



**HOW THE HALT TO ROAD SPREADING TOXIC
OIL & GAS WASTEWATER MADE
PENNSYLVANIANS LESS SAFE**

BETTER PATH COALITION



As concerns mount regarding the environmental and health impacts of toxic, radioactive oil and gas drilling wastewater, so, too, do concerns regarding the Pennsylvania Department of Environmental Protection's oversight of its management and reporting. The agency halted one of the more controversial disposal methods, the practice of spreading the wastewater as a dust suppressant and deicer on Pennsylvania roadways, in response to a 2017 Environmental Hearing Board appeal filed by Siri Lawson, a Warren County resident. Lawson argued that brining was polluting the air and water near her Farmington Township home¹. Documents obtained by the Better Path Coalition in response to a Right-to-Know request and our analysis of the agency's Oil and Gas Reporting Electronic (OGRE) system reveal significant policy and data collection failures that have left our air, water, and health less protected from the dangerous waste than they were before the moratorium went into effect.

COPRODUCT DETERMINATION LOOPHOLE

Conventional gas drillers spread 54,327 barrels or 2,281,747 gallons of toxic, radioactive drilling wastewater on Pennsylvania roads between 2018, when the Department of Environmental Protection (DEP) declared the moratorium, and the end of 2020. Another arm of the agency, the Bureau of Waste Management, provides drillers the loophole that has allowed them to keep spreading the waste.

It is a program called Coproduct Determination and it allows owners of a waste product to determine whether or not it can be beneficially used in place of a commercially available product. For instance, owners of glass waste may determine that it can be used as an aggregate rather than end up in a landfill. No waste products are prohibited from inclusion in the program, however, so when the Oil and Gas Division imposed the moratorium on road spreading, some owners of drilling waste turned to the Bureau of Waste Management for the solution to their predicament. According to Oil and Gas Waste Reports from 2018 through 2020, at least 29 owners presumably determined for themselves that the wastewater was on par with commercial dust suppressants and deicers and used that as justification for continued road spreading.

The DEP defines a coproduct as “a material generated by a manufacturing or production process, or a spent material, of a physical character and chemical composition that is consistently equivalent to the physical character and chemical composition of an intentionally manufactured product or produced raw material, if the use of the material presents no greater threat of harm to human health and the environment than the use of the product or raw material.”ⁱ

Given that the program is one that generally operates in good faith, the Bureau of Waste Management provided no oversight after the moratorium was in effect. Waste owners are required to document the self-determinations they conduct and must provide that documentation should the Department request it.ⁱⁱ This spring, for the first time since drillers started availing themselves of the loophole, the Bureau of Waste Management requested documents from some drillers. Pennsylvania Independent Oil and Gas Association (PIOGA) representative Burt Waite said in his remarks to the PA Grade Crude Development Advisory Council (CDAC) in August that the DEP's action has left operators 'nervous'.ⁱⁱⁱ He did not

elucidate. Self-determination documents obtained through a Right-to-Know request by the Better Path Coalition may provide some clues.

RIGHT-TO-KNOW REQUEST

In October, Ali Tarquino-Morris, Director of the Bureau of Waste Management, said in an interview that the Department had requested self-determination documents from 17 drillers.^{iv} On October 8, the Better Path Coalition requested copies of all of the documents the drillers had submitted.^v On October

WASTE OWNERS REPORTING ROAD SPREADING SINCE 2018	LAST YEAR REPORTED	AMOUNT SPREAD IN BARRELS
BOBCAT WELL & PIPELINE LLC	2018	707
CAMERON ENERGY CO	2020	269.93
CRS ENERGY LLC	2020	6944.6
DIVERSIFIED OIL & GAS LLC	2018	10410
DJR WELL SERVICES INC	2020	2322
ELDER OIL & GAS CO	2020	440.01
EMPIRE ENERGY E & P LLC	2019	405
ENERGY RESOURCES OF AMER INC	2020	4285
ENERVEST OPR LLC	2019	2458.53
G & G GAS INC	2020	168.7
GASP INVESTMENT LLC	2018	.04
GLORIA J & ROGER S WENZEL	2020	3
HEITER ROBERT & CAROL	2020	43
HOWARD DRILLING INC	2020	1860.14
JMG ENERGY LLC	2020	5313
L & B ENERGY LLP	2019	4856
LHS PROD LLC	2020	100
LT OIL CO LLC	2020	95.79
MCCOMB OIL INC	2020	675
METZLER JEFFERY A	2018	50
MILLENNIUM OIL & GAS INC	2019	182
MISSING MOON OIL INC	2019	574.1
PEMBROOKE OIL & GAS INC	2017	1096
RIVER RIDGE GRAVEL CO	2020	107.8
SAVKO JOHN A	2018	100.1
STEDMAN ENERGY INC	2018	280
VICTORY OIL & GAS CO	2018	205
VISTA OPR INC	2020	10125.57
WB PROD MGMT CO	2019	250
TOTAL BARRELS SPREAD		54327.31

BOLDFACE indicates companies' documents provided in response to RTK

documentation supporting their coproduct determinations." A 17th driller spread waste on roads in

18, the DEP provided eight.^{vi} Seven of the self-determinations came from owners found on the list of 29 identified in Oil and Gas Waste Reports. The eighth came from Pennfield Energy, LLC, a company that last reported spreading waste on roads in 2017, prior to the moratorium.

The coalition filed an appeal to get any documents that had not yet been provided. The DEP responded on November 24 with an affidavit from Kevin Beer, Chief of the Compliance and Technical Support Section of the Division of Municipal and Residual Waste, Bureau of Waste Management. According to Beer, his office "issued letters to 16 Oil and Gas Operators starting in the Spring of 2021 seeking

New York State. Since none of the waste was spread in Pennsylvania, “no coproduct determination is necessary and documentation supporting a coproduct determination had not been sought by the department.”^{vii}

Beer stated that two drillers did not provide coproduct determinations because none of their produced fluids was being used as a dust suppressant. The remaining six had not responded by the time of our request. Beer’s response did not name any of the companies it referred to.

Beer and Joseph Cigan, Director, Office of Chief Council in the agency’s General Law Division addressed some unanswered questions in a meeting on December 7. Beer explained that the 17 operators he contacted had reported spreading waste on roads in 2020. Pennfield, as noted above, is the exception, having not reported waste disposal by any method since 2017. Beer did not explain its inclusion on the list. He initially contacted operators the day after the waste reporting deadline in February, but expanded the list as he identified more companies that had reported road spreading.

In a follow-up email on December 8, Beer provided the names of the companies he contacted and the current status of the responses to that outreach.^{viii} The table below provides the number of barrels companies reported road spreading in 2020 and the responses Beer has received. In his affidavit, Beer refers to a company that road spread in New York only, but that was not noted on the list. According to the list of operators Beer provided, CRS Energy LLC provided a “copy of a brine wastewater disposition report covering 2018 – 2020” that was not included in the documents provided in response to the Right-to-Know. The Coalition requested a copy of that report and is awaiting a response.

Operator	Reported 2020 Road Spreading in Barrels	Response to DEP
ELDER OIL & GAS CO.	440.1	No response to date
ENERGY RESOURCES OF AMER INC	1900	No response to date
G&G GAS INC	99.63	Working on compiling info after initial contact in October 2021
HEITER ROBERT & CAROL	43	Said no brine wastewater was provided for road spreading in 2020
L&B ENERGY	36	Said no brine wastewater was provided for road spreading in 2020
LT OIL CO LLC	95.79	No response to date
PEMBROOKE OIL & GAS INC.	1096	Requested additional time in October 2021
RIVER RIDGE GRAVEL CO	58.3	No response to date
STEDMAN ENERGY INC	70	No response to date

SELF-DETERMINATIONS

Section 287.8 of the Pennsylvania Code lays out five steps a waste owner must take in making the determination that their proposed coproduct does not “present a greater threat of harm to human health and the environment” than the product it seeks to replace. The requirements are as follows:

(1) An evaluation to determine which, if any, hazardous or toxic constituents are present in the proposed coproduct at levels exceeding those found in the material it is replacing.

(2) An evaluation of the total levels of hazardous or toxic constituents, including the constituents in 40 CFR Part 261, Appendix VIII (relating to hazardous constituents) as incorporated by reference in § 261a.1 (relating to incorporation by reference, purpose and scope), to determine whether the total levels of constituents contained in the proposed coproduct exceed the total levels found in the intentionally manufactured product or produced raw material it is replacing. Based on generator knowledge, if a hazardous or toxic constituent is not present evaluation of total levels is not required.

(3) An evaluation of the levels of leaching of hazardous or toxic constituents, including the constituents in 40 CFR Part 261, Appendix VIII as incorporated by reference in § 261a.1, to determine whether the levels of leaching from the proposed coproduct exceed the levels of leaching from the manufactured product or produced raw material it is replacing. A leaching procedure shall be performed that is appropriate for the intended use of the proposed product. Based on generator knowledge, if a hazardous or toxic constituent is not present evaluation of leaching levels is not required.

(4) The routes of exposure to humans and ecological receptors shall be identified. These routes of exposure shall include ingestion, inhalation, dermal contact, leaching to the groundwater, plant uptake and surface runoff potential. Mitigating circumstances, such as protective gear worn by workers to reduce exposure during processing or application of the proposed coproduct, shall be identified.

(5) The use of a 95% upper confidence interval, using the “Test Methods for Evaluating Solid Waste” (EPA SW-846), may be applied to the comparisons of constituent levels between the proposed coproduct and the intentionally manufactured product or produced raw material it is replacing.^{ix}

The Department provides no further guidance on how the evaluations must be conducted. For instance, the requirements do not take into account inconsistencies in waste belonging to a single owner. The contents of oil and gas wastewater are not consistent from one well to another, yet no instruction is given on how take those differences into account.

None of the eight self-determinations submitted to the DEP comes close to meeting the Section 287.8 requirements. Lacking guidance on conducting the evaluations, drillers’ self-determinations are an inconsistent mess of reliance on old data, irrelevant supporting documentation, and a lack of evidence of any thorough analysis. The following are examples:

- Outdated lab analyses
 - Cameron Energy submitted lab results from 2012 and early 2013 and, for purposes of comparison, included lab reports for the commercial product, LS-25, from 2010 and 2016.
 - Howard Drilling and LHS Production LLC's 2017 lab results used in 2019 determinations were not as outdated as Cameron's, but the LS-25 reports were from 2010.
- Extraneous information
 - Cameron Energy included in its exhibits a 2015 Safety Data Sheet for LS-25
 - Burt Waite, the Pennsylvania Independent Oil & Gas Association representative who claimed drillers were 'nervous' when the DEP started requesting self-determinations, wrote determinations as an independent geologist for two companies, Howard Drilling, Inc. and LHS Production LLC. Both submissions contained variations of a couple of form letters from several townships. Although the letters have no relevance to the self-determinations, most of them provide information about where the waste can be spread, something missing from OGRE. Waite also included as an endorsement an image of a torn piece of paper listing resolutions under consideration in 2019 by the Pennsylvania State Association of Township Supervisors calling for the legislature to pass a bill requiring DEP to allow road spreading that is marked SUPPORT.
 - Pennfield Energy LLC's submission includes a copy of 25PA Code § 287.7, a copy of a 2018 Penn State study, "Environmental and Human Health Impacts of Spreading Oil and Gas Wastewater on Roads," published in *Environmental Science and Technology*, an LS-25 Product Sheet, the same 2015 LS-25 Safety Data Sheet Cameron included, and an LS-25 Material Safety Data Sheet, for good measure.
 - Vista Resources included a copy of a letter from a township claiming to have done its own favorable determination and a resolution passed by the township approving the use of production brine on roadways.
- Too little information
 - While none of the companies did the evaluations required under Section 287.8, DJR Well Services, Inc., JMG Energy LLC, and McComb Oil, Inc. submitted nothing more than lab reports.
- Self-determinations after the fact
 - JMG Energy LLC spread waste in each of the three years since the moratorium began, but the lab report they submitted as their self-determination was dated December 30, 2019 for a sample taken on December 19, 2019.
 - Vista Resources also spread waste all three years, but their lab report was dated February 11, 2020 for a sample taken on January 30, 2020.

Dr. John Stolz, Director of Duquesne's Center for Environmental Research and Education and Professor of Microbiology in the university's Bayer School of Natural and Environmental Sciences, reviewed the self-determinations and made the following observations:

- It appears that the DEP is only concerned with Calcium, Magnesium, and Sodium Chloride (the usual make up of de-icing salt). So most of the reports are for the Ca, Mg, Na, and Cl content.
- Additional tests included bromide, potassium, pH, conductivity (an indication of Total Dissolved Solids), and specific gravity (another indication of TDS)
- When toxic metals were included, such as Arsenic and Chromium, they were below detection limits and Not Detected (ND). Closer examination of the results, however, revealed that their detection limits were set higher than the EPA Maximum Contaminant Levels for several metals. The MCL for Arsenic is 10ppb (10 ug/L). PACE's limit said 50ppb; Cadmium is 5ppb, PACE is 30ppb (JMG Energy Brine report, page 2). The EPA action level for lead is 0.015 mg/L (or 15 ppb). PACE's reporting limit for lead is 500ppb.
- Sample collection protocols were not always followed. Sample collection dates and times were missing and samples were acidified only after arriving at PACE labs (i.e., JMG energy brine)
- Samples were often diluted 100-10,000X due to the high salinity. This runs the risk of diluting some constituents below detection limits.
- Spike and recovery amounts were high. Arsenic was spiked at 500ppb.
- PACE and Microbac were the most frequently used testing companies. It looks like Modern Testing Laboratory and FREE-COL Laboratories contracted out to PACE ^x

OGRE AND DATA GAPS

Although the agency has provided little oversight of road spreading since the moratorium, conventional drillers are required to report the disposition of their waste annually in the Oil & Gas Division's OGRE system. Despite the halt, road spreading is still a Disposal Method waste owners can select from a menu. Without that data, no record of road spreading since 2018 would exist. Still, critically important information is missing from OGRE.

One company, River Ridge Gravel Company, spread 107.8 barrels of drilling waste between 2018 and 2020, according to its entries identifying the disposal method as road spreading, but the company listed another 60.5 barrels under the vague category, Reuse Other Than Road Spreading. The Waste Facility field for those 110 entries listed Venango County Roadspreading – Cranberry Township. Subsequent fields requesting the address and GIS coordinates of the waste facility were left blank. Later, under Waste Comment, the company entered either 'Private Road waste spreading' or simply 'Private Roads'.

The River Ridge is but one example of significant problems with the OGRE system. By far, the most significant is that database does not track anything about where or when waste was spread. Among the other reporting issues are the following:

- The Waste Facility field shows the counties and townships where the waste was spread, but no addresses are provided and the GIS coordinate fields only allow one set of submissions. Although there is no facility, per se, when the disposal site is a stretch of roadway, GIS coordinates could be used to identify more than a starting point, assuming that is what those values currently represent, if additional fields were added to OGRE to capture coordinates for an end point.
- The fields for production period start and end dates provide no clues about when the waste was spread because they all start on January 1 and end on December 31, the dates that would be more correctly labeled as the reporting period.
- Unlike unconventional drillers who are required to file monthly reports, conventional drillers file reports annually.
- The Submission Final Date field shows that some reports took more than two years to finalize. The lack of access to year-to-date information is compounded by the lag in finalizing submissions. The system provides no information about how many reports may still be pending.
- Compliance with reporting is difficult to track. Pennfield Energy LLC, the company that hasn't reported road spreading of waste since 2017 hasn't reported *any* form of waste disposal during that time. But the DEP's Oil & Gas Well Production reports from 2018 through 2020 show that the company produced 10165.66 barrels of oil. Pennfield's self-determination included lab results from 2018, which suggests they were planning to road spread some of the resulting waste.
- Some fields are populated with vague options. "Reuse other than road spreading" tells the end user nothing about the disposal method. Owners using that option also select "Reuse without processing at a permitted facility" under Waste Facility Name.
- The Waste Quantity field displays numbers, but Units are provided in the next field where barrels and tons are both options, so the end user can't tabulate amounts without sorting lists and doing multiple calculations.
- Some operators report the same quantity of waste in all or most of their entries. Cameron Energy reported .87 barrels in 2018 and 2019. In 2020, they reported .87 or .47 barrels. LT Oil entered 1.03 barrels for each of its 93 records for the three years. Millennium Oil & Gas always used 14 barrels. Missing Moon used 3, 6.7, 8.5, or 14 barrels for all of its entries. Pembroke alternated between 1.93 and 9.83 barrels. River Ridge alternated between 0.45 and 0.53 barrels. For Savko, who reported in tons, the two values were 3.64 and 4.62. WB Prod Mgmt reported either 25 or 40 barrels. Some of the other companies use the same values a lot, but not with the same regularity.
- Some problems reported go unresolved. "This is not our well" appears for years for the same well.
- Some entries may be misclassified. Cameron Energy asked in each of its 399 entries for a total of nearly 270 barrels of waste disposed of by road spreading during 2020 in McKean County, "Why is Warren County Private Road not an option this year?" It's unclear if additional waste went unrecorded or if the McKean entries were actually the ones for neighboring Warren County.

DISCUSSION

The 2018 moratorium on road spreading may have provided some relief to those concerned about the practice's dangerous effects. By prompting conventional drillers to find a virtually unregulated alternative, however, the moratorium has made our air, water, and health less protected than they were before.

Siri Lawson's appeal to the Environmental Hearing Board came after years of experiencing adverse impacts of road spreading. The DEP's announcement of the moratorium, while viewed as a concession, effectively punctuated the Board's proceedings. Lawson's attorney, Rose Monahan of Fair Shake Environmental Legal Services, told the *Post-Gazette*, "We think spreading oil and gas wastewater contributes to air and water pollution, and we do not have a decision by the board agreeing that's true."^{xi} She'd hoped the process would close loopholes in the brine spreading approval process. As we have seen, the abrupt end of the case only opened a new loophole.

Since the moratorium went into effect, the conventional drilling industry has been vocal in expressing its dissatisfaction and its desire to see the practice permitted once again. Several of the more vocal opponents of the moratorium can be found under the heading of public participation on the DEP's website. The page provides links to two advisory committees, the Oil and Gas Technical Advisory Board (TAB) and the PA Grade Crude Development Advisory Council (CDAC).^{xii}

Both groups are heavily populated with industry representatives. The public has no representation in either group. Instead, members include the Marcellus Shale Coalition, the Pennsylvania Independent Oil & Gas Association, the Pennsylvania Independent Petroleum Producers, the Pennsylvania Grade Crude Oil Coalition, energy companies, like Shell and CONSOL, and consulting firms, like ECHELON Applied Geoscience Consulting and another firm it lists as an affiliate, Moody & Associates.^{xiii xiv} Fred Baldassare, ECHELON's owner and principle scientist, spent years at the DEP and co-authored the study that claimed that the methane found in drinking water was naturally-occurring. He told the *Patriot Times*, "It's really irresponsible for [Duke] researchers to make those gross generalizations about Marcellus gas migrating up into the aquifer system. Hopefully this paper will make people understand that a little bit better."^{xv}

Those are the advisory committees that have been pressuring the DEP and the legislature to bring back road spreading. In the 2019-2020 session, the bill that sought to reinstate road spreading was SB790.^{xvi} In early 2020, the road spreading provision was cut from the bill by the House Environmental Resources and Energy Committee. This session, HB1144 would reinstate road spreading on both unpaved and paved roads. SB790 co-sponsor Senator Scott Hutchinson is the Senate majority's representative on CDAC. HB1144 prime sponsor is Representative Martin Causer, CDAC's House majority representative.^{xvii}

The advisory committees continue to pressure the DEP, as well. Kurt Klapkowski, Director of the Bureau of Oil and Gas Planning and Program Management responded to CDAC at its August meeting, telling them, "We have to be able to defend our decisions with data. And that was the attempt, with

working with Penn State, that's what we were attempting to do was to develop that data to be able to have a program that we could go to the Environmental Hearing Board and the Commonwealth Court and Supreme Court under the constitution and under the statutes that we administer, that would be defensible. I do not think we would have any objection to working with [the Council] and the Legislature to try to figure out a way to develop that data. I think we're hopeful that the study that we funded and expect to have finished will provide data that will allow us to have a program that we can defend in court. But that's really the bottom line for us, I mean we can only exercise the authority that we're given within the limitations that we have and that's what we're attempting to do.”^{xviii} The study he refers to is a PennState study that was expected to be completed by the end of the year.

The following month, TAB asked to meet with authors of a different PennState study that looked at the efficacy of road spreading with drilling wastewater and found it to be far less effective than commercial products and, in some cases, performed worse than using no treatment.^{xix}

The efficacy study contributes to a growing body of research that has already found oil and gas wastewater to pose a threat to aquatic life and human health due to its toxic, radioactive contents.^{xx} David Hess has written extensively about road spreading in *PA Environment Digest* and provides a good summary of the research.^{xxi}

Decades-old problems with the management and tracking of oil and gas wastewater spread on Pennsylvania's roads have made it impossible to know where it has been spread and in what quantities. Those problems have only deepened since drillers started availing themselves of the virtually unregulated coproduct determination program. Science has shown the wastewater to be a toxic soup that threatens our air, our water, aquatic life, and human health. Yet the conventional drilling industry continues to pressure elected officials and regulators to reinstate the practice on unpaved roads and allow it on paved roads too. What should happen next?

RECOMMENDATIONS

- Ban road spreading – The DEP banned road spreading of waste from unconventional wells in 2016. The ban should be extended to include all oil and gas wastewater.

According to PIOGA, “A traditional, conventional well is usually drilled into a sandstone formation that can range from as shallow as 1,500 feet to as much as 21,000 feet deep. Oil and gas are able to pass through these formations without hydraulic fracturing, but nearly all wells are stimulated through fracturing to improve production. Conventional wells have been drilled vertically, although a few operators are experimenting with horizontal drilling techniques in conventional formations.”^{xxii}

If the drilling techniques are the same, then the rules for handling wastewater should be the same. Conventional drillers might argue that the difference is in the geology, that theirs are

shallow wells drilled in sandstone layers that sit atop the shale, but geologist Paul Rubin cautions regulators to recognize the relationship between the sandstone layers and the shale rock below.

Says Rubin, “Operating Requirements fail to consider the provenance of shales and interbedded shales and sandstones that are geologically linked and exhibit similar geochemical signatures (e.g., black shales provide hydrocarbon-rich products that migrated upward into overlying sandstone reservoirs).”^{xxiii}

“Essentially, the concentrations of brine parameters in Marcellus Shale produced water that PA DEP Operating Requirements state are not applicable for road spreading are **matched or exceeded** [emphasis added] by Bradford Group produced water chemistry concentrations. Based on chemical comparison of Marcellus and Bradford Group brines, there is no chemical/water quality basis for spreading contaminant-rich oil and gas field wastewater from either group where they will flow downward and degrade vulnerable surface and groundwater resources,” Rubin concludes.^{xxiv}

- Reclassify oil and gas wastewater as hazardous – For more than 40 years, Pennsylvania has failed to break with the federal government’s classification of oil and gas wastewater as a special waste and use the authority it has to reclassify it as hazardous. In 1980, the classification exempted the special wastes from regulation under the Resource Conservation and Recovery Act (RCRA). “Specifically, the Bentsen Amendment (section 3001(b)(2)(A)) exempted drilling fluids, produced waters, and other wastes associated with the exploration, development, and production of crude oil or natural gas or geothermal energy,”^{xxv} according to the EPA.
- Restrict wastes eligible for co-product determination – Without the flawed OGRE system, there would be no record at all of how much wastewater has been spread on roads by conventional drillers since 2018. The Coproduct Determination program was intended to keep waste that could safely be reused from ending up in landfills, but conventional drillers did not hesitate to exploit the program when it was the one way they could legally continue to dispose of wastewater by spreading it on roads. The DEP should determine which waste products are ineligible from inclusion in the program and require oversight by the Bureau of Waste Management before and during the coproduct determination process. Regulatory programs should never operate on good faith to the degree the Coproduct Determination program has.
- Require conventional drillers to file monthly reports – The DEP should have the same reporting requirements for conventional and unconventional drillers. Reports that are pending final approval should be posted and marked Pending. Waiting months or even years for reports to be posted in OGRE is unacceptable.
- Auditor General DeFoor should audit DEP’s management of oil and gas wastewater and the OGRE system - In 2014, Auditor General DePasquale concluded that the DEP was “woefully

unprepared” to monitor and regulate the shale gas boom after his office’s audit of the agency. The obvious mismanagement of dangerous oil and gas wastewater should prompt another audit, this time focused on conventional drilling.

ACKNOWLEDGEMENTS

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ⁱ [25 PA Code § 287.1](#)

ⁱⁱ [25 PA Code § 287.8](#)

ⁱⁱⁱ [Letter from Better Path Coalition to DEP Secretary Patrick McDonnell and Deputy Secretary for Oil and Gas Management Scott Perry, October 8, 2021](#)

^{iv} [17 Conventional Oil & Gas Drilling Operators Under Review By DEP To Determine If They Comply With Program Allowing Road Dumping Of Drilling Wastewater, David Hess, PA Environmental Digest Blog, October 8, 2021](#)

^v [Right-to-Know request from Better Path Coalition, October 8, 2021](#)

^{vi} [Coproduct Determinations received in response to RTK](#)

^{vii} [Affadavit from Kevin Beer](#)

^{viii} Email from Kevin Beer

^{ix} [Ibid. ii](#)

^x Email from Dr. John Stolz

^{xi} [DEP revokes permission to dump wastewater brine from drilling on dirt roads](#)

^{xii} <https://www.dep.pa.gov/pages/search.aspx>

^{xiii} [PA Grade Crude Development Advisory Council webpage \(DCED website\)](#)

^{xiv} [Oil and Gas Technical Advisory Board webpage \(DEP website\)](#)

^{xv} [New study of gas drilling and ground water shows gas is often in water before drilling begins](#)

^{xvi} [PA Senate Bill 790 \(2019-2020\)](#)

^{xvii} [PA House Bill 1144 \(2021-2022\)](#)

^{xviii} [Ibid. iii](#)

^{xix} [Study finds drilling wastewater not usually best option for road treatment](#)

^{xx} [Environmental and Human Health Impacts of Spreading Oil & Gas Wastewater on Roads](#)

^{xxi} [The Science Says: Spreading Conventional Drilling Wastewater On Dirt & Gravel Roads Can Harm Aquatic Life, Poses Health Risks To Humans - And It Damages The Roads](#)

^{xxii} [PIOGA website](#)

^{xxiii} [Disposal of Oil & Gas Field Produced Waters: A Hydrologic Case Study of PA Brine Spreading Practice](#)

^{xxiv} [Ibid. xviii](#)

^{xxv} [Special Wastes, EPA webpage](#)