas, and Geothermal Energy, Volumes 1–3 EPA530-SW-88-003 (1987)
5. Regulatory Determination for Oil and Gas and Geothermal Exploration, Development and Production Wastes, 53 Fed. Reg. 25 (July 6, 1988)
6. EPA Region 8, An Assessment of the Environmental Implications of Oil and Gas Production: A Regional Case Study (Working Draft 2008)
7. 101 F.3d 772 (D.C. Cir. 1996)
8. Closing Argument of the New Mexico Citizens for Clean Air and Water, Dec. 2007, OCD Document Image No. 14015\_648\_CF[1]
9. Drilling Down: Protecting Western Communities from the Health and Environmental Effects of Oil and Gas Production (2007)
10. Railroad Commission of Texas, Waste Minimization in the Oil Field
11. Claudia Zagrean Nagy, California Department of Toxic Substances Control, Oil Exploration and Production Wastes Initiative (2002)
12. Kelly Corcoran, Katherine Joseph, Elizabeth Laposata, & Eric Scot, UC Hastings College of the Law' Public Law Research Institute, Selected Topics in State and Local Regulation of Oil and Gas Exploration and Production
13. C. Tsouris, Oak Ridge National Laboratory, Emerging Applications of Gas Hydrates
14. Letter from West Virginia Department of Environmental Protection to William Goodwin, Superintendent Clarksburg Sanitary Board, July 23, 2009
15. Oklahoma Corporation Commission Oil and Gas Conversation Division, Guidelines for Responding to and Remediating New or Historic Brine Spills (2009)

16. Colorado Oil and Gas Conservation Commission, Inspection/Incident Inquiry, Spill Reports, Document Nos. 1631502, 1631508
17. A.H. Beyer, Chevron Oil Field Research Co., Technical Memorandum, Purification of Produced Water, Part 1—Removal of Volatile Dissolved Oil by Stripping (1972)
18. U.S. General Accounting Office, RCED-89-97, Safeguards Are Not Preventing Contamination from Injected Oil and Gas Wells (1989)
19. Keith Schneider, *Radiation Danger Found in Oilfields Across the Nation*, N.Y. Times, Dec. 3, 1990
20. N.Y. Department of Environmental Conservation, Draft Supplemental General Environmental Impact Statement (2009)
21. Abrahm Lustgarten & ProPublica, *Natural Gas Drilling Produces Radioactive Wastewater*, Scientific American, Nov. 9, 2009
22. Motion in Limine to Exclude Rogers and Associates Engineering Reports, Lester v. Exxon Mobil Corp., No. 630-402 (La. 24th Jud. Dist. Ct. 2009)
23. Wilma Subra, Louisiana Environmental Action Network, Comments on Hydraulic Fracturing to the Louisiana Senate Environmental Quality Committee, Mar. 11, 2010
24. Susan Riha et al, *Comments on the Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program*, Jan. 2010
25. U.S. Congress, Office of Technology Assessment, Managing Industrial Solid Wastes from Manufacturing, Mining, Oil and Gas Production, and Utility Coal Combustion—Background Paper (1992)
26. U.S. Fish & Wildlife Service, Region 6, Environmental Contaminants Program, Reserve Pit Management: Risks to Migratory Birds (2009)
27. Oil & Gas Accountability Project, Pit Pollution—Backgrounder on the Issues, with a New Mexico Case Study (2004)
28. U.S. Environmental Protection Agency, *Technology Transfer Air Toxics: Acrylamide*
29. T.A. Kassim, *Waste Minimization and Molecular Nanotechnology: Toward Total Environmental Sustainability*, in 3 Environmental Impact Assessment of Recycled Wastes on Surface and Ground Waters: Engineering Modeling and Sustainability (Tarek A. Kassim ed., 2005)
30. Texas Railroad Commission, Waste Minimization in Drilling Operations

31. Jonathan Wills, *Muddied Waters, A Survey of Offshore Oilfield Drilling Wastes and Disposal Techniques to Reduce the Ecological Impact of Sea Dumping* (2000)
32. American Petroleum Institute, *Waste Management*
33. Dara O'Rourke & Sarah Connolly, *Just Oil? The Distribution of Environmental and Social Impacts of Oil Production and Consumption*, 28 Annual Review of Environment and Resources (2003)
34. Testimony of Margaret A. Ash, OGCC Environmental Supervisor, In the Matter of Changes to the Rules and Regulations of the Oil and Gas Conservation Commission of the State of Colorado
35. The Endocrine Disruption Exchange, *Potential Health Effects of Residues in 6 New Mexico Oil and Gas Drilling Reserve Pits Based on Compounds Detected in at Least One Sample*, Nov. 15, 2007
36. Shannon D. Williams, David E. Ladd & James J. Farmer, U.S. Geological Survey, *Fate and Transport of Petroleum Hydrocarbons in Soil and Ground Water at Big South Fork National River and Recreation Area, Tennessee and Kentucky, 2002–2003* (2006)
37. The Endocrine Disruption Exchange, *Number of Chemicals Detected in Reserve Pits for 6 Wells in New Mexico That Appear on National Toxic Chemical Lists: Amended Document*, Nov. 15, 2007
38. Letter from Roy Staiger, District Office Cleanup Coordinator, Texas Railroad Commission, to Exxon Mobil Corporation, Dec. 31, 2009
39. Oil & Gas Accountability Project, *Spring/Summer 2006 Report* (2006)
40. Wolf Eagle Environmental, *Environmental Studies: Fugitive Air Emissions Testing, Impacted Soil Testing, Mr. and Mrs. Timothy Ruggiero* (2010)
41. U.S.G.S., *Toxic Substance Hydrology Program: BTEX*
42. Eric Griffey, "Toxic drilling waste is getting spread all over Texas farmland," *Fort Worth Weekly* (May 12, 2010)
43. U.S. Department of Health & Human Services, Agency for Toxic Substances and Disease Registry, *ToxFAQs for Acetone* (1995)
44. U.S. Department of Health & Human Services, Agency for Toxic Substances and Disease Registry, *ToxFAQs for Arsenic* (2007)

45. ScienceLab.com, Chemicals & Laboratory Equipment, Material Safety Data Sheet: Arsenic MSDS 1 (2008)
46. U.S. Department of Health & Human Services, Agency for Toxic Substances and Disease Registry, ToxFAQs for Barium (2007)
47. U.S. Department of Health & Human Services, Agency for Toxic Substances and Disease Registry, ToxFAQs for Radium (2007)
48. Chris Gray, *Pits Cause Stink in Lafourche*, Times-Picayune, July 14, 1997
49. Miguel San Sebastian, Ben Armstrong, & Carolyn Stephens, *Outcomes of Pregnancy among Women Living in the Proximity of Oil Fields in the Amazon Basin of Ecuador*, 8 International Journal of Occupational and Environmental Health (2002)
50. Anna-Karin Hurtig & Miguel San Sebastian, *Geographical Differences in Cancer Incidence in the Amazon Basin of Ecuador in Relation to Residence near Oil Fields*, 31 International Journal of Epidemiology (2002)
51. Henry Spitz, Kenneth Lovins & Christopher Becker, *Evaluation of Residual Soil Contamination From Commercial Oil Well Drilling Activities and Its Impact on the Naturally Occurring Background Radiation Environment*, 6 Soil & Sediment Contamination: An International Journal (1997)
52. Joint Factual Statement, ¶¶ 10–27, U.S. v. Exxon Mobil Corp., (D.Col. 2009)
53. Bryan M. Clark, *Dirty Drilling: The Threat of Oil and Gas Drilling in Lake Erie* (2005)
54. Letter from Lisa Kirkpatrick, Chief, New Mexico Dept. of Game & Fish, Conservation Services Division, to Florene Davidson, Commission Secretary, EMNRD Oil Conservation Division (Jan. 20, 2006)
55. Letter from Lisa Kirkpatrick, Chief, New Mexico Dept. of Game & Fish, Conservation Services Division, to Florene Davidson, Commission Secretary, EMNRD Oil Conservation Division (Mar. 7, 2006)
56. Letter from Lisa Kirkpatrick, Chief, New Mexico Dept. of Game & Fish, Conservation Services Division, to Florene Davidson, Commission Secretary, EMNRD Oil Conservation Division (Feb. 2, 2007)

57. Press Release, Pennsylvania Department of Environmental Protection, *Cattle from Tioga County Farm Quarantined after Coming in Contact with Natural Gas Drilling Wastewater* (July 1 2010)
58. Amended Complaint at ¶ 32, *Sweet Lake Land and Oil Co. v. Exxon Mobil Corp.*, No. 209CV01100, (W.D. La. filed Sept. 14, 2009), 2009 WL 4701364
59. Test results from Veterinary Medical Diagnostic Laboratory on 26 July 2005, 18 August 2005, and 6 September 2005
60. Bluedaze: Drilling Reform for Texas, <http://txsharon.blogspot.com/2008/07/more-barnett-shale-sludge-pond.html>. (July 25, 2008)
61. Susan Hylton, *Drilling Waste Feud, Neighbors of Maverick Energy Services Think Water is Being Polluted*, *Tulsa World*, March 21, 2010
62. E&P Forum, *Exploration and Production (E&P) Waste Management Guidelines* (1993)
63. League of Women Voters of Tarrant County, *Gas Drilling Waste-Water Disposal* (2008)
64. Testimony of James E. McCartney to the 128<sup>th</sup> General Assembly, Ohio Senate Environmental and Natural Resources Committee. Opposition Testimony on Senate Bill 165, Oct. 28, 2009
65. State Review of Oil and Natural Gas Environmental Regulations, Inc., *Tennessee State Review* (2007)
66. FY2008 EPA Region 6 End-of-year Evaluation of the Railroad Commission of Texas Underground Injection Control Program, with transmittal letter from Bill Luthans, Acting Director, Water Quality Protection Division, Region 6 to Tommie Seitz, Director, Oil and Gas Division (June 19, 2009)
67. Joe Carroll, *Exxon's Oozing Texas Oil Pits Haunt Residents as XTO Deal Nears*. *Bloomberg*. April 16, 2010
68. New Mexico Energy, Minerals and Natural Resources Department, *Oil Conservation Division, Cases Where Pit Substances Contaminated New Mexico's Ground Water* (2008)
69. Oil & Gas Accountability Project, *Groundwater Contamination*

70. Kim Weber, Regarding Support of HB 1414—Evaporative Waste Facilities Regulations
71. Colorado Oil and Gas Conservation Commission, Inspection/Incident Inquiry, Spill Reports, Document Nos. 1630424, 1630426, 1630427, 1630428, 1630429, 1630430
72. Oil & Gas Accountability Project, Contamination Incidents Related to Oil and Gas Development, Maralex Drilling Fluids in Drinking Water
73. Colorado Oil and Gas Conservation Commission, Inspection/Incident Inquiry, Spill Report, Document No. 1953000
74. Colorado Oil and Gas Conservation Commission, Inspection/Incident Inquiry, NOAV Report, Document No. 200085988
75. Colorado Oil and Gas Conservation Commission, Inspection/Incident Inquiry, Spill Reports, Document Nos. 1631518, 1631599, 2605176, 2605847
76. Colorado Oil and Gas Conservation Commission, Inspection/Incident Inquiry, Spill Reports, Document Nos. 200225543, 200225547, 200225546
77. Colorado Oil and Gas Conservation Commission, Inspection/Incident Inquiry, Spill Reports, Document No.1632846
78. COGCC Prather Springs Administrative Order by Consent
79. Toxics Targeting, Inc., Hazardous Materials Spills Information Request (2009)
80. Consent Assessment of Civil Penalty, In re Atlas Resources LLC, Dancho-Brown 4, ¶¶ AV–AZ, Groves 8, ¶¶ BA–BE
81. Ohio Department of Natural Resources, Notice of Violation No. 1278508985, June 21, 2010.
82. Ohio Department of Natural Resources, Notice of Violation No. 2016754140, May 16, 2008.
83. Phillip Yates, *Clean Air Group Contends Evaporation Ponds in Garfield County More Dangerous than Previously Believed*, Post Independent, Jan. 9, 2008
84. Colorado Oil and Gas Conservation Commission, Inspection/Incident Inquiry, Complaint Report, Document No. 200081602

85. Amended Complaint, Stephenson v. Chevron U.S.A, Inc., No. 209CV01454, (W.D. La. filed Sept. 11, 2009), 2009 WL 4701406
86. Petition for Damages, Brownell Land Corp., LLC v. Honey Well Int'l., No. 08CV04988, (E.D. La. filed Nov. 21, 2008), 2008 WL 5366168
87. Rice Agricult. Corp., Inc., v. HEC Petroleum Inc., 2006 WL 2032688 (E.D. La)
88. Petition for Damages, Tensas Poppadoc, Inc. v. Chevron U.S.A., Inc., No. 040769, (7th Judicial Court La. filed Sept. 21, 2005), 2005 WL 6289654
89. Petition for Damages to School Lands, Louisiana v. Shell Oil Co., No. CV04-2224 L-O, (W.D. La. filed Oct. 29, 2004), 2004 WL 2891505
90. State Review of Oil and Natural Gas Environmental Regulations, Inc., Kentucky State Review (2006)
91. State Review of Oil and Natural Gas Environmental Regulations, Inc., Louisiana State Review (2004)
92. Christie Campbell, *Foul Odor from Impoundment Upsets Hopewell Woman*, Observer-Reporter, Apr. 14, 2010
93. EPA Office of Compliance Sector Notebook Project, Profile of the Oil and Gas Extraction Industry, EPA/310-R-99-006 (2000)
94. Letter from Gary M. Maslanka, New York State Division of Solid & Hazardous Materials, to Joseph Boyles, Casella (April 27, 2010)
95. Press Release, Arkansas Dept. of Env'tl. Quality, ADEQ Releases Landfarm Study Report (Apr. 20, 2009)
96. M.G. Puder & J.A. Veil, Argonne National Laboratory, Offsite Commercial Disposal of Oil and Gas Exploration and Production Waste: Availability, Options, and Costs (2006)
97. Abrahm Lustgarten, *State Oil and Gas Regulators Are Spread Too Thin to Do Their Jobs*, ProPublica, December 30, 2009
98. EPA, Office of the Inspector General, Complete Assessment Needed to Ensure Rural Texas Community Has Safe Drinking Water, No. 2007-P-00034 (2007)

99. Robert D. Bullard, *Testimony before the Subcommittee on Superfund and Environmental Health of the Senate Environment and Public Works Committee* (July 25, 2007)
100. Marcellus Gas Well Hydrofracture Wastewater Disposal by Recycle Treatment Process, ProChemTech International, Inc.
101. New York State Water Resources Institute, *Waste Management of Cuttings, Drilling Fluids, Hydrofrack Water and Produced Water*
102. Ohio Environmental Protection Agency, *Marcellus Shale Gas Well Production Wastewater*
103. Joaquin Sapien, *With Natural Gas Drilling Boom, Pennsylvania Faces an Onslaught of Wastewater*, ProPublica, October 4, 2009
104. Marcellus Shale Natural Gas Wastewater Treatment, Hearing Before the S. Comm. on Environmental Resources and Energy (Pa. 2010) (statement of Peter Slack, Pennsylvania Municipal Authorities Association)
105. Press Release, Pennsylvania Department of Environmental Protection, *DEP Says Jersey Shore Borough Exceeds Wastewater Permit Limits* (June 23 2009)
106. Pennsylvania Department of Environmental Protection, Press Release, *DEP Fines Atlas \$85,000 for Violations at 13 Well Sites*, Jan. 7, 2010
107. Laura Legere, *Massive use of water in gas drilling presents myriad chances for pollution*, Scranton Times-Tribune, June 22, 2010
108. Colorado Oil and Gas Conservation Commission, *Inspection/Incident Inquiry, Spill Report*, Document No. 1630697
109. Colorado Oil and Gas Conservation Commission, *Inspection/Incident Inquiry, Spill Reports*, Document Nos. 1631155, 1631831, 1631794, 1632853
110. Colorado Oil and Gas Conservation Commission, *Inspection/Incident Inquiry, Spill Reports*, Document Nos. 1630885, 1631496, 1631519, 1632057, 2605191, 1632995
111. Colorado Oil and Gas Conservation Commission, *Inspection/Incident Inquiry, Spill Reports*, Document Nos. 200226284, 200225725, 2605709
112. Oil & Gas Accountability Project, *Colorado Oil and Gas Industry Spills: A review of COGCC data (June 2002-June 2006)* (2006)

113. *Frac Fluid Spill Reported in Flower Mound*, Cross Timbers Gazette, Mar. 17, 2010
114. Letter from Robert F. Fetty, Mayor, Town of West Union, to Barbara Taylor, Director, WVBPH/Office of Environmental Health Services, Oct. 28, 2009
115. Posting of Ken Ward Jr. to Sustained Outrage: A Gazette Watchdog Blog
116. Letter from Louanne McConnell Fatora to Governor Manchin, West Highlands Conservancy (Aug. 30, 2009)
117. U.S. Energy Information Administration, Number of Producing Gas Wells (2009)
118. Bureau of Land Management, BLM FY 2009 Budget Justifications III-1834 (2009)
119. Hannah Wiseman, *Untested Waters: The Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation*, 20 Fordham Environmental. Law Review (2009)
120. Texas Railroad Commission, Newark, East (Barnett Shale) Field, Drilling Permits Issued
121. Newark, East (Barnett Shale) Drilling Permits Issued (1993-2009), Texas Railroad Commission
122. Industry Sets Record For Drilling, Well Completions, Land Letter, Jan. 18, 2007
123. *API: US Drilling at 21-year High in 1Q*, Oil & Gas Journal, May 7, 2007
124. Utah Department of Natural Resources, Division of Oil, Gas and Mining, Produced Water Disposal(2007)
125. EPA, Region 8, Oil and Gas Environmental Assessment Report 1996–2002 (2003)
126. Statement of Commissioner William Olson before the New Mexico Oil Conservation Division, Apr. 16, 2008, OCD Document Image 14015\_657\_CF[1]
127. “Governor Bill Richardson Announces Oil and Gas Drilling Activity in New Mexico Is Strong: *Environmental regulations are not driving business away*,” State of New Mexico, Press Release, May 19, 2010
128. Dorsey Rogers, Gary Fout & William A. Piper, New Innovative Process Allows Drilling Without Pits in New Mexico (2006)
129. Oil & Gas Accountability Project, Alternatives to Pits

130. Oil & Gas Accountability Project, Notice of Errata in the Oil & Gas Accountability Project's Closing Argument and Proposed Changes, *Re: Case 14015: Application of New Mexico Oil Conservation Division for Repeal of Existing Rule 50 Concerning Pits, etc.*, Dec. 11, 2007, OCD Document Image No.14015\_654\_CF[1]
131. Dorsey Rogers, Dee Smith, Gary Fout & Will Marchbanks, *Closed-loop drilling system: A Viable Alternative to Reserve Waste Pits*, World Oil, Dec. 2008
132. Exhibit 8, Closed-Loop Drilling Case Studies, *Re: Case 14015: Application of New Mexico Oil Conservation Division for Repeal of Existing Rule 50 Concerning Pits, etc.*, OCD Document Image No. 14015\_637\_[CF]1
133. Abrahm Lustgarten, *Underused Drilling Practices Could Avoid Pollution*, ProPublica, Dec. 14, 2009
134. U.S. Fish & Wildlife Service, *Wildlife Mortality Risk in Oil Field Waste Pits*, U.S. FWS Contaminants Information Bulletin (2000)
135. Bureau of Land Management, *The Gold Book: Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development* (4th ed. 2007)
136. Controlled Recovery Inc.'s Written Closing Argument, *Re: Case 14015: Application of New Mexico Oil Conservation Division for Repeal of Existing Rule 50 Concerning Pits, etc.*, Dec. 10, 2007
137. Lowell Brown, *Officials Give Few Answers to Argyle*, Denton Record-Chronicle, Jan. 30, 2010
138. E&P Forum/UNEP Technical Publication, *Environmental Management in Oil and Gas Exploration and Production: An Overview of Issues and Management Approaches* (1997)
139. STW Resources, Inc., *Contaminated Waste Water Reclamation Opportunities*
140. Railroad Commission of Texas, News Release, *Commissioners Approve of Devon Water Recycling Project for the Barnett Shale*, July 29, 2008
141. *Energy Companies Strive to Reuse Water*, Weatherford Telegram, July 25, 2007
142. *Nine New Projects*, Oil & Gas Program Newsletter (U.S. Dept. of Energy, National Energy Technology Lab), Winter 2009

143. Katie Burford, *ExxonMobil Favors Fracing Disclosure, Environmental Group Welcomes Position from Oil Industry Giant*, Durango Herald, Apr. 19, 2010
144. Drilling Waste Management Information System, Drilling Waste Management Fact Sheet: Using Muds and Additives with Lower Environmental Impacts
145. Schlumberger, *Earth-friendly Green Slurry system for uniform marine performance*, March 2003
146. Rifle, Silt, New Castle Community Development Plan, January 1, 2006
147. EPA, RCRA Orientation Manual, Chapter III: RCRA Subtitle C—Managing Hazardous Waste, Hazardous Waste Identification.
148. Hazardous Waste Treatment Council v. U.S. EPA, 861 F.2d 277, 279 (D.C. Cir. 1988)
149. U.S. Dept. of Labor, Occupational Safety & Health Administration, Potential Flammability Hazard Associated with Bulk Transportation of Oilfield Exploration and Production (E&P) Waste Liquids, SHIB-03-24-2008
150. Janice Crompton, *Residents Reported Gas Odors Before Explosion*, Pittsburgh Post-Gazette, Apr. 1, 2010
151. Kathie O. Warco, *Fumes Ignite at Gas Well*, Observer-Reporter, Apr. 1, 2010
152. Earthworks, OCD's 2007 Pit Sampling Program: What is in That Pit?