

# Hydraulic Fracturing and Surface Water in the Tar Heel State

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## *Introduction*

A growing trend of natural gas production using hydraulic fracturing, or “fracking,” has been prevalent recently in the U.S. The new technology allows the excavation of an abundant amount of shale gas, which is present in dense geologic formations deep underground.<sup>1</sup> This type of gas is estimated to provide 20% of the U.S. natural gas supply by 2020.<sup>2</sup> A few years ago, natural gas was discovered in North Carolina’s Triassic Basin running through the center of the state. This geological formation covers approximately 785,000 acres of land.<sup>3</sup> It has been estimated that the amount of natural gas in North Carolina could supply the state with 5.6 years of its energy needs.<sup>4</sup> The exploration and production of gas, however, has been highly controversial within North Carolina. Some of the main issues surrounding hydraulic fracturing are the contamination to the local community’s water supply and increased pressures on the local infrastructure. Surface water is particularly vulnerable, as the production process requires a large amount of fluid to be pumped into the ground and, consequently, produces much wastewater that needs to be stored, transported and disposed. This paper will briefly cover the technical details surrounding surface water’s involvement with fracking and explore the applicable federal, state, and local laws to which surface water in North Carolina is subject in this process. An

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<sup>1</sup> *U.S. Shale Gas: An Unconventional Resource.*, HALLIBURTON 2 (2008), available at [http://www.halliburton.com/public/solutions/contents/shale/related\\_docs/H063771.pdf](http://www.halliburton.com/public/solutions/contents/shale/related_docs/H063771.pdf).

<sup>2</sup> *Hydraulic Fracturing Research Study*, ENVTL. PROT. AGENCY (June 2010), available at <http://www.epa.gov/safewater/uic/pdfs/hfresearchstudyfs.pdf>.

<sup>3</sup> *North Carolina Oil and Gas Study*, N.C. DEPT. OF ENVIRONMENT AND NATURAL RESOURCES (April 2012), available at [http://portal.ncdenr.org/c/document\\_library/get\\_file?uuid=a4546484-3b9c-4feb-90ef-ef29b8f337b2&groupId=14](http://portal.ncdenr.org/c/document_library/get_file?uuid=a4546484-3b9c-4feb-90ef-ef29b8f337b2&groupId=14).

<sup>4</sup> John Murawski, *Senate Passes Fracking Bill, But N.C. May Be Less Rich in Gas*, NEWS AND OBSERVER (June 6, 2012), available at <http://www.newsobserver.com/2012/06/06/2117412/federal-estimate-of-nc-gas-reserves.html>.

examination of future potential legislation in North Carolina will be presented using the suggestions of applicable state agencies.

### *Hydraulic Fracturing Process*

Hydraulic fracturing involves similar processes throughout all of the states. First, exploration establishes the locations of natural gas that are suitable for extraction.<sup>5</sup> Once these locations are established, a well is constructed onsite. Hydraulic fracturing wells can be drilled vertically, vertically then horizontally, or directionally.<sup>6</sup> Wells may extend from approximately 1,000 to 8,000 feet vertically and several thousands of feet horizontally.<sup>7</sup> The geologic formation is fractured by pumping fracking fluid into the ground at pressures greater than the rock strength.<sup>8</sup> Consequently, fissures are created in the rock to allow natural gas to escape through the well to the surface.<sup>9</sup> This fluid is composed of 98-99.5% water and sand, with the rest being chemical additives.<sup>10</sup> The purpose of these chemicals is to “thicken or thin the fluid, prevent corrosion of the well casing, kill bacteria or for other purposes.”<sup>11</sup> Several hundred chemicals have been identified by the fracking industry as possible additives.<sup>12</sup> Some of the most common compounds are displayed in the table below. Normally there are between six and twelve chemicals added to the water and sand mixture.<sup>13</sup> The composition of the fracking fluids greatly differs between well sites.<sup>14</sup> Approximately 9-35% of the water returns to the surface, as flowback, from the well in the two weeks following fracturing.<sup>15</sup> Additionally, once adequate

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<sup>5</sup> *U.S. Shale Gas*, *supra* note 1.

<sup>6</sup> *Hydraulic Fracturing Research Study*, *supra* note 2.

<sup>7</sup> *Id.*

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

<sup>9</sup> *Id.*

<sup>10</sup> *North Carolina Oil and Gas Study*, *supra* note 3.

<sup>11</sup> *Id.*

<sup>12</sup> *Id.*

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

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

<sup>15</sup> *Id.* at 5.

fissures are created and the well is in operation, there is still a small continuous stream of fluid flowing out of the well, which is called produced water.<sup>16</sup> The flowback typically contains chemicals from the fracking fluid and “salts, metals, and trace amounts of naturally occurring radioactive materials (NORM) that may be present in the water produced from the geologic formations.”<sup>17</sup>

Select Components of Flowback and Produced Water *					
Parameters (mg/L)	Flowback Water (first 2 weeks)	Produced Water (after 2nd week)	Parameters (mg/L)	Flowback Water (first 2 weeks)	Produced Water (after 2nd week)
Barium	0 – 10,000	0 – 20,000	Sulfate	0 – 1,000	0 – 5,000
Calcium	0 – 20,000	0 – 40,000	Carbonate	0 – 1,000	0 – 1,000
Sodium	2,000 – 100,000	4,000 – 135,000	Bicarbonate	100 – 6,000	100 – 6,000
TDS	5,000 – 250,000	10,000 – 336,000	Acetate	0 – 500	0 – 2,500
Ammonia-N	10 – 200	10 – 200	Propionate	0 – 100	0 – 400
Potassium	0 – 750	0 – 1,000	Butyrate	0 – 25	0 – 75
Magnesium	0 – 2,000	0 – 4,000	BTEX	0 – 100	0 – 100
Barium	0 – 10,000	0 – 20,000	Radionuclides	<i>No reliable data available</i>	
Strontium	0 – 5,000	0 – 10,000	pH	4 – 10	4 – 10
Iron	0 – 100	0 – 200	TSS	1 – 500	1 – 500
Chloride	3,000 – 150,000	6,000 – 200,000	Oil-in-Water	5 – 1,000	5 – 1,000

\*Sun et al., 2012  
TDS = total dissolved solids.

BTEX = benzene, toluene, ethylbenzene, and xylenes.  
TSS = total suspended solids.

**Figure 1. EPA Flowback and Produced Water Composition<sup>18</sup>**

### Hydraulic Fracturing and Surface Water

Between 2005 and 2009, the leading fourteen oil and gas companies used 780 million gallons of fracking fluid in their hydraulic fracturing operations.<sup>19</sup> This fluid is either stored deep in the earth or returns to the surface where it is disposed.<sup>20</sup> The complete process of accommodating the wastewater involves a variety of stresses on many parts of environment.

<sup>16</sup> North Carolina Oil and Gas Study, *supra* note 3.

<sup>17</sup> Adam Vann et al., *Hydraulic Fracturing: Selected Legal Issues*, 7-5700 Cong. Research Serv., 7 (July 16, 2013).

<sup>18</sup> Adrienne Beckman et al., *Considerations for Accepting Fracking Wastewater at Water Resource Recovery Facilities*, Water Environment Federation 3, [http://www.wef.org/uploadedFiles/Access\\_Water\\_Knowledge/Wastewater\\_Treatment/Fracking%20Factsheet%20Final\(1\).pdf](http://www.wef.org/uploadedFiles/Access_Water_Knowledge/Wastewater_Treatment/Fracking%20Factsheet%20Final(1).pdf) (last visited Jan. 9, 2014).

<sup>19</sup> Vann, *supra* note 17.

<sup>20</sup> *Hydraulic Fracturing Research Study*, *supra* note 2.

Hydraulic fracturing will put a considerable stress on the surface water supply in North Carolina. The North Carolina Division of Environment and Natural Resources (DENR) estimates that three to five million gallons will be used per horizontal drilling well.<sup>21</sup> This is the equivalent to a small North Carolinian city usage per day.<sup>22</sup> The quantity, however, can vary depending on the type of formation being fractured, as the EPA estimates fracking into coal bed formations requires 50,000 to 350,000 gallons of total water.<sup>23</sup> DENR, observing the Sanford sub-basin, stated that these quantities withdrawn should not be a major problem, as long as the rate of removal is not too large.<sup>24</sup> The agency elaborated, however, that precautions should be taken to insure withdrawals are not made during times of low water level.<sup>25</sup> In addition, DENR deemed that permitting should limit these withdrawals to a reasonable level.<sup>26</sup>

Proper disposal of the wastewater is a large concern for regulatory agencies, as improper practices could cause environmentally toxic surface water. As mentioned above, a considerable amount of flowback reemerges on the surface with a number of constituents. EPA has established six different types of acceptable injection wells for storage.<sup>27</sup> Oil and gas byproducts fall under Class II because of the large amount of brines in the flowback.<sup>28</sup> DENR is currently studying whether the underground composition of the soil is suitable for any type of storage.<sup>29</sup> Part of this discovery will include identifying areas that are not hydrologically linked to any groundwater sources.<sup>30</sup> One finding of the DENR, however, is that the rock in the Triassic Basin

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<sup>21</sup> *North Carolina Oil and Gas Study*, *supra* note 3.

<sup>22</sup> *Id.*

<sup>23</sup> *Hydraulic Fracturing Research Study*, *supra* note 2.

<sup>24</sup> *North Carolina Oil and Gas Study*, *supra* note 3.

<sup>25</sup> *Id.*

<sup>26</sup> *Id.*

<sup>27</sup> Vann, *supra* note 17.

<sup>28</sup> *Id.*

<sup>29</sup> *North Carolina Oil and Gas Study*, *supra* note 3.

<sup>30</sup> Amy Pickle & Sen. Bob Rucho, Address to Carolina Law Republicans (Oct. 7, 2013).

is quite permeable, unlike other shale reservoirs.<sup>31</sup> This presents a problem in regards to leaks in the storage tanks. NC General Statute § 143-214.2 (b) disallows injection straight into wells, without tanks.<sup>32</sup>

There are also a considerable number of options in regards to aboveground storage. The industry standard is to contain all of the surface water fluids in either pits or tanks.<sup>33</sup> These holding areas are used as a reservoir for fracking fluid while the well is in operation, storage for flowback, and emergency spillover.<sup>34</sup> These tanks and pits are composed of either steel or concrete.<sup>35</sup>

### *Current Applicable Legislation*

Fracking fluid and flowback are concerns for possible contamination of surface water, and there have been federal laws to address this problem. A large amount of fracking fluid and wastewater, however, are exempt from federal environmental laws due to the Energy Policy Act of 2005.<sup>36</sup> Many states, such as North Carolina, are in the process of developing regulations to fill these gaps left by the exemptions.

### *Safe Drinking Water Act (SDWA)*

The SDWA regulates any diesel fuel that is used in the fracking fluid. Specifically, it is subject to the Class II Underground Injection Control (UIC). A certain percentage of the liquid must meet specified characteristics to be considered diesel.<sup>37</sup> The Energy Policy Act amended the SDWA not to include “(i) the underground injection of natural gas for purposes of storage; and (ii) the underground injection of fluids or propping agents (other than diesel)” in the

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<sup>31</sup> *North Carolina Oil and Gas Study*, *supra* note 3.

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

<sup>33</sup> *Fracturing Fluid Management*, FRAC FOCUS (2013), available at <http://fracfocus.org/hydraulic-fracturing-how-it-works/drilling-risks-safeguards>.

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

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

<sup>36</sup> See Vann, *supra* note 17.

<sup>37</sup> *Id.*

regulations of UICs.<sup>38</sup> States have an option of regulating these wells themselves or transferring authority to the EPA.<sup>39</sup>

#### *Clean Water Act (CWA)*

A North Carolina NPDES permit is necessary for any discharge of fracking wastewater into state water.<sup>40</sup> This allows for discharges otherwise forbidden by Section 301(a) of the CWA.<sup>41</sup> The discharge standards vary, as they are based off the technology available to control effluents and the characteristics of the receiving waters.<sup>42</sup> Many companies, however, decide not to discharge water in accordance to a NPDES permit, but instead send it to a local municipal water plant.<sup>43</sup> A plant will only receive wastewater that adheres to the treatment facility's standards.<sup>44</sup> The wastewater normally has too high a Total Dissolved Substance (TDS).<sup>45</sup> Thus, many standards require onsite treatment at the well before accepting the wastewater.<sup>46</sup>

#### *Resource Conservation and Recovery Act (RCRA)*

RCRA limits the unused fracturing fluids and acids if they portray hazardous characteristics.<sup>47</sup> The EPA determined that hydraulic fracturing processes involving flowback and drilling fluids would not be subject under Subtitle C of RCRA.<sup>48</sup> The agency, however, has stated that they would pursue a three-pronged program to develop a plan to treat wastewater:

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<sup>38</sup> *Id.*

<sup>39</sup> *Id.* at 6.

<sup>40</sup> *Id.* at 7.

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

<sup>42</sup> *Id.*

<sup>43</sup> *Id.* at 9.

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

<sup>45</sup> *Id.* at 8.

<sup>46</sup> *Management of Exploration and Production (E&P) Waste Management: Wastewater*, N.C. DEPT. OF ENVIRONMENT AND NATURAL RESOURCES, [http://portal.ncdenr.org/c/document\\_library/get\\_file?uuid=08d32318-b2a0-4239-b4a2-b794890e3f10&groupId=8198095](http://portal.ncdenr.org/c/document_library/get_file?uuid=08d32318-b2a0-4239-b4a2-b794890e3f10&groupId=8198095) (last visited Jan. 8, 2014)).

<sup>47</sup> Vann, *supra* note 17.

<sup>48</sup> *Id.*

improve federal regulatory programs under RCRA Subtitle D, SDWA, and CWA; help improve their own regulatory programs; and work with Congress develop any further needed legislation.<sup>49</sup>

*Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)*

CERCLA holds facility operators, hazardous waste disposers, and transporters of chemicals liable for any spills that might occur.<sup>50</sup> These liable parties must pay retributions to cover cleanup costs, effects to the natural environment, and site studies expenses.<sup>51</sup> The party is not liable, however, if it is on a list of exemptions. The exemptions are not for the natural gas industry in general, but only for the fuels used in hydraulic fracturing.<sup>52</sup> These chemical exemptions are defined by those that are excused in the SDWA, CWA, and other adequate federal statutes.<sup>53</sup> Communities can also request, through CERCLA, for the EPA to complete studies in their area for groundwater contamination.<sup>54</sup> The agency has not confirmed a link between hydraulic fracturing and the release of hazardous materials to the surrounding groundwater.<sup>55</sup>

*National Environmental Protection Act (NEPA)*

NEPA requires the government to investigate the environmental impacts of its legislation. The effects are reported in an Environmental Impact Assessment (EIA).<sup>56</sup> A judge found that an EIA was reasonable to complete on the hydraulic fracturing operation on the Monterey Shale because:

- (1) hydraulic fracturing is highly controversial because of its potential effects on health and the environment;
- (2) the proposed lease sale would affect public health

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<sup>49</sup> *Id.* at 10.

<sup>50</sup> *Id.* at 12.

<sup>51</sup> *Id.*

<sup>52</sup> *Id.* at 13.

<sup>53</sup> *Id.* at 14.

<sup>54</sup> *Id.* at 14–15.

<sup>55</sup> *Id.* at 15.

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

and safety because of the risk of water pollution; and (3) the environmental impacts of hydraulic fracturing are uncertain.<sup>57</sup>

Because NEPA is only applicable on the federal level, however, it can only apply to hydraulic fracturing on federal land.<sup>58</sup>

#### *The Emergency Planning and Community Right-to-Know Act (EPCRA)*

EPCRA requires owners responsible for the storage of certain hazardous chemicals to comply with emergency planning, notification, and storage requirements.<sup>59</sup> This Act also creates a chain of command between federal, state, and local authorities to manage emergency hazardous spills.<sup>60</sup> A locality is required to have a minimal level of response for chemicals that are considered extremely hazardous.<sup>61</sup> Furthermore, most states require having detailed statistics of the identification and amounts of the chemicals that are not a trade secret.<sup>62</sup>

#### *Occupational Safety Health Act (OSHA)*

OSHA mandates hydraulic fracturing well owners to create a Hazard Communication Standard (HCS).<sup>63</sup> This standard communicates to employees the potential health effects of toxic substances involved in fracking.<sup>64</sup> Currently the standards only communicate the identity of certain hydraulic fracturing fluids that are deemed hazardous and not considered a trade secret.<sup>65</sup>

#### *Current North Carolina Law*

Because of the new presence of fracking in the state, North Carolina is currently formulating the applicable regulatory framework to protect N.C. citizens and environment. It is

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<sup>57</sup> Vann, *supra* note 17.

<sup>58</sup> *Id.* at 15–16.

<sup>59</sup> *Id.* at 24.

<sup>60</sup> *Id.*

<sup>61</sup> *Id.*

<sup>62</sup> *Id.*

<sup>63</sup> *Id.* at 23.

<sup>64</sup> *Id.* at 23–24.

<sup>65</sup> *Id.*

important to understand the structure of these new pieces of legislation to anticipate how state law, and the agencies tasked with developing it, will affect North Carolinian surface water quality.

Until recently, the applicable North Carolina law regarding oil and gas drilling was from 1945.<sup>66</sup> Article 27 of Chapter 113 in the General Statutes, which has been recently amended, prohibits the injection of wastes into wells (G.S 143-214.2) and drilling that substantially differs from the vertical plain (G.S 113-393).<sup>67</sup> There are a series of recently enacted state legislations to amend these outdated laws and prepare for hydraulic fracturing.

The first bill passed by the N.C. General Assembly was House Bill 242. This piece of legislation directed the DENR to study the multiple different technical facets of the possible social and environmental impacts of fracking.<sup>68</sup> In addition, the agency is directed to complete at least two public hearings in localities affected by oil and gas operations. DENR will inform the communities of legal, environmental, economic and consumer protection measures, including land and mineral rights.<sup>69</sup> Further, the N.C. Consumer Protection Division of the Department of Justice is tasked with studying the relevant consumer protections and legal issues.<sup>70</sup> Their findings will then be submitted to the Environmental Review Commission.<sup>71</sup> Finally, this bill establishes that well owners identify impacts of drilling on affected land, post notice

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<sup>66</sup> Jennifer McGinnis, *House Bill 242: Nat. Gas/Bond/Fees/Studies*, NCGA RESEARCH DIVISION 1 (May 26, 2011), available at <http://www.ncleg.net/documentsites/committees/HouseFinance/Meeting%20Documents/5-26-2011/H242%20Summary.pdf>.

<sup>67</sup> *Id.*

<sup>68</sup> *Id.* at 1–2.

<sup>69</sup> *Id.* at 2.

<sup>70</sup> *Id.*

<sup>71</sup> *Id.*

requirements for entry onto the property, and adhere to maximum lease terms.<sup>72</sup> The bill became effective as of June 23, 2011.<sup>73</sup>

The second bill, Senate Bill 820, was in response to the findings of the DENR.<sup>74</sup> First, it amended the past legislation prohibiting horizontal drilling.<sup>75</sup> It does not permit drilling until the General Assembly approves the regulatory measures suggested by the relevant agencies.<sup>76</sup> Additionally, and probably most importantly, the Bill reinstated the Mining and Energy Commission (MEC).<sup>77</sup> This group is composed of 15 members representing mining, environmental, and academic backgrounds.<sup>78</sup> The MEC reports to the Joint Legislative Commission on Energy Policy and the Environmental Review Commission.<sup>79</sup> The MEC is charged with submitting hydraulic fracturing regulations by October 1, 2014, for the General Assembly to approve.<sup>80</sup> The bill lists specific items of concern required to preserve surface water quality: a baseline measurement of surface water, prohibitions of certain chemicals, disclosure of all chemicals except those described as trade secrets under G.S 152(3) and G.S 132-1.2, and storm water controls to protect local infrastructure.<sup>81</sup> Finally, this bill establishes the presumption of local water contamination to natural gas rigs.<sup>82</sup> Consequently, the owners of these wells will be required to supply local residents with fresh, clean water if there is any contamination from drilling activities.<sup>83</sup>

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<sup>72</sup> *Id.*

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

<sup>74</sup> Jennifer McGinnis, *Senate Bill 820: Clean Energy and Economic Security Act*, NCGA RESEARCH DIVISION 1-2 (September 12, 2012), available at [www.sog.unc.edu/sites/www.sog.unc.edu/files/S820%20-%20Summary%20-%20Fracking\\_0.pdf](http://www.sog.unc.edu/sites/www.sog.unc.edu/files/S820%20-%20Summary%20-%20Fracking_0.pdf).

<sup>75</sup> *Id.*

<sup>76</sup> *Id.*

<sup>77</sup> *Id.* at 2.

<sup>78</sup> *Id.*

<sup>79</sup> *Id.*

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

<sup>81</sup> *Id.*

<sup>82</sup> *Id.* at 5.

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

The most recent passed bill was Senate Bill 76.<sup>84</sup> It encourages the governor to develop regional compacts for offshore drilling.<sup>85</sup> Additionally, it charges the MEC and DENR to develop a master environmental permit for exploration and development.<sup>86</sup> Finally, it requires the owner of a well to compensate an affected local resident the cost of reclaiming his or her land after the natural gas operations are finished.<sup>87</sup>

Local laws are allowed to dictate anything not regulated by the federal or state levels. This normally involves only the zoning of operations that dictate where the location of hydraulic fracturing processes.<sup>88</sup> A local law must pass the “Operational Conflicts Test,” which deems that it cannot break a state law on its face or in application.<sup>89</sup>

A significant question exists on the local level to the extent that tortuous suits can be brought against hydraulic fracturing companies. Studies have commented that scientific research needs to be completed to understand the extent of a reasonable duty of care for fracking activities.<sup>90</sup> Currently, if a local resident wanted to sue a well company, they have to provide a prima facie case of exposure, injury, and causation.<sup>91</sup> This would have to be supported by expert opinions on the nature of the substance and the plaintiff’s extensive medical records.<sup>92</sup> Additionally, the court has struggled with the definition of inherently dangerous activity.<sup>93</sup> If all discovery and production activities for natural gas are classified under this term, then the well

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<sup>84</sup> Jennifer McGinnis, *Senate Bill 76: Domestic Energy Jobs Act*, NCGA RESEARCH DIVISION (Feb. 12, 2013), available at <http://ncleg.net/documentsites/committees/senatefinance2013/Meeting%20Documents/2-13-2013/S76-Domestic%20Energy%20Jobs%20Act%20Summary.pdf>.

<sup>85</sup> *Id.* at 1.

<sup>86</sup> *Id.* at 1–2.

<sup>87</sup> *Id.* at 3.

<sup>88</sup> Vann, *supra* note 17.

<sup>89</sup> *Id.*

<sup>90</sup> *Id.* at 29–31.

<sup>91</sup> *Id.* at 29.

<sup>92</sup> *Id.*

<sup>93</sup> *Id.* at 30–31.

owners will be liable for any negative impact to the local community, even if they exercised the highest duty of care.<sup>94</sup>

### *Future Legislative Possibilities*

The N.C. DENR has released with an extensive list of suggestions about controlling wastewater produced from fracking operations. A cradle-to-grave approach is recommended for the full lifetime of a well.<sup>95</sup> This includes “siting requirements, facility designs . . . . operating plan- Groundwater Monitoring, and a Closure Plan- to include Site Investigation.”<sup>96</sup> In addition, emphasis has been placed on accommodating EPA’s rule that, after January 1, 2015, no company can flare excessive gas.<sup>97</sup>

DENR explored how N.C. regulation would accommodate the variability of fracking fluid from its original state compared to flowback. They first give recommendations on the schematics of the pits. The distance between the pit and any surface water should be maximized. They suggest considering Mississippi’s rule of at least 100 feet separating the pit and surface water.<sup>98</sup> The bottom of the pit should be at least 10 feet above the seasonal water table.<sup>99</sup> A suggestion is made that the reservoir be able to accommodate a 10-year, 24-hour storm without overtopping.<sup>100</sup> DENR advises 2 feet of extra height be included to the reservoir to accommodate this storm.<sup>101</sup> There needs to be an emergency reservoir to manage overflow.<sup>102</sup> In addition, the tanks or pits should not receive any storm water runoff from surrounding areas.<sup>103</sup> The slope of

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<sup>94</sup> *Id.*

<sup>95</sup> *Management of Exploration and Production (E&P) Waste Management*, *supra* note 46.

<sup>96</sup> *Id.* at 8.

<sup>97</sup> *Id.* at 1.

<sup>98</sup> *Id.* at 4.

<sup>99</sup> *Id.*

<sup>100</sup> *Id.*

<sup>101</sup> *Id.* at 8.

<sup>102</sup> *Id.*

<sup>103</sup> *Id.*

the sides should be at least 2:1 and need to include a clay, synthetic or concrete liner.<sup>104</sup> An additional liner should be located below the top layer to prevent any slippage.<sup>105</sup>

DENR also states that oil and water based fracking fluid should be separated.<sup>106</sup> The agency suggests that record keeping of all fluids disposed or transported off-site should occur for at least a three-year period.<sup>107</sup> Produced water should also be treated for suspended solids before being placed in reservoir to prevent crude oil or condensate from entering the pit.<sup>108</sup> Drilling fluids, or “muds,” should be disposed in a permitted commercial solid-waste facility or be subject to burial.<sup>109</sup> Proper records of disposing water should also be kept, as the sender and receiver must properly document the location, identity of transporter, type, and volume of waste, and many other items.<sup>110</sup> DENR also suggested such disposal methods that have been used in other states, such as road spreading for effluent less than 3500 mg/l and evaporation at a centralized waste management facility (Colorado).<sup>111</sup> Additionally, the agency goes on to state that they do not believe NORMs will be a problem in the Triassic Basin, but they will be subject to 49 CFR 173 if they reach a certain threshold.<sup>112</sup> Finally, the agency suggests that surface or irrigation applications of produced water over a piece of land would be acceptable, as long as it follows 15A NCAC 02T rules.<sup>113</sup>

The NPDES is also considering pretreatment options such as membrane filtration, reverse osmosis, and thermal distillation to minimize the impact of the wastewater.<sup>114</sup> Another option is

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<sup>104</sup> *Id.*

<sup>105</sup> *Id.*

<sup>106</sup> *Id.* at 5.

<sup>107</sup> *Id.*

<sup>108</sup> *Id.* at 7.

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

<sup>110</sup> *Id.*

<sup>111</sup> *Id.* at 6.

<sup>112</sup> *Id.*

<sup>113</sup> *Id.* at 7–8.

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

land application, which involves spreading the wastewater over a parcel of vegetated land.<sup>115</sup> The waste can then be treated through natural processes, such as bioremediation and soil infiltration. Tests by some agencies, however, have unfortunately resulted in the waste from gas operations killing the vegetation.<sup>116</sup> Pre-treatment is recommended before land application, as the wastewater contains high levels of salt and chlorides.<sup>117</sup> Many companies are also trying to minimize the total amount of wastewater from their processes by developing close-looped systems that recycle the water.<sup>118</sup>

DENR suggests that the responsible company should record all spills, leaks, or releases.<sup>119</sup> A spill of over 5 barrels of material should include a verbal report to the state within 24 hours.<sup>120</sup> Additionally, a plan of how the spill was investigated and mitigated should be sent to the state within 10 days.<sup>121</sup> Finally, if a spill went into a waterway, the N.C. Department of Water Quality should be consulted.<sup>122</sup>

DENR suggests the surrounding pits to the rig be closed between 14 and 90 days after operations cease.<sup>123</sup> The closure involves filling the pits, unless all of the fluids, solids, and liners have been already properly disposed.<sup>124</sup> All constituents left in the pit must be dewatered until they are below a certain concentration.<sup>125</sup> This concentration should be determined by following other states' examples by using Colorado's Table 910-1 or Arkansas's 3% dry weight

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<sup>115</sup> *North Carolina Oil and Gas Study*, *supra* note 3.

<sup>116</sup> Amy Pickle & Sen. Bob Rucho, Address to Carolina Law Republicans (Oct. 7, 2013).

<sup>117</sup> *North Carolina Oil and Gas Study*, *supra* note 3.

<sup>118</sup> *Id.*

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

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

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

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

<sup>123</sup> *Id.* at 7.

<sup>124</sup> *Id.*

<sup>125</sup> *Id.*

standard.<sup>126</sup> Further, the pit should be filled with native topsoil. Finally, the notice of the closure should be sent to the state.<sup>127</sup>

An additional potential change to the legislative landscape are EPA's classification of toxic substances under the Toxic Substance Control Act, which requires manufacturers to create an understanding of how the chemicals used in their processes affect human health.<sup>128</sup>

Additionally, N.C. has to develop a plan to accommodate storm water runoff caused by the increased amount of infrastructure in oil and gas operations, as this type of surface water was exempted from the CWA.<sup>129</sup>

### *Conclusion*

The merging of federal, state, and local authorities will regulate the relationship between surface water and hydraulic fracturing. The federal level seems to be stagnant and unobtrusive for the near future. Thus, North Carolina will be charged with providing the necessary measures to protect human health and environmental quality from fracking processes in the state. The responsible agencies are busy developing appropriate measures for the General Assembly to eventually approve, so hydraulic fracturing processes may start in the state. Much work is still to be completed to adequately protect the citizens of North Carolina while allowing the industry to thrive and be productive.

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<sup>126</sup> *Id.*

<sup>127</sup> *Id.*

<sup>128</sup> Vann, *supra* note 17.

<sup>129</sup> *Id.*