

# Fracking's Radioactive Impact on Pennsylvania

Hydraulic fracturing or fracking is a process by which fossil fuel corporations inject a slurry of high-pressure water, sand, and often proprietary chemicals into a well to unlock natural gas and other hydrocarbons. The harms of this practice are well documented nationally, but Pennsylvania's combination of unique radioactive geology and woefully inadequate regulation puts residents at particular risk of toxic environmental pollution. Fracking creates large volumes of salty, radioactive, and chemically contaminated wastewater that flows back up the well to the surface. Pennsylvania allows this waste to be dumped on roads, shoved back underground, and in many cases simply hauled to the landfill. This approach has meant that Pennsylvania has remained committed to environmentally destructive and economically lackluster fracking.

## Fracking's Toxic Backwash

Fracking fluid injections are exempt from the rules of the U.S. Safe Drinking Water Act, and companies can withhold the identity of chemicals used to frack a well because they are "trade secrets."<sup>1</sup> Of the disclosed chemicals applied in fracking, 14 are known or possible human carcinogens, and many are linked to developmental health and reproductive problems.<sup>2</sup>

In addition to the original fluids that are pumped underground, drilling and fracking can bring to the surface, through the produced wastewater, naturally occurring contaminants such as brines and radioactive material from underground.<sup>3</sup> The precise composition of the wastewater varies depending on the geology of the extraction site,<sup>4</sup> but it can contain salts (chlorides, bromides, and sulfides of calcium, magnesium, and sodium); metals (barium, manganese, iron, and strontium); oil, grease, and dissolved organics (benzene and toluene); and radioactive material (radium-226).<sup>5</sup> These chemicals can cause cancer, disrupt the endocrine system, affect the nervous, immune, and cardiovascular systems, and affect sensory organs and the respiratory system.<sup>6</sup>

According to data from the Pennsylvania Department of Environmental Protection (DEP), frackers generated 63 million barrels of liquid waste in 2024.<sup>7</sup> That reflects a 46 percent increase since 2014.<sup>8</sup> Increased pollution goes hand in hand with declining employment. While the industry now produces 74 percent more natural gas, it employs only 17,415 people, down 46 percent from 2014.<sup>9</sup> This means that for every job in the state, the industry generates 3,635 barrels of liquid waste (compared to 1,347 barrels per job in 2014).<sup>10</sup>

## The Fossil Fuel Industry's Special Gift to Pennsylvania: Radioactive Sludge

In addition to natural gas and toxic brine, fracking has unlocked a significant new source of naturally occurring radioactive materials (NORM).<sup>11</sup> NORM are radioactive elements and radionuclides such as radium and thorium, and their decay products include radon, a radioactive gas.<sup>12</sup> When human activity exposes or concentrates these materials, they are known as technologically enhanced naturally occurring radioactive materials (TENORM).<sup>13</sup>

TENORM are an especially large problem in Pennsylvania, which, as a result of natural geology, has the third highest indoor radon levels of any state.<sup>14</sup> Around 40 percent of homes in the state have indoor radon levels that exceed federal guidelines.<sup>15</sup> A study of 37 public schools in eastern Pennsylvania found that all children at these schools were exposed to radon levels that exceeded the U.S. Environmental Protection Agency (EPA) action threshold.<sup>16</sup>

The oil and gas industry is a significant source of TENORM.<sup>17</sup> Water brought up from the Marcellus shale reservoir during fracking has uniquely large amounts of radium.<sup>18</sup> Radium releases radon gas as it decays.<sup>19</sup> Some of this radioactive waste takes thousands of years to fully decay.<sup>20</sup> Even though it is naturally occurring, radon is harmful for the environment.<sup>21</sup> Radioactive isotopes can also bioaccumulate as they move up the food chain, wreaking further havoc on wild animals.<sup>22</sup>

Radon is the second leading cause of lung cancer in Americans behind only smoking, responsible for more deaths annually than drunk driving.<sup>23</sup> According to the U.S. EPA, there is no safe level of exposure to radon.<sup>24</sup> Recent research has also shown that radon exposure can cause childhood leukemia.<sup>25</sup> Radon contamination of drinking water is associated with developing internal organ cancer, particularly stomach cancer.<sup>26</sup>

## There Is No Solution to Fracking's Wastewater Problem

Sometimes, fracking wastewater is used to frack more wells, but it can also be discharged into surface waters or stored in pits until it evaporates into the atmosphere or percolates into the ground.<sup>27</sup> During transportation and management of wastewater, storage tanks can leak and trucks and pipelines can spill.<sup>28</sup> Radioactive material can become concentrated when wastewater is stored in storage pits, ponds, or surface impoundments, a common practice prior to disposal in landfills or underground injection.<sup>29</sup> Contaminants can evaporate from open-air waste ponds,<sup>30</sup> and people can be exposed to radon that off-gases from impoundment sludge.<sup>31</sup> Microbial activity can also cause corrosion, compromising well equipment and causing leaks.<sup>32</sup>

There are no safe ways to dispose of or manage fracking wastewater.<sup>33</sup> Nationally, 98 percent of fracking wastewater is injected into a disposal well.<sup>34</sup> But this practice can put aquifers and drinking water at risk and has been linked to increased earthquake activity.<sup>35</sup>

It is incredibly difficult to safely manage fracking wastewater at treatment facilities.<sup>36</sup> In Pennsylvania, sewage treatment plants that are supposed to treat local municipal wastewater and industrial discharges have been used to treat fracking wastes.<sup>37</sup> This process has been ineffective, with heavy metals, radionuclides, salts, and other fracking waste contaminants passing through the treatment systems.<sup>38</sup> High salt content interferes with water treatment technologies by killing

microbes and fouling filters.<sup>39</sup> Dedicated fracking wastewater treatment facilities also accumulate and discharge radionuclides.<sup>40</sup> One study found that sediments located near a discharge point of a Pennsylvania treatment plant that had accepted waste from the oil and gas industry contained radioactive material that was 200 times the level found in sediments at other locations.<sup>41</sup>

Commonly used testing methods can underestimate the radioactivity of fracking wastewater from the Marcellus shale.<sup>42</sup> One study found that improper testing can underestimate the radioactivity of Marcellus wastewater fivefold.<sup>43</sup> While testing focuses on radium, the Marcellus shale contains other radionuclides.<sup>44</sup> This can mean that regulators, water treatment facilities, and oil and gas corporations unknowingly handle radioactive waste.<sup>45</sup> Meanwhile, the U.S. EPA does not have the authority to regulate wastewater as it is generated.<sup>46</sup>

## Pennsylvania Allows Fracking Waste at Landfills

Wastewater injection can be expensive. To get around this, frackers in Pennsylvania are allowed to dispose of fracking waste that is “absorbed” by wood chips or sawdust.<sup>47</sup> Solid waste (drill cuttings) may also be sent to the landfill, but sometimes it is simply buried near the gas well.<sup>48</sup> Predictably, this radioactivity leaches out and creates highly radioactive liquid runoff.<sup>49</sup> Landfills are not designed for fracking waste, and potential fracking waste leaks from landfills are not routinely monitored.<sup>50</sup>

Waste from management facilities in Pennsylvania has spilled into rivers and streams.<sup>51</sup> In one case, a landfill submitted an application to dump treated runoff water directly into the Monongahela River.<sup>52</sup> Nearby communities are then exposed to this pollution from evaporation, soil contamination, and contact with surface water and groundwater.<sup>53</sup> Radium levels in water bodies downstream of landfills that accepted fracking waste were four times higher than radium levels in waters upstream of those landfills.<sup>54</sup> The streams with the largest changes in radium had classic chemical fingerprints of oil and gas wastewater.<sup>55</sup>

## Frackers in Pennsylvania Dump Fracking Waste on Roads

In Pennsylvania, oil and gas wastewater has been used for decades for dust control on dirt roads, even though the effectiveness of this practice was not studied until recently.<sup>56</sup> A 2022 study by researchers at Penn State University found that oil and gas wastewater was not more effective at dust suppression than rainwater.<sup>57</sup> In fact, the high sodium content in wastewater is likely to destabilize gravel roads and increase long-term maintenance costs.<sup>58</sup> These findings are broadly consistent with other recent studies that find wastewater to be as or less effective than rainwater at dust suppression and dramatically less effective than commercial products designed for this purpose.<sup>59</sup>

People can inhale radioactive materials and toxic chemicals that evaporate or mix with dust on unpaved roads.<sup>60</sup> Oil and gas brine also leaves radium behind on the roads.<sup>61</sup> Among alternatives, soybean oil has proven to be more effective at dust suppression than both wastewater and commercially available dust suppressants.<sup>62</sup> After rain, wastewater used for de-icing can run off of roads, bringing radium with it.<sup>63</sup>

The Pennsylvania DEP theoretically ended road spreading of fracking waste in 2016 and outlawed spreading of waste from conventional gas wells in 2018.<sup>64</sup> However, in rural communities the

practice is still widespread, occurring without DEP permission.<sup>65</sup> Long after the 2016 ban, corporations have continued to claim that they dispose of fracking waste through road application, and local government officials discuss sourcing wastewater from these companies for dust suppression.<sup>66</sup> The oil and gas lobby has also mounted full-throated opposition to a bill that would ban the practice by making oil and gas waste illegal to “beneficially reuse” through road application.<sup>67</sup>

Blatant disregard of these regulations should come as no surprise to those familiar with the state’s oil and gas industry. According to the Pennsylvania DEP, the oil and gas industry exhibits a “culture of non-compliance” with environmental regulations.<sup>68</sup> Fracking waste records at landfills do not match records of fracking waste deliveries to landfills.<sup>69</sup> This means that the waste is likely either lost in transport or disposed of in a different location.<sup>70</sup>

## Pennsylvania’s Government Fails to Protect Residents

While Pennsylvania Governor Josh Shapiro gained notoriety for his scrutiny of the oil and gas industry as attorney general, he has failed to follow through as governor.<sup>71</sup> Few of the recommendations in Shapiro’s 2020 attorney general report on the state’s failure to regulate fracking had been implemented five years later.<sup>72</sup> Instead, the administration has promoted a purely voluntary deal with fracker CNX Resources as a model for the industry.<sup>73</sup>

Failure to regulate the industry results in environmental disasters. Researchers have found increasing levels of radon in houses near Marcellus shale fracking sites.<sup>74</sup> In August 2025, a fracking wastewater processing company leaked 16,000 gallons of an oily substance, some of which ended up in the Susquehanna River.<sup>75</sup> An earlier DEP investigation found that leakage-warning systems at the facility were inoperable or even disconnected, but despite this investigation, the DEP failed to take action that may have prevented the ensuing leak.<sup>76</sup>

This lack of will to regulate is up against a notoriously hard-to-regulate industry. Tracking of leaks in Pennsylvania is challenging, as the state’s DEP provides only limited fluid sample information to researchers.<sup>77</sup> The Pennsylvania DEP does not have an up-to-date public database of containment pits for wastewater.<sup>78</sup> The composition of produced water from fracking can vary even at the same well.<sup>79</sup> Pennsylvania must step up to protect residents from these dangerous contaminants.

## Endnotes

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