ENVIRONMENTAL HEALTH PROJECT

DEFENDING PUBLIC HEALTH SINCE 2012

Risks from Liquid, Sludge and Solid Waste from Shale Gas Development

The shale gas industry produces a tremendous amount of toxic waste, in liquid, sludge and solid forms. This waste is a public health concern because of its toxicity, radioactivity, and lack of government oversight in its handling due to exemptions in federal and state environmental legislation. As the amount of shale gas waste increases, the industry's need to dispose of it in a cheap, effective manner intensifies, leading to incidences of diluting waste to mask the toxicity, truckloads going missing, and illegal dumping. Inadequate containment and maintenance procedures, inadequate radioactivity testing equipment, and loopholes have allowed for radioactive substances to enter unqualified landfills and potentially the environment. Exposure to radioactivity from this waste in the form of radium-226 and radon gas can cause various organ and bone cancers. Stronger protections should be in place to ensure the public is not exposed to radioactivity from shale gas waste.

DEFINITIONS:

a. **Produced Water:** water found in the original rock formation known to contain high amounts of salts, metals, various gases, and naturally occurring radioactive materials (NORMs). Treatment facilities remove the sediments from the liquid, leaving solid waste (sludge) and liquid waste (water).

b. **Sludge:** a byproduct of the treatment of produced water known to contain naturally occurring radioactive materials (NORMs).

c. **Solid Waste:** Solid waste includes drill cuttings and sand.
   i. Drill Cuttings: ground up rock pulled up from formation after drilling.
   ii. Sand (Proppant): fine silica sand used to keep fractures open to allow natural gas/oil extraction.

d. **Naturally Occurring Radioactive Materials:** NORMs are radioactive compounds found throughout the Earth's crust. Some common NORMs are Uranium, Thorium, Radium, Radon gas, Polonium-210, and Lead-210.[14]

e. **Technologically Enhanced NORMs:** TENORMs are created when large amounts of NORMs are brought up to the surface and concentrated due to man-made processes such as the shale gas extraction.

f. **Radium-226:** A decay product of uranium, found in shale gas waste, which gives off alpha radiation, along with unstable decay products. It has a half-life of 1600 years, meaning in that length of time, it will continue to give off unstable/radioactive byproducts.

g. **Radon:** An odorless colorless gas that is a decay product of radium. It gives off alpha, beta, and gamma radiation, and has a half-life of 3.8 days.

h. **Alpha, Beta, and Gamma Radiation:** Alpha particles travel a short distance and cannot penetrate skin. Beta particles can penetrate a few inches into your body. Gamma radiation can go through your body.

i. **Orphan Waste:** Waste that is not controlled by any one government agency. There is no federal cradle to grave, or production of waste to dumping of waste tracking, of shale gas waste. These gaps in regulation and oversight allow for illegal dumping and missing truckloads of shale gas waste.

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HOW TENORMS IMPACT HUMAN HEALTH

In shale gas waste, there are primarily two radioactive compounds that raise serious health concerns: Radium-226 and Radon gas. Radium-226 dissolves easily in water and is brought to the surface in produced water as part of the liquid waste that returns to the surface with the gas. The half-life of a radioactive compound can be defined as the time needed for half the atoms of a radioactive substance to disintegrate. This decay process gives off unstable atoms in the form of alpha, beta, and gamma radiation. Alpha and beta particles are dangerous when inhaled/ingested, because they are cancer-causing when exposed to organs or bones. Gamma radiation is known to break bonds of genetic materials and structural components in cells, leading to various cancers.[1] The problem with radioactive compounds with longer half-lives is that it will persist in your body and cause cell abnormalities, leading to various cancers. Produced water may contaminate the environment via leaks, spills (accidental or intentional), or otherwise inadequate containment facilities, such as a ripped flowback pond liners.

During its half-life of 1600 years, Radium-226 gives off harmful radiation known to cause lymphomas, leukemia, and bone cancer when ingested or exposed.[3] Since radium is molecularly similar to calcium, the body incorrectly recognizes it as dissolved calcium and deposits it in bone tissue, causing bone cancer.[7] The unstable byproducts of Radium, such as polonium-210 and lead-210, which also persist for up to 1600 years in the environment, can also cause various organ and bone cancers.

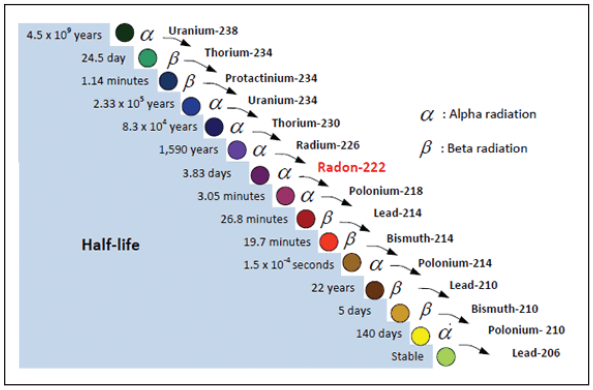
Radon gas leaks from landfills as radium decays into radon gas. It has a half-life of 3.8 days, meaning that it does not persist in an unstable form as long as radium. Radon can travel through air, settle on surface water, seep into ground water, and rise up/collect in basements. Ingestion of contaminated water/food, or inhalation can cause cancer of various organs.[3] With no regulatory oversight of toxic pollutants escaping the landfill into the atmosphere, it is up to the facility owners to contain the toxic gases. With significant amounts of radioactive waste coming from shale gas development, it is difficult for landfill owners to maintain compliance.

Filter socks are an overlooked waste in the shale gas industry with the potential to be very dangerous. These sock-like filters are used to capture solids in produced water, accumulating radioactive materials over time from 5 to 80pCi per filter. The EPA has a limit of 5pCi/g for radioactivity entering landfills. Contamination of soil and water may occur if the filter socks are not disposed of properly. Ideally, these filter socks would be properly disposed of at a low-level radioactive disposal facility, but they have turned up along roads, on Native American Reservations, in city garbage cans, and tucked under other waste trucked to landfills.[5]

WHAT ARE THE PROBLEMS ASSOCIATED WITH SLUDGE?

The Resource Conservation and Recovery Act (RCRA) Loophole: The Resource Conservation and Recovery Act (RCRA) of 1976 is the federal law regulating solid and hazardous wastes and their proper disposal. cradle to grave tracking of nonexempt waste is required. Some examples of nonexempt oil and gas waste are unused fracturing fluids, unused acid, and empty drum barrels. The EPA was given the task of determining what was considered hazardous waste in the oil and gas industry. In 1988, the EPA exempted oil and gas waste despite finding that it contained toxic materials that pose risks to human health and the environment. The EPA determined that regulations would hinder the oil and gas industry's economic growth. They remain exempt to this day, allowing oil and gas waste to be considered an "orphan waste", with no federal cradle to grave tracking requirements.[4]

"Orphan Waste": No single government organization has full control or oversight on radioactive sludge, due to an exemption in the Resource Conservation and Recovery Act described previously. There is no federal cradle to grave tracking of where, and how much, sludge is being disposed. Some truckloads trigger sensors and are considered too "hot", or too radioactive, for landfills to accept. A commonly-reported method of disposal is the action of "shopping around" or finding the cheapest and most efficient way possible to dispose of this waste, whether it be legal or illegal.[15] Truckloads of radioactive waste can travel from landfill to landfill in the hopes of being allowed to dispose of the waste. If it's too "hot" they are required to find a different means of disposal.



One common way of getting around radiation limits is to dilute the waste, accomplished by mixing radioactive waste with non-radioactive waste to make it "less toxic" and allow it to be dumped in landfills.[11] Radioactive waste may be dangerous for thousands of years, and the facilities that are accepting the waste are not designed to last as long. The only way to truly protect the public from radioactive waste is to completely isolate and contain it, and this can't be done at a municipal landfill. There have been incidents of illegal dumping in PA, and even falsifying documents to the EPA to get away with it. For example, the owners of Hallstead Sanitary Services Inc. were charged with tampering of public records and unlawful conduct when they were caught dumping radioactive waste into farm fields in Susquehanna County from January to March in 2010. They also forged paperwork sent to the EPA to make it seem like they were sending their waste to a proper disposal facility, when the facility in question stopped accepting sludge disposals in 2006.[2]

Liners, Covers, and Leachate Pipes: The equipment at landfills used to contain waste are not suitable for harmful products. Covers and liners can wear out after years of use, and runoff pipes can clog and cause backups of toxic liquids. In addition, according to the "Subtitle D Rule" of the Hazardous and Solid Waste Amendments of 1984, companies are only required to maintain inactive landfills for thirty years after closure. This regulation was made despite the EPA's knowledge that landfill liners, covers, and leachate pipes, were only meant to last a few decades at most.[13]

Obsolete Radioactivity Testing Equipment: Each PA landfill is equipped with a drive-through radiation detector for waste entering the site; however, these detectors only detect gamma radiation, not alpha or beta radiation. Because of this, substances that emit alpha and beta radiation can enter landfills and may eventually enter the environment. When radiation levels are high, further laboratory testing can be done, but these methods can give false readings when levels of salt and organic compounds are present, as is the case with waste from shale gas.[13]

Lab tests were completed by Pace Analytical Services LLC and On-Site Technical Services Inc. on sludge samples from PA disposed of in Hakes Landfill in New York. These tests concluded that the radiation was at background levels, deeming it safe to dump. The Sierra Club reported that the same sample of sludge from Hakes Landfill had a radium-226 level of 180pCi/g when a new testing strategy was used.[9] This old way of testing radioactive waste allows it to be passed off as safe when it isn't. Both methods of testing are obsolete and should be updated to account for the high volumes of radioactive sludge being brought into landfills.[13]

Resources

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PICTURE 1

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PICTURE 2

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