America's Radioactive Secret

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Oil-and-gas wells produce nearly a trillion gallons of toxic waste a year. An investigation shows how it could be making workers sick and contaminating communities across America

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Excerpts from the story:

Radium, typically the most abundant radionuclide in brine, is often measured in picocuries per liter of substance and is so dangerous it's subject to tight restrictions even at hazardous-waste sites. The most common isotopes are radium-226 and radium-228, and the Nuclear Regulatory Commission requires industrial discharges to remain below 60 for each.

In an investigation involving hundreds of interviews with scientists, environmentalists, regulators, and workers, *Rolling Stone* found a sweeping arc of contamination — oil-and-gas waste spilled, spread, and dumped across America, posing under-studied risks to the environment, the public, and especially the industry's own employees. There is little public awareness of this enormous waste stream, the disposal of which could present dangers at every step — from being transported along America's highways in unmarked trucks; handled by workers who are often misinformed and underprotected; leaked into waterways; and stored in dumps that are not equipped to contain the toxicity. Brine has even been used in commercial products sold at hardware stores and is spread on local roads as a de-icer.

"Essentially what you are doing is taking an underground radioactive reservoir and bringing it to the surface where it can interact with people and the environment," says Marco Kaltofen, a nuclear-forensics scientist at Worcester Polytechnic Institute.

Radioactivity was first discovered in crude oil, from a well in Ontario, as early as 1904, and radioactivity in brine was reported as early as the 1930s.

"There is no one federal agency that specifically regulates the radioactivity brought to the surface by oil-and-gas development," an EPA representative says. In fact, thanks to a single exemption the industry received from the EPA in 1980, the streams of waste

generated at oil-and-gas wells — all of which could be radioactive and hazardous to humans — are not required to be handled as hazardous waste.

Penn State **researchers have shown** that in streams and creeks, radium can build up in sediment to levels that are hundreds of times more radioactive than the limit for topsoil at Superfund sites. Texas-based researcher Zac Hildenbrand has shown that brine also contains volatile organics such as the carcinogen benzene, heavy metals, and toxic levels of salt, while fracked brine contains a host of additional hazardous chemicals. “It is one of the most complex mixtures on the planet,” he says.

Silverio Caggiano, a near 40-year veteran of the Youngstown fire department and a hazardous-materials specialist with the Ohio Hazmat Weapons of Mass Destruction Advisory Committee states, “If we caught some ISIS terrorist cells dumping this into our waterways, they would be tried for terrorism and the use of a WMD on U.S. citizens,” says Caggiano. “However, the frac industry is given a pass on all of this.”

“There is nothing to remediate it with,” says Avner Vengosh, a Duke University geochemist. “The high radioactivity in the soil at some of these sites will stay forever.” Radium-226 has a half-life of 1,600 years. The level of uptake into agricultural crops grown in contaminated soil is unknown because it hasn’t been adequately studied.

“Not much research has been done on this,” says Bill Burgos, an environmental engineer at Penn State who co-authored a bombshell **2018 paper** in *Environmental Science & Technology* that examined the health effects of applying oil-field brine to roads. Regulators defend the practice by pointing out that only brine from conventional wells is spread on roads, as opposed to fracked wells. But conventional-well brine can be every bit as radioactive, and Burgos’ paper found it contained not just radium, but cadmium, benzene, and arsenic, all known human carcinogens, along with lead, which can cause kidney and brain damage.

But the new buzzword in the oil-and-gas industry is “beneficial use” — transforming oil-and-gas waste into commercial products, like pool salts and home de-icers. In June 2017, an official with the Ohio Department of Natural Resources entered a Lowe’s Home Center in Akron and purchased a turquoise jug of a liquid de-icer called AquaSalina, which is made with brine from conventional wells. Used for home patios, sidewalks, and driveways — “Safe for Environment & Pets,” the label touts — AquaSalina was found by a state lab to contain radium at levels as high as 2,491 picocuries per liter. Stolz, the Duquesne scientist, also had the product tested and found radium levels registered about 1,140 picocuries per liter.

“Every time you put this solution onto your front steps you are basically causing a small radioactive spill,” says Vengosh, the geochemist, who has examined AquaSalina. “If you use it in the same place again and again, eventually you will have a buildup of radioactivity in the sediment and soil and create an ecological dead zone.”

Meanwhile, Ohio is pushing forward with legislation to *protect* the practice of brine-spreading.