February 28, 2022

VIA ONLINE PUBLIC COMMENT
Pamela Bush, Commission Secretary
Delaware River Basin Commission
25 Cosey Road
West Trenton, NJ 08628

Re: Proposed Rulemaking—Importations of Water Into and Exportations of Water From the Delaware River Basin; Discharges of Wastewater from High Volume Hydraulic Fracturing and Related Activities

Dear Ms. Bush,

Delaware Riverkeeper Network and Maya K. van Rossum, the Delaware Riverkeeper, (collectively, "DRN") appreciate the opportunity to submit the below comments to the Delaware River Basin Commission ("Commission" or "DRBC") regarding its proposed rulemaking concerning Importations of Water Into and Exportations of Water From the Delaware River Basin and Discharges of Wastewater from High Volume Hydraulic Fracturing and Related Activities ("Proposed Rulemaking").

Beginning with its November 2017 Proposed Rulemaking,[1] the Commission engaged in a robust information-gathering and public commenting process, receiving nearly 9,000 public comments. In response to these comments and the overwhelming scientific and regulatory data showing that high volume hydraulic fracturing ("HVHF") and HVHF-related activities posed unacceptable environmental and human health risks, the Commission issued a final rule in February 2021 prohibiting HVHF in hydrocarbon bearing rock formations within the Delaware River Basin.[2] This prohibition was based on a finding that "[HVHF] and related activities pose significant, immediate and long-term risks to the development, conservation, utilization, management, and preservation of the water resources of the

[1] Administrative Manual & Special Regulations Regarding Natural Gas Development Activities; Additional Clarifying Amendments, 83 Fed. Reg. 1586 (proposed Jan. 12, 2018) (to be codified at 18 C.F.R. pts. 401 & 440).
[2] Comprehensive Plan and Special Regulations With Respect to High Volume Hydraulic Fracturing; Rules of Practice and Procedure Regarding Project Review Classifications and Fees, 86 Fed. Reg. 20,628 (Apr. 21, 2021). The rulemaking process beginning in 2017 and resulting in the February 2021 Final Rule is hereinafter referred to as the "HVHF Rulemaking."

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Delaware River Basin and to Special Protection Waters of the Basin, considered by the Commission to have exceptionally high scenic, recreational, ecological, and/or water supply values."[3]

DRN urges the Commission to follow through on its findings, and prohibit *all* HVHF-related activities within the Delaware River Basin, and to protect the Basin from exports that result in the permanent loss of Basin water to the hydrologic cycle. The unfortunate reality is that the Commission's Proposed Rulemaking has several fatal loopholes that undermine its findings and conclusions that were based on the extensive administrative record created in support of the HVHF Rulemaking. If the Proposed Rulemaking was finalized, the following activities would likely be permitted:

Exportation of Basin Water

- Exportation of Basin water to a straddled or adjacent public water system that needs Basin water because of a shortage caused by selling its own water to HVHF operations
- An "emergency" is declared based on economic reasons to prop up the fracking industry and is shrouded in the language of "public health and safety", so that Basin water is exported for fracking for an undefined amount of time
- Basin water is used within the watershed for an industrial process and the sponsor proposes to export the "wastewater" from that process, which is simply "transported" outside of the Basin for treatment and reuse as fracking fluid.
- The export of water from the DRB is a depletive use that can have far-reaching adverse environmental impacts on the water resources of the basin. These include diminishment of groundwater, wetlands, seeps, springs, streams, and the main stem river that has cascading ecologic and hydrologic impacts. These, in turn, can harm benthic and aquatic life, wildlife, and water quality due to less fresh water to dilute inputs of pollution. Degradation of habitat qualities can occur such as reduced oxygen, temperature changes, changes in rate and volume of flow and stream morphology changes can reduce or eliminate existing uses and Special Protection Waters.
- Industrial processes that create wastewater are able to simply export their wastewater for discharge in a jurisdiction with less stringent treatment standards because it is cheaper than complying with DRBC regulations for discharge.
- Water is exported from critical areas defined in DRBC's Southeastern Pennsylvania Ground Water Protected Area, causing depletion of groundwater and interfering with the interests and rights of lawful users of the same water source, and threatening the balance of uses of the region's limited water resources. https://www.nj.gov/drbc/programs/project/gwpa.html .
- Water is exported without any required conditions if the volume is under DRBC's threshold of 100,000 gallons per day average withdrawal during any calendar month or under 10,000 in DRBC's Southeastern Pennsylvania Ground Water Protected Area. https://www.nj.gov/drbc/programs/project/gwpa.html

[3] Del. River Basin Comm'n, Res. No. 2021-01 (Feb. 25, 2021), available at https://www.nj.gov/drbc/library/documents/Res2021-01_HVHF.pdf (hereinafter, "Res. No. 2021-01").

Importation/Acceptance[4] of Fracking Wastewater

- Fracking wastewater is accepted into the Basin but is not "discharged" to land or water but rather is "treated" through evaporation or some other process that avoids discharge to land or water but results in deposition of contaminants via air pollution.
- Fracking wastewater is accepted into the Basin and reused as a "beneficial use" in manufacturing, utility or industrial cooling systems, industrial processing, and various non-potable uses, releasing pollution through the air or other environmental media and through product degradation.
- Fracking wastewater is accepted into the Basin but is not "discharged" to land or water but rather is "disposed" of in a landfill, cavern or underground injection well.
- Fracking wastewater, whether treated or untreated, is accepted into the Basin and stored in storage and transfer facilities (without any stated limitations on size, volume, or oversight) and/or is stored for use or reuse, releasing pollution through spills, leaks, venting, and other incidents, polluting surface and groundwater, soils, vegetation and other receptors, including human and nonhuman communities.
- Fracking wastewater pollution is spread into the watershed through stormwater runoff and erosion and sedimentation of fracking wastewater-contaminated sediments from acceptance and storage of HVHF wastewater within the Basin, transfer facilities, pipelines carrying wastewater or other transportation-related activities.
- Solids such as crystals or hard salts made from fracking wastewater could be spread on roads for de-icing and dust control. Additionally, wastewater produced by "conventional" wells that do not meet the definition of HVHF, as defined in the Commission's Part 440.2, can be spread on roadways in the watershed.[5]

These outcomes would undermine the years of work the Commission devoted to protecting the Basin and its water resources from HVHF and HVHR-related activities, and must be avoided through a revision of the Proposed Rulemaking

I. The Commission has the authority and obligation to prohibit all HVHF-related activities within the Basin, and to prohibit exportations that serve the HVHF industry.

The Commission must draft its regulations with the objectives of: protecting, conserving, and managing the water resources of the Basin; effectuating the Comprehensive Plan; avoiding injury to the water resources of the Basin; and protecting the public health and preserving the waters of the Basin for uses in accordance with the Comprehensive Plan.

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[4] DRN uses the term "accepted" or "acceptance" throughout this comment to mean "the conveyance, transfer, or diversion of water, including wastewater, into the Delaware River Basin from a source outside the Basin, whether treated or untreated." This term is used in contrast with the Commission's definition of "import," which, far from its common meaning, is limited only to importation of water or wastewater resulting in a discharge.

[5] Del. River Basin Comm'n SUBCHAPTER B – SPECIAL REGULATIONS, Part 440.2 defines High volume hydraulic fracturing (HVHF): hydraulic fracturing using a combined total of 300,000 or more gallons of water during all stages in a well completion, whether the well is vertical or directional, including horizontal, and whether the water is fresh or recycled and regardless of the chemicals or other additives mixed with the water.

These were the goals and purposes identified in the HVHF Rulemaking, which were "consistent with the purpose for which the Commission was established and its various powers granted by the Compact."[6] In order to achieve these objectives, the Commission must revise the Proposed Rulemaking to totally prohibit all HVHF-related activities within the Basin, including the acceptance of HVHF wastewater into the Basin, regardless of whether the "importer" intends to discharge to land or water. The Commission must also make clear that exportations of Basin water are not permitted if they are likely to result in the permanent removal of water from the hydrologic cycle, or to serve a straddled or adjacent public water system that has depleted its water supply to support HVHF activities.

As the Commission explained in its FAQ document accompanying its HVHF Rulemaking, its authority to manage and protect the water resources of the Basin through regulation is broad and flexible enough to be responsive to threats such as HVHF-related activities and ecologically damaging exportations:

> The Compact recognized "the water and related resources of the Basin as regional assets" and established the Commission as an agency through which these vital shared resources could be jointly managed. (Compact, Part 1, Recitals). The Compact defines water resources broadly to include surface water, groundwater and "related natural resources," as well as "related uses of land." (§ 1.2(i)). It directs the Commission to adopt a Comprehensive Plan "for the immediate and long range development and uses of the water resources of the basin" to which federal, state, and local agencies and private parties are bound. (§§ 3.2 and 13.1). It provides the Commission with a range of tools for developing and implementing its Comprehensive Plan, including among others, the power to adopt and implement regulations. (§§ 14.2, 3.6(b), 3.6(h)). Article 5 of the Compact grants the Commission authority to, among other things, "adopt and from time to time amend and repeal rules, regulations and standards to control such future pollution and abate existing pollution . . . as may be required to protect the public health or to preserve the waters of the basin for uses in accordance with the comprehensive plan." (§ 5.2).[7]

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[6] Del. River Basin Comm'n, Comment & Response Document: Proposed Amendments to the Administrative Manual and Special Regulations Regarding High Volume Hydraulic Fracturing Activities; Additional Clarifying Amendments at 300–01 (Feb. 25, 2021), available at https://www.nj.gov/drbc/library/documents/CRD_HVHFrulemaking.pdf (hereinafter "Comment & Response Document") (citing Compact at §§ 3.1, 13.1). The February 25, 2021 Comment and Response Document was adopted in its entirety by the Commission in Resolution No. 2021-01.

[7] Del. River Basin Comm'n, Frequently Asked Questions (FAQs): Final Rules Addressing Hydraulic Fracturing Activities within the Delaware River Basin, p. 3, available at https://www.nj.gov/drbc/library/documents/FAQ_HVHFrulemaking.pdf

This comment—as well as the record developed by the Commission during the HVHF rulemaking--outlines the myriad risks posed by acceptance of wastewater containing fracturing fluids into the Basin.

A. The Commission must prohibit all HVHF-related activities within the Basin.

In Resolution No. 2021-01,[8] the Commission determined that "high volume hydraulic fracturing *and related activities* pose significant, immediate and long-term risks to the development, conservation, utilization, management, and preservation of the water resources of the Delaware River Basin and to Special Protection Waters of the Basin, considered by the Commission to have exceptionally high scenic, recreational, ecological, and/or water supply values."[9] Accordingly, the Commission concluded that "[c]ontrolling future pollution by prohibiting high volume hydraulic fracturing in the Basin is required to effectuate the Commission's Comprehensive Plan, avoid injury to the waters of the Basin as contemplated by the Comprehensive Plan and protect the public health and preserve the waters of the Basin for uses in accordance with the Comprehensive Plan."[10] In this Proposed Rulemaking, the Commission must act on its previous conclusion regarding HVHF-related activities and also prohibit those activities as defined in proposed § 440.2. To do otherwise would result in an arbitrary and capricious decision falling short of the Commission's obligations under the Compact.

Without a prohibition on HVHF-related activities within the Basin, the Proposed Rulemaking undermines the Commission's objectives by focusing exclusively on prohibiting intentional "discharge" of HVHF wastewater accepted into the Basin.[11] The Commission was created, in large part, for the purpose of controlling pollution within the Basin, and was granted multiple powers to exercise that control beyond point source discharges.[12] This limited and narrow prohibition runs counter to the Commission's findings and determinations in Resolution No. 2021-01, which were based on the extensive record created during the Commission's HVHF Rulemaking process.

The Commission considers spills to be "accidental, unintended, or unlawful releases."[13] In Pennsylvania, spills are self-reported, and not consistently or reliably.[14] Thus, by prohibiting all HVHF-related activities including the acceptance of HVHF wastewater within the Basin, the Commission would greatly reduce the risk that HVHF wastewater being stored, treated, transported, reused, or disposed of within the Basin will spill and endanger water resources. As the Commission has acknowledged, "[t]he potential for contamination

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[8] Res. No. 2021-01, *supra* n.3.
[9] *Id*. at 4 (emphasis added).
[10] *Id*. at 4–5.
[11] *See* Proposed § 440.4. Although "discharge" is not defined in the regulations, based on the context of environmental regulation and pollution control, it is likely to be interpreted in the context of the federal Clean Water Act, 33 U.S.C. § 1362(12)(A) ("any addition of any pollutant . . . from any point source").
[12] *Cf.* 33 U.S.C. § 1311 (The federal Clean Water Act prohibits only "the discharge of any pollutant by any person.").
[13] Comment & Response Document at 66.
[14] *Id.* at 68.

of water resources from spills [was] an important factor underlying the Commission's decision" to prohibit HVHF in the Basin.[15]

This risk is completely unaddressed in proposed § 440.4, which prohibits only the *intentional* discharge of HVHF wastewater in the Basin. In February 2021, the Commission concluded that "the collection, storage, handling, transport, treatment, discharge, and disposal of wastewater from high volume hydraulic fracturing activities presents significant risks, vulnerabilities and impacts to the water resources of the Delaware River Basin."[16] Nothing in the Proposed Rulemaking addresses the threat from storage, handling, transport, treatment, or disposal.[17]

Indeed, Table 7 in the Commission's February 2021 Comment & Response document neatly displays the threats posed by HVHF-related activities to the drinking water resources of the Basin, Table 8 describes the threats to surface waters and aquatic life, and Table 9 details the risks to groundwater. Many of the risks are not addressed in the Proposed Rulemaking—specifically spills, leaks, and other releases, inadequate treatment, air emissions, improper storage or disposal, and reuse for roadway de-icing or dust control.[18]

The Commission has recognized that "regulation is not capable of preventing adverse effects or injury to water resources from HVHF-related spills and releases of chemicals and hydraulic fracking wastewater"—which is why it found the total ban of HVHF within the watershed necessary.[19] The Commission has also concluded that regulatory approaches that may be acceptable in other jurisdictions are not necessarily sufficient to protect the water resources of the Basin.[20] As a result, the Commission should not rely here on state or federal regulatory programs to prevent the hazards associated with HVHF-related activities. Instead, a complete ban on HVHF-related activities within the Basin is required to effectuate the Commission's Comprehensive Plan, avoid injury to the waters of the Basin as contemplated by the Comprehensive Plan, and protect the public health and preserve the waters of the Basin for uses in accordance with the Comprehensive Plan.[21]

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[15] *Id*. at 65.
[16] *Id*. at 127.
[17] *See generally* Section III.B, *infra.*
[18] *See id*. at 156, 183–84, 210. Although the FAQ document provided along with the Proposed Rulemaking states that "[l]and application of HVHF wastewater by road spreading would constitute a prohibited discharge" under the Proposed Rulemaking, in Pennsylvania and other states, the HVHF industry is creating consumer products from HVHF wastewater and selling it to the public. *See* Glen Hendrix, *The Fracking Industry Is Selling Radioactive Waste Brine to the Public as a Road Deicer and Pool Treatment*, medium.com (Jan. 27, 2020), available at https://medium.com/age-of-awareness/the-fracking-industry-is-selling-radioactive-waste-brine-to-the-public-as-a-road-deicer-and-pool-ba77a0f67e1d. *See also* Section III.B.6, *infra*.
[19] *See id*. at 92, 179, 206, 226, 264. *See also* Sections III.B.2, III.B.9, *infra*.
[20] *See id*. at 260 ("The Commission respects Pennsylvania's choices for the area of the Commonwealth outside the Delaware River Basin. For its part, in light of the geology of the Basin and the likelihood and severity of potential adverse water resource impacts, the Commission has determined that the risks to water resources posed by HVHF—however well regulated—are not acceptable within the Basin, a shared resource that provides the water supply for more than 13 million people in four states.")
[21] *See* 18 C.F.R. § 440.1(a)

Additionally, given the "highly mobile and decentralized nature of unconventional oil and gas operations," prohibiting all HVHF-related activities within the Basin will prevent the widespread "storage and use of hazardous substances throughout the landscape" and multiple vehicular trips carrying HVHF fluids in and out of the Basin.[22] Without a total ban, these sorts of cross-basin operations would pose the same threats the Commission sought to thwart in its HVHF Rulemaking.

The proposed regulations also do not clearly prohibit storage or disposal of HVHF wastewater via underground injection wells, as disposal could be characterized as a method of "containing" the contamination rather than an intentional "discharge."[23] Nor does it prohibit disposal of HVHF in landfills. The Commission has stated that it will "review discharges of treated [landfill] leachate when such discharges meet the thresholds set forth in DRBC's Rule of Practice and Procedure ("RPP")."[24] However, given the obstacles posed by the fracking industry's use of unidentified chemicals, there is a chance that leachate may contaminate water resources despite the Commission's oversight.[25]

Another benefit of a total ban would be a significant reduction of the risk that airborne contaminants from the treatment of HVHF wastewater would deposit on land and water across the Basin.[26] The concept of air deposition is not new to the Commission: "Although the Commission does not directly regulate air emissions, the Commission has considered air deposition in its development of total maximum daily loads (TMDLs) pursuant to Article 4 of its Water Code and Water Quality Regulations, and in the development of strategies for implementing these TMDLS as appropriate."[27] A ban on HVHF-related activities would effectively mitigate this pathway of contamination.

In sum, the robust scientific and technical analysis undertaken by the Commission for its HVHF Rulemaking requires that HVHF-related activities must be prohibited in the Basin, and the Compact provides the Commission with ample authority to do so. Indeed, any less stringent prohibition would seriously undermine the objectives the Commission sought to achieve through its HVHF Rulemaking process.

B. The Commission must prohibit any exportation resulting in the permanent loss of water to the hydrologic cycle, and any exportation the purpose of which is to replace water that was consumptively used by HVHF outside of the Basin.

The Commission should revise its Proposed Rulemaking to explicitly prohibit exportation of Basin water for the purpose of HVHF and HVHF-related activities, as well as explicitly prohibit exportation of Basin water to serve a straddled or adjacent public water

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[22] *See* Comment & Response Document at 67. *See also* Sections III.B.3, III.B.4, *infra*.
[23] The Commission has expressed concern that even regulated underground injection of frack waste may not be sufficient to protect water resources. *See* Comment & Response Document at 303 n.69.
[24] *Id*. at 327 (citing 18 C.F.R. §§ 401.35(a)(5) and 401.35(b)(8)).
[25] *See* Sections III.B.2, III.B.6, III.B.7, & III.B.9, *infra*, discussing dangers of landfill disposal of fracking waste.
[26] *See* Section III.B.6, *infra*.
[27] *Id*. at 319 (emphasis added).

system that depleted its own supply through HVHF or HVHF-related activities. To do otherwise would mean that the Commission may be contributing to the permanent loss of water to the hydrologic cycle. The Commission has the authority to impose conditions, obligations, and release requirements related to any new exportation of Basin water pursuant to Sections 3.3, 3.8, 5.2, 10.3, 10.4 and Article 11 of the Compact and the regulations and docket approvals implementing those provisions.

In its rulemaking, the Commission must address the circumstance where water is exported from the Basin to support straddled or adjacent water systems—systems that have depleted their own supply by providing water for HVHF activities. To ignore this possibility would result in the Commission sanctioning a major loss of water to the hydrologic cycle.[28] Given that such systems are adjacent to or straddling the Basin, that loss is likely to directly impact the Basin. In addition, exportations of vast quantities of water may be allowed under the proposed regulations so long as that water is designated "wastewater," thus allowing industrial water users to sell water that would otherwise be treated and discharged to fracking companies as reusable "wastewater." Again, much of this water would be permanently lost to the hydrologic cycle.[29]

As the Commission has previously acknowledged, a loss of water from the Basin may interfere with water supply objectives as well as pose risks to water resources.[30] This interference would only become exacerbated over time, as the exported water (or the water the exported water is meant to replace) is locked underground. Indeed, this outcome is worse than a mere "consumptive use,"[31] as many consumptive uses do not permanently remove water from the hydrologic cycle. Thus, Section 2.30 of the Water Code should be amended to make clear that no new exportation of Basin water will be approved where the proposed exportation will result in the permanent loss of water to the hydrologic cycle, or where the proposed exportation's purpose is to replace water that was consumptively used by the HVHF industry. Such an amendment is within the Commission's authority to impose conditions on exportations for the protection and preservation of the Basin's water resources.

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[28] *See id*. at 56 ("[W]ater used for [HVHF] activities differs from existing water uses within the Delaware River Basin in that the majority (~90 percent) of water used is completely removed from the hydrologic cycle.")
[29] *See* Sections III.B.1, III.B.11, *infra*, discussing the significance of water quantity within the Basin and the harms caused by a permanent loss to the hydrologic cycle.
[30] *Id*. at 61–62.
[31] Defined as "water lost due to transpiration from vegetation in the building of plant tissue, incorporated into products during their manufacture, lost to the atmosphere from cooling devices, evaporated from water surfaces, exported from the Delaware River Basin, or any other water use for which the water withdrawn is not returned to the surface waters of the basin undiminished in quantity." 18 C.F.R. § 420.1.

II. Specific Comments Addressing the Proposed Rulemaking's Language

WATER CODE
2.30 IMPORTATIONS AND EXPORTATIONS OF WATER, INCLUDING WASTEWATER

DRBC Proposed Amendment:
2.30.1(D)–"Exportation" means the conveyance, transfer, or diversion of Basin water from a source within the Delaware River Basin to a location outside the Basin without return of such water to the Basin. Exportations from the Basin of consumer goods or foods that have been manufactured, bottled, packaged, or processed using Basin water are not considered "exportations" for purposes of this rule.

DRN Comment:
The definition (current and proposed) implies that if water is exported and then returned to the watershed it is not considered to be an exportation of water and this section would not apply. This would allow the transfer of water without DRBC restrictions under the Water Code. This could be exploited as a loophole that allows water to be transferred for any purpose, including HVHF, and the wastewater produced by fracking returned without any regulation or oversight by DRBC. How would DRBC implement its proposed prohibition for the discharge of HVHF wastewater to water or land or any other prohibition of how the wastewater is to be handled? The first sentence in the definition should be changed to: "Exportation" means the conveyance, transfer, or diversion of Basin water from a source within the Delaware River Basin to a location outside the Basin."

DRN Proposed Language:
2.30.1(D) – "Exportation" means the conveyance, transfer, or diversion of Basin water from a source within the Delaware River Basin to a location outside the Basin ~~without return of such water to the Basin~~. Exportations from the Basin of consumer goods or foods that have been manufactured, bottled, packaged, or processed using Basin water are not considered "exportations" for purposes of this rule.

DRBC Proposed Amendment:
2.30.1(E) – "Importation" means the conveyance, transfer, or diversion of water, including wastewater, into the Delaware River Basin from a source outside the Basin, resulting in a discharge of the imported water to land or water within the Basin, with or without prior treatment.

DRN Comment:
There is no definition of "discharge", which makes this term ambiguous and subject to interpretation. The lack of a definition of discharge must be remedied to close a potential loophole that could lead to the release of pollution.
The definition removes from DRBC control the release of pollution contained in wastewater through means other than an actual discharge to water to land. This loophole would not stop air emissions of pollutants at processing facilities; the reuse of wastewater in

manufacturing, cooling water for power plants, refineries, and other systems; the use in construction materials and other products, and other "beneficial uses" as defined by federal and state governments. It also would allow the storage and transfer of wastewater within the watershed outside of DRBC's regulatory reach. This proposed definition should be changed to: "Importation" means the conveyance, transfer, or diversion of water, including wastewater, into the Delaware River Basin from a source outside the Basin."

DRN Proposed Language:
2.30.1(E) – "Importation" means the conveyance, transfer, or diversion of water, including wastewater, into the Delaware River Basin from a source outside the Basin~~, resulting in a discharge of the imported water to land or water within the Basin, with or without prior treatment~~.

DRBC Proposed Amendment:
2.30.1(F)–"Public water system" means a system primarily for the provision to the public of piped water for human consumption, if such system has at least fifteen service connections or regularly serves at least twenty-five individuals. A "public water system" may be publicly or privately owned.

DRN Comment:
It is unclear how nonpublic water systems or industrial water withdrawal systems are affected. This must be clarified.

DRBC Proposed Amendment:
2.30.1(H) – "Wastewater" means water that is stored, transported or discharged after use, including, but not limited to, any water for which a National Pollutant Discharge Elimination System (NPDES) permit under the federal Clean Water Act or any state or DRBC approval is required before the water can lawfully be discharged to waters or land within the Basin.

DRN Comment:
Under this definition, wastewater that is not permitted under a NPDES permit also is subject to being defined as wastewater and cannot be discharged to water or land, which DRN supports.
The terms "stored" and "transported" should be clarified so that "wastewater" is defined to exclude water that will be reused in an industrial or commercial process.

DRN Proposed Language:
2.30.1(H) – "Wastewater" means water that is stored, transported, or discharged after use, ***and will not be reused in an industrial or commercial process.*** *~~including, but not limited to,~~* ***This definition includes, but is not limited to,*** *any water for which a National Pollutant Discharge Elimination System (NPDES) permit under the federal Clean Water Act or any state or DRBC approval is required before the water can lawfully be discharged to waters or land within the Basin.*

DRBC Proposed Amendment:

2.30.2(C)–"A proposed new exportation of Basin water that is subject to review under the Compact and implementing regulations, including any proposed increase in the rate or volume of an existing exportation, may be approved by the Commission after consideration of the factors set forth at Section 2.30.3 below, if:
1. the sponsor demonstrates that the exportation of Basin water is required to serve a straddled or adjacent public water system;
2. the sponsor demonstrates that the exportation of Basin water is required on a temporary, short-term, or emergency basis to meet public health and safety needs; or
3. the sponsor is proposing an exportation of wastewater."

DRN Comment:

DRN supports the DRBC's stated policy in Proposed 2.30.2(A) "to promote the conservation and preservation of water and related natural resources, including aquatic ecosystems". DRBC's plan to accomplish this "by discouraging, limiting, or placing conditions on the exportation of Basin water as may be required to protect the health and safety of Basin residents, aquatic ecosystems and the uses of water identified in the Compact and Comprehensive Plan" is not effective.

A straddled or adjacent water system can sell water for industrial purposes, including HVHF. Simply because the system is located on the watershed divide does not guarantee that the use of the water will not be depletive, wasteful, and fouled by contamination. This provision does not provide protection from these impacts. It does provide some limits and DRN supports that water not be allowed to be exported to water systems located outside of those defined as straddled or adjacent but this provision cannot be interpreted to provide the level of protection required. Public water systems can sell water for industrial purposes, including HVHF. The depletive nature of water used in HVHF is qualitatively different than water that is used without diminution at the point of use. The majority of the volume of water is lost to the hydrologic cycle when injected into deep geologic formations and what is returned is contaminated, impacting the environment more broadly than is measurable at a watershed border. The loss is detrimental to the region, despite watershed boundaries, and can impact the atmosphere, groundwater levels, and regional habitats. In practical terms, the water contamination is unmitigatable due to its persistence in the environment, high toxicity, radioactivity, the unknown constituents that are used in HVHF fluids which makes dangerous chemicals unmeasurable and their removal unverifiable, and the unregulated compounds (despite dangerous or hazardous properties) that are in HVHF wastewater.

There are no definitions of "a temporary, short-term, or emergency basis" or "public health and safety needs". The ambiguity of these terms is a loophole that can be exploited. #2 should be rewritten to clearly define these terms or should be deleted. It must be recognized that an emergency could be created by low flow conditions in a stream or groundwater due to over-withdrawal of water for use in HVHF or could be caused by pollution of water by HVHF, as has occurred in surface and groundwaters in regions where fracking is occurring. The Delaware River Watershed should not be rescuing responsible parties who have acted imprudently, practiced poor planning, violated permits, or caused water supply problems through HVHF operations.

The allowance of the exportation of wastewater is short-sighted, lacks environmental integrity, and shows disregard for neighboring watersheds. It will also deplete water resources within the Delaware River Watershed. The definition of water exportation requires that the

water not be returned. So, we know that the wastewater will never return to its source within the Delaware River Basin, it will be a depletion of water, the same as with fresh water exports. The environmental impacts of water depletion will remain because cleaned wastewater will not be returned to its source, on the basin level or at the subwatershed level. This can diminish the flow and health of streams and tributaries, springs, seeps, and hydrologically-connected resources such as wetlands and groundwater. The practice of the wholesale allowance of the export of wastewater sets up a convenient way for dischargers and generators to escape DRBC regulation, potentially handling and producing wastewater that is more laden with contaminants because the generator is aware it would not need to treat the wastewater to DRBC water quality standards, which are in many instances stricter and more protective of water quality than state standards. This is one of the important benefits of DRBC jurisdiction that provides needed protection of exceptional water quality where it exists, particularly in DRBC-defined Special Protection Waters, and also requires treatment to remove toxics and hazardous substances where remediation programs are operating or species or habitats require special protection. The practice would potentially allow wastewater generators to foul water and escape meeting DRBC water quality standards by simply exporting it outside of the basin. Wastewater produced within the Delaware River Watershed should be cleaned of pollution to the highest standards under DRBC water quality regulations, which provides protection from water quality degradation from discharges but also supports reduction of dangerous pollutants at the manufacturing source. In the big picture, each watershed, including the Delaware River Watershed, must be mindful of its responsibility not to pass its pollution on to any other watershed, as a matter of ethics and environmental stewardship.

<u>DRN Proposed Language:</u>
2.30.2(C) – A proposed new exportation of Basin water that is subject to review under the Compact and implementing regulations, including any proposed increase in the rate or volume of an existing exportation, may be approved by the Commission after consideration of the factors set forth at Section 2.30.3 below, if:
1. the sponsor demonstrates that the exportation of Basin water is required to serves a straddled or adjacent water system;
2. the sponsor demonstrates that the exportation of Basin water is required on a temporary, short-term, or emergency basis to meet public health and safety needs.~~;~~
~~3. the sponsor is proposing an exportation of wastewater.~~
A proposed new exportation of Basin water to be used for HVHF or HVHF-related activities, or to replace a water supply diminished by HVHF or HVHF-related activities, will be denied.

<u>DRBC Proposed Amendment:</u>
2.30.2(D)–Basin waters have limited capacity to assimilate pollutants without significant impacts to the health and safety of Basin residents, the health and functioning of aquatic ecosystems in the Basin, and the effectuation of the Comprehensive Plan. Accordingly, it is the policy of the Commission to discourage, limit, or condition the importation of wastewater into the Delaware River Basin as necessary to avoid impairment of Basin waters. A proposed new importation of water or wastewater, including any proposed increase in the rate or

volume of an existing importation, shall be reviewed by the Commission consistent with the factors set forth at Section 2.30.3 below.

DRN Comment:

The importation of wastewater into the watershed opens a loophole for highly polluted wastewater to enter the watershed. DRN agrees with the policy statement in Paragraph D that "Basin waters have limited capacity to assimilate pollutants without significant impacts to the health and safety of Basin residents, the health and functioning of aquatic ecosystems in the Basin, and the effectuation of the Comprehensive Plan." The rest of Paragraph D in this section should be rewritten: Accordingly, it is the policy of the Commission to discourage, limit, or condition the importation of wastewater into the Delaware River Basin as necessary to avoid impairment of Basin waters. A proposed new importation of wastewater produced by HVHF, including any proposed increase in the rate or volume of an existing importation, shall be prohibited".

DRN Proposed Language:

2.30.2(D)–Basin waters have limited capacity to assimilate pollutants without significant impacts to the health and safety of Basin residents, the health and functioning of aquatic ecosystems in the Basin, and the effectuation of the Comprehensive Plan. Accordingly, it is the policy of the Commission to discourage, limit, or condition the importation of wastewater into the Delaware River Basin as necessary to avoid impairment of Basin waters. A proposed new importation of water or wastewater including any proposed increase in the rate or volume of an existing importation, shall be reviewed by the Commission consistent with the factors set forth at Section 2.30.3 below. ***A proposed new importation of water or wastewater from HVHF or HVHF-related activities, including any proposed increase in the rate or volume of an existing importation, shall be prohibited.***

18 C.F.R. Part 440—HIGH VOLUME HYDRAULIC FRACTURING

DRBC Proposed Amendment:

440.2 – HVHF-related activities are:

(1) Construction of an oil or natural gas production well that is to be stimulated using HVHF as defined herein;

(2) Chemical mixing or storage of proppant, chemicals and other additives to make fracturing fluid; and

(3) Management of wastewater from hydraulic fracturing, including storage, disposal, treatment, or reuse in hydraulic fracturing operations or other uses.

DRN Comment:

DRN supports this comprehensive definition of HVHF-related activities.

Proposed Amendment:

440.4 Wastewater from high volume hydraulic fracturing and related activities

(a) Determination. The Commission has determined that the discharge of wastewater from high volume hydraulic fracturing and HVHF-related activities poses significant, immediate and

long-term risks to the development, conservation, utilization, management, and preservation of the Basin's water resources. Controlling future pollution by prohibiting such discharge is required to effectuate the Comprehensive Plan, avoid injury to the waters of the Basin as contemplated by the Comprehensive Plan and protect the public health and preserve the waters of the Basin for uses in accordance with the Comprehensive Plan.
(b) Prohibition. No person may discharge wastewater from high volume hydraulic fracturing or HVHF-related activities to water or land within the Basin.

DRN Comment:
DRN supports this prohibition and recommends retaining this language, but is concerned about regulatory gaps and proposes the following additional language to prohibit all HVHF-related activities within the Basin.

DRN Proposed Language Alternative #1-New Section 440.5:
440.5 High volume hydraulic fracturing-related activities.
(a) Determination. The Commission has determined that HVHF-related activities pose significant, immediate and long-term risks to the development, conservation, utilization, management, and preservation of the water resources of the Delaware River Basin and to Special Protection Waters of the Basin, considered by the Commission to have exceptionally high scenic, recreational, ecological, and/or water supply values. Controlling future pollution by prohibiting HVHF-related activities in the Basin is required to effectuate the Commission's Comprehensive Plan, avoid injury to the waters of the Basin as contemplated by the Comprehensive Plan, and protect the public health and preserve the waters of the Basin for uses in accordance with the Comprehensive Plan.

(b) Prohibition. HVHF-related activities are prohibited within the Delaware River Basin.

DRN Proposed Language Alternative #2-Amended Section 440.3:
440.3 High volume hydraulic fracturing (HVHF) ***and HVHF-related activities***
(a) Determination. The Commission has determined that high volume hydraulic fracturing ***and HVHF-related activities*** *pose~~s~~ significant, immediate, and long-term risks to the development, conservation, utilization, management, and preservation of the water resources of the Delaware River Basin and to Special Protection Waters of the Basin, considered by the Commission to have exceptionally high scenic, recreational, ecological, and/or water supply values. Controlling future pollution by prohibiting such activity in the Basin is required to effectuate the Comprehensive Plan, and protect the public health and preserve the waters of the Basin for uses in accordance with the Comprehensive Plan.*

(b) Prohibition. High volume hydraulic fracturing in hydrocarbon bearing rock formations ***and HVHF-related activities are*** *~~is~~ prohibited within the Delaware River Basin.*

III. General Comments Concerning the Subject Matter of the Proposed Rulemaking

DRN advocates that the draft regulations be revised to categorically ban the importation of wastewater produced by HVHF and categorically ban the export of Basin water from the Delaware River Watershed for use to support HVHF and HVHF-related activities.

A. DRN supports the Commission's prohibition in proposed § 440.4 of the discharge of wastewater from HVHF or HVHR-related activities to waters or land within the Basin.

DRN supports the proposed prohibition of the *discharge* of wastewater produced by HVHF and HVHF-related activities. The discharge of HVHF wastewater would carry toxic and radioactive pollution into the streams, groundwater, water bodies, and rivers of the Delaware River.[32] This would degrade the main stem river in violation of the requirements of the DRBC Water Code to maintain the existing exceptionally high water quality of the Delaware River and to protect the entire river from degradation because "Basin waters have limited capacity to assimilate pollutants without significant impacts to the health and safety of Basin residents, the health and functioning of aquatic ecosystems in the Basin, and the effectuation of the Comprehensive Plan."[33]

DRN agrees with the Commission's technical findings regarding the highly contaminated wastewater produced by HVHF and its potential to pollute and degrade the Delaware River Watershed as expressed in its Notice of Proposed Rulemaking.[34] This decision is supported by scientific, academic and government reports that have assessed the environmental impacts of discharging wastewater produced by oil and gas extraction and related activities to land and water.

One key report was issued by the U.S. Environmental Protection Agency ("EPA") in 2018 and documented pathways of pollution for toxic, hazardous and radioactive wastewater under current regulations and industrial processes.

> Centralized waste treatment facilities [("CWTs")] accepting oil & gas extraction (O&G) wastewaters can release pollutants into the environment that impact aquatic ecosystems and human health. Potential pollutants can reach the environment (1) through effluent discharging to surface waters either directly from a CWT facility or indirectly from publicly owned treatment works (POTWs) accepting treated CWT effluent; (2) during managed use of wastewater, such as irrigation; and (3) by

[32] *See* "Attachment A" for a comment submitted by DRN to PADEP regarding a proposed centralized wastewater treatment facility discharge in the Allegheny River watershed.
[33] Proposed Water Code § 2.30.2.
[34] Importations of Water Into and Exportations of Water From the Delaware River Basin; Discharges of Wastewater From High Volume Hydraulic Fracturing and Related Activities, 86 Fed. Reg. 66,250 (proposed Nov. 22, 2021) (to be codified at 18 C.F.R. Parts 410 & 440).

> releases from storage impoundments and spills. Direct discharges of treated effluent from CWT facilities accepting O&G wastewater have caused environmental impacts, particularly on water quality, drinking water, and aquatic health.[35]
>
> Because the effect CWT facilities have on downstream water quality is variable, Warner et al. (2013) calculated an annual average enrichment factor for pollutants discharged from facilities accepting O&G wastewater to determine how much impact CWT facilities had on downstream waters (see Box 1). Even with variability in effluent concentrations and upstream conditions, there is a clear impact to downstream concentrations from CWT effluent. In the following sections, documented and potential impacts from elevated concentrations for pollutants from CWT effluent are discussed.[36]

EPA's report further elaborates that wastewater produced by fracking is being treated and discharged at permitted centralized waste treatment facilities today. Scientific investigations in Pennsylvania of the downstream surface water quality and sediments show that the discharges have caused pollution plumes in these streams and that dangerous levels of contaminants such as radium 226 have accumulated in the stream's sediments.

> Effluents from CWT facilities treating O&G wastewater have been associated with alterations in downstream surface water quality in individual receiving streams (e.g., Warner et al., 2013; Ferrar et al., 2013) as well as at the watershed level (e.g., Wilson and VanBriesen, 2012; Olmstead et al., 2013; Vidic et al., 2013). Extraction techniques, such as hydraulic fracturing (HF), became a major source of O&G wastewater in the early 2000s (Wilson and VanBriesen, 2012; U.S. EPA, 2016c). HF wastewater has been characterized as either flowback water or produced water in some references. Some pollutants of potential concern from an environmental or human health perspective in O&G wastewater include TDS; halides (e.g., bromide, chloride, and iodide); metals; technologically enhanced naturally occurring radioactive materials (TENORM); and a wide range of poorly characterized chemicals in injected fluids including surfactants, biocides, wetting agents, scale inhibitors, and organic compounds.[37]

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[35] U.S. Envtl. Prot. Agency, Engineering and Analysis Division, Office of Water, "Detailed Study of the Centralized Waste Treatment Point Source Category for Facilities Managing Oil and Gas Extraction Wastes", May 2018. EPA-821-R-18-004. P. 9-1

[36] *Id*. at 9-18

[37] *Id*. at 9-1

> CWT facilities treating O&G wastewater and discharging to surface waters have direct and measurable impacts on downstream surface waters and sediment. As shown in Figure 9-2 through Figure 9-6, reported effluent and downstream concentrations are higher than upstream concentrations in the surface water for TDS, chloride, bromide, metals, and TENORM. In many instances, downstream concentrations exceed applicable aquatic and/or drinking water thresholds, indicating that the elevated downstream concentrations can negatively affect human health or aquatic life. Documented and potential impacts to human health and aquatic life are discussed in more detail in Sections 9.4 and 9.5.[38]

In its report, EPA says many of the constituents identified are known pollutants of concern and have negative human health effects including:

> TDS; halides (e.g., bromide, chloride, and iodide); metals; technologically enhanced naturally occurring radioactive materials (TENORM); and a wide range of poorly characterized chemicals in injected fluids including surfactants, biocides, wetting agents, scale inhibitors, and organic compounds.[39]

EPA further documents water quality problems from the high concentrations of halides, including bromide and chloride, in frack wastewater that has been processed to current treatment standards and the dangers that presents to human health. Studies show that disinfection by-products (DBPs) can form when the fracking wastewater effluent mixes with halides during drinking water treatment. Brominated and iodinated DBPs are known to increase the risk of bladder cancer. DBPs are a drinking water hazard because of the propensity for the brominated DBP's to form trihalomethanes and haloacetic acid, which can cause cancer.[40]

> As summarized in Section 9.3, CWT effluent has been reported to contain high concentrations of halides, including bromide and chloride. Halides are precursors for DBPs, which can form when drinking water disinfection processes interact with organic and inorganic matter in intake waters. DBPs can have potential adverse effects on human health (Hladik et al., 2014). Because brominated species of these compounds tend to be more toxic than chlorinated analogs (e.g., McTigue et al., 2014), one of the primary human health concerns related to CWT effluent is the downstream formation of brominated DBPs during drinking water treatment. An increase in halides in intake waters could

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[38] *Id*. at 9-18.
[39] *Id*. at 9-1.
[40] http://www.duq.edu/academics/schools/natural-and-environmental-sciences/academic-programs/environmental-science-and-management/3-rivers-quest

> also affect the ability of conventional drinking water plants to comply with the Stage 2 Disinfectants/Disinfection Byproducts Rule (DBPR)."[41]
>
> Documented increases in bromide concentrations in rivers receiving CWT effluent, combined with the known human health effects of brominated THMs in drinking water, demonstrate that CWT effluent poses human health risks related to drinking water contamination. In watersheds where O&G activities are active and CWT facilities are present, studies have shown evidence of a shift in surface water ionic composition toward relatively greater amounts of bromide (McTigue et al., 2014).[42]
>
> High levels of bromide and iodide, such as those found in effluent from CWT facilities accepting O&G wastewater, can pose greater human health risks than other halides because brominated and iodinated DBPs tend to be more cyto- and genotoxic than their chlorinated analogues (Harkness et al., 2015). Regli et al. (2015) estimated that bromide concentration increases in drinking water sources can increase the risk of bladder cancer. Wang et al. (2016) also estimated that brominated DBPs significantly increase the cancer risk level if bromide is not properly removed or reduced in source waters.[43]

EPA states in their study that frack wastewater can negatively affect aquatic life and documents that with studies by scientists and PADEP. It was found in one study that juvenile federally listed northern riffleshell mussels (Epioblasma torulosa rangiana, in the Unionidae family) had very low survival rates when in waterways downstream of frack wastewater effluent discharges.

> Documented and potential impacts to both aquatic life and human health related to discharges from CWT facilities treating oil and gas extraction wastewater exist due to the prevalence of some pollutants. Levels of pollutants downstream from CWT facility discharges have been reported to exceed applicable thresholds, such as primary and secondary drinking water

[41] U.S. Environmental Protection Agency (EPA), Engineering and Analysis Division, Office of Water, "Detailed Study of the Centralized Waste Treatment Point Source Category for Facilities Managing Oil and Gas Extraction Wastes", May 2018. EPA-821-R-18-004. p. 9-20 (hereinafter, "CWT Study"); more detailed information on this at p. 9-20-21

[42] *Id*. at 9-23–9-24.

[43] *Id*. at 9-26.

> standards and acute and chronic water quality criteria for protection of aquatic life.[44]
>
> A study by PA DEP documented shifts in population structure for macroinvertebrate and phytoplankton communities upstream and downstream of CWT discharges. Based on this study, upstream locations contained a higher percentage of pollution-intolerant macroinvertebrate species compared to pollution-tolerant species. Macroinvertebrate populations located downstream of brine discharges (Short et al., 1991) and CWT facilities (PA DEP, 2009, 2013) showed reduce species richness and contained a higher percentage of pollution-tolerant compared to pollution-intolerant species. Phytoplankton communities followed a similar pattern shift in taxa, with an elevated percentage of brackish water taxa found in downstream locations compared to upstream locations (PA DEP, 2009).[45]
>
> In another study, native unionid mussel composition was also negatively affected downstream of CWT discharge (Patnode et al., 2015). In the Patnode et al. (2015) study, stream locations with elevated conductivity measurements downstream of CWT discharge had reduced abundance and diversity compared to upstream locations with lower conductivity." (9-27) "Patnode et al. (2015) performed an in-situ study on the lethality of CWT effluent to juvenile unionid mussels, which are a federally listed endangered species. Using caged mussels at an array of sites downstream of a CWT facility, these authors found that mussel survival decreased significantly at sites with high specific conductivity related to the CWT discharge.[46]

In another study of freshwater mussels, researchers analyzed shells of freshwater mussel species *Elliptio dilatata* and *Elliptio complanata* collected in the Allegheny River approximately 0.5–1 km downstream of a fracking wastewater NPDES-permitted facility for evidence of accumulation of strontium from O&G wastewater.[47] Previous research has shown that this treated wastewater increases salinity and radioactivity in the receiving streams and increases mortality in freshwater mussels.[48] Mussels are sensitive to changes in salinity because glochidia, the larval stage of mussels, are sensitive to chloride concentrations and thus have the potential to be good indicators of high salinity O&G

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[44] *Id*. at 1-4.
[45] *Id*. at 9-26.
[46] *Id*. at 9-27; more detail on Index of Biotic Integrity data, *id*. at 9-27
[47] Geeza at al. (2018). Accumulation of Marcellus Formation Oil and Gas Wastewater Metals in Freshwater Mussel Shells. *Environmental Science & Technology*.
[48] *Id*. at B

wastewater disposal impacts to streams.[49] Various metals, such as Mg, Mn, Ba, and Sr, can also accumulate in the shells of mussels.

In the samples collected downstream of the NPDES-permitted facility, the results showed elevated Sr/Ca and lower 87Sr/86Sr compared to the shells collected upstream of the facility.[50] The upstream samples did not show these results. This study represents the first indication of bioaccumulation of unconventional O&G wastewater downstream of surface water disposal facilities.[51] These data were compared to samples taken from the Delaware and Juniata Rivers, which have no history of frack wastewater discharges. These variations were not found in the Delaware or Juniata. The Delaware River currently hosts populations of federally endangered dwarf wedge mussels and other freshwater mussels, of crucial importance to the water quality and healthy biodiversity of the Delaware River.

B. The Commission must revise its Proposed Rulemaking to ensure pollution from HVHF industry does not harm the Basin and its water resources.

Pollutants associated with HVHF wastewater can also enter surface and groundwater through air deposition, leaks, spills and other releases that do not strictly constitute a "discharge to water and land". For this reason, DRN urges the Commission to go further in its Proposed Rulemaking to protect the Basin and its water resources. The regulations do not prohibit the acceptance of wastewater produced by HVHF—only imports that would result in a discharge to land or water. This allows pathways for HVHF pollution through the allowance of HVHF-related facilities such as wastewater processing systems that don't strictly "discharge to water or land". This loophole would allow HVHF wastewater to enter the watershed and cause pollution through other, sometimes unintentional, means of release.

For instance, air permits issued by the states will result in polluting air emissions that deposit on surface water, vegetation, and soils, contaminating the watershed and its water, even if they aren't directly "discharged to water or land". This pollution threatens public health as people breathe in dangerous pollutants and by reducing the quality of water and other environmental media, it also endangers our watershed's health, including ecosystems, habitats, species and important recreational and economic values.[52] The proposed regulations must categorically prohibit the importation of wastewater produced by HVHF in order to prevent the pollution for HVHF from being released into the watershed.

The pollution emitted into the air by the burning, thermal oxidation, evaporation or air-drying of toxic and radioactive frack wastewater may not technically discharge to water or land under DRBC's Water Code, but it would still be an import of fracking pollution that

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[49] *Id*. at B
[50] *Id*. at G
[51] *Id*. at G
[52] "Air pollution: effects on soil and water" at: https://www.canada.ca/en/environment-climate-change/services/air-pollution/quality-environment-economy/ecosystem/effects-soil-water.html

would endanger human health and the environment and spread fracking's footprint even further than it reaches today.

Compounding the problems posed by the Commission's proposed narrow discharge-only regulation, is a lack of regulatory controls over oil and gas industrial operations, including HVHF treatment facilities and storage sites at the federal and state level. Exemptions from federal laws, many of which apply at the state level, have led to environmental pollution and water and air quality degradation. As explained in a report regarding the federal exemptions:

> The oil and gas industry enjoys sweeping exemptions from provisions in the major federal environmental statutes intended to protect human health and the environment. These statutes include the:
>
> • Comprehensive Environmental Response, Compensation, and Liability Act
> • Resource Conservation and Recovery Act
> • Safe Drinking Water Act
> • Clean Water Act
> • Clean Air Act
> • National Environmental Policy Act
> • Toxic Release Inventory under the Emergency Planning and Community Right-to-Know Act
>
> This lack of regulatory oversight can be traced to many illnesses and even deaths for people and wildlife across the country. There are a variety of chemicals used during the many phases of oil and gas development. These chemicals also produce varying types of waste throughout these processes. Because of the exemptions and exclusions, toxic chemicals and hazardous wastes are permeating the soil, water sources and the air threatening human health to an alarming extent.[53]

The loopholes in the draft regulations, therefore, are made even more dangerous because of exemptions for the oil and gas industry from bedrock environmental laws and regulations that may apply to the facilities that would operate in the watershed. Whether all or some of the exemptions would apply may have to be decided on a case-by-case basis but the potential for a facility that treats, stores, transfers, or otherwise handles wastewater produced by HVHF that does not discharge to water or land is very real and untenable.

The Commission documented the hazards associated with HVHF within the Delaware River watershed in its Comment & Response Document issued following the 2017-2018

[53] Kosnik, Renee Lewis, MSEL, JD, "The Oil and Gas Industry's Exclusions and Exemptions to Major Environmental Statutes" at 2, Oil and Gas Accountability Project, a Project of Earthworks, October, 2007. https://earthworks.org/assets/uploads/archive/files/publications/PetroleumExemptions1c.pdf

proposed rulemaking regarding HVHF.[54] Reports and studies amplify the findings that supported the Commission's decision to ban HVHF within the Delaware River Watershed.[55]

1. *The volume of water being used and wastewater being produced by HVHF has greatly increased.*

The continuing trend in the Marcellus shale to drill supersized wells, with horizontal wellbores up to 4 miles long, has increased volumes of wastewater produced by each fracked well.[56] Approximately 10–15% of the 10 to 20 million gallons of water injected for fracking comes back to the surface as flowback. That means between 1–1.5 million gallons of wastewater (at 10M gal. of water) to between 2 and 3 million gallons of wastewater (at 20M gal. of water) per well, increasing the volumes three to four times over what fracked wells produced just a few years ago. This adds a glut of wastewater that has to go somewhere, and the Delaware River Watershed's proximity to one of the most productive regions of the Marcellus Shale play, in the northeastern portion of the Susquehanna Watershed, makes it especially attractive.

The use of enormous and growing amounts of water to frack HVHF wells has far-reaching environmental consequences for the watersheds that are the source of water. Some wastewater, as discussed in this comment, is reused in fracking wells but the majority of the water used in fracking each well is fresh water.

Only 3% of the earth's water is freshwater and only about 0.5% is available to use as drinking water. [57] How we manage water will define our watershed's future and the future of the planet. Yet modern society tends to take water for granted, using water as if it has no limits. In fact, water is replenished through the hydrologic cycle but it is diminished by depletive use and by pollution, both limiting the water available and its potability.

Fracking uses enormous volumes of water, approximately 5-10 million gallons per well, and increases of 10-20 million gallons are becoming more frequent. Longer well bores mean that more water is needed to flood the bores with fracking water. FracTracker Alliance reports that this increased the average amount of water used per fracked well in

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[54] Comment & Response Document, *supra* n. 6.

[55] "Companies are not mandated by federal regulations to disclose the identities or quantities of chemicals used during hydraulic fracturing operations on private or public lands. These chemicals can volatilize into the air from tanks and wastewater impoundments and contribute to air pollution." ("Fracking Fumes: Air Pollution from Hydraulic Fracturing Threatens Public Health and Communities", Natural Resources Defense Council, 2014. https://www.nrdc.org/resources/fracking-fumes-air-pollution-fracking-threatens-public-health-and-communities

"Fracking sites release a toxic stew of air pollution that includes chemicals that can cause severe headaches, asthma symptoms, childhood leukemia, cardiac problems, and birth defects. In addition, many of the 1,000-plus chemicals used in fracking are harmful to human health—some are known to cause cancer." ("Reduce Fracking Health Hazards", Natural Resources Defense Council, 2021. https://www.nrdc.org/issues/reduce-fracking-health-hazards

[56] "These days, oil and gas companies are super-sizing their well pads", *Pittsburgh Post-Gazette*, 2018. https://www.post-gazette.com/business/powersource/2018/01/15/These-days-oil-and-gas-companies-are-super-sizing-their-well-pads/stories/201801140023

[57] https://www.nj.gov/drbc/programs/flow/

Pennsylvania to about 11 million in 2017.[58] The FracTracker report estimates "the industry used 51.4 billion gallons of water to stimulate 7,721 unconventional wells in Pennsylvania in the seven-year period from 2011 through 2017[59] and over 6 billion gallons in 2017 alone."[60]

In Pennsylvania in 2017, gas wells consumed over 6 billion gallons of fresh water for drilling and fracking 539 shale gas wells.[61] 2.2 billion gallons of liquid waste and 2.1 billion pounds of solid waste were generated by those wells.[62] There are wells in Ohio that have used as much as 87 million gallons of water per "super lateral" well.[63] These huge volumes mean that the industry is seeking more water outside of the watersheds they have been depleting for years and the Delaware River Watershed is untapped by them.

The water used in fracking is a depletive use—it doesn't return to the source. These huge volumes of water either are locked underground or flow back as highly contaminated wastewater that cannot be fully cleansed of its toxic and radioactive properties. By comparison, evaporative losses for uses such as agriculture or recreation use water that evaporates to the atmosphere, essentially recycling the used water into the air where it returns to earth as precipitation. But much of the water used for fracking is no longer available to the hydrologic cycle because much of it is left sequestered deep in the ground, cut off from the natural water cycle, compounding the impacts of the loss. Over time, an additional portion of the water injected for fracking comes up to the surface called "produced water", but is no longer considered "water" and must be handled as wastewater. This "produced" water is highly polluted and is never restored to its original quality, representing an irretrievable loss.

The loss of flows in waterways has a cascade of degrading impacts that can harm in-stream habitats, disrupt species' life cycles, reduce biodiversity, and destroy ecological flow regimes.[64]

In New York, NY State Department of Environmental Conservation (NYDEC) advises:

> Potential impacts that should be evaluated due to decreased flow include loss of habitat, direct impacts on sensitive life stages, loss of mobility for aquatic organisms, thermal impacts, decreased dissolved oxygen, impacts on wetland hydrology, impacts on recreation and fishing, and decreased quantity of

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[58] FracTracker Alliance, "Potential Impacts of Unconventional Oil and Gas on the Delaware River Basin", March 20, 2018. PDF p. 6 https://www.delawareriverkeeper.org/sites/default/files/FT-WhitePaper-DRB-2018%20%28003%29.pdf
[59] *Id,* PDF p. 7
[60] *Id,* PDF p. 13
[61] *Id,* PDF p. 7
[62] *Id,* PDF p. 13
[63] Ted Auch, Fractracker Alliance, "The Freshwater and Liquid Waste Impact of Unconventional Oil and Gas in Ohio and West Virginia", http://midatlanticwrc.org/event-info/agenda/the-freshwater-and-liquid-waste-impact-of-unconventional-oil-and-gas-in-ohio-and-west-virginia/
[64] Instream Flows for Riverine Resource Stewardship, Instream Flow Council, Cheyenne, Wyoming, 2004.

> water available for public water supply. Any new flow-related permit conditions should give priority to the best usage of domestic and municipal water supply.[65]

In the Administrative Agreement between DRBC and New York State, DRBC was given delegated authority over New York's water withdrawals from the Delaware River Watershed, not New York State government. DRBC is supposed to implement New York's stricter guidelines when it dockets withdrawals.[66] Nonetheless, how this arrangement will play out regarding export of water for fracking has never been proven in practice.

The depletion of water from waterways reduces their ability to assimilate pollutants and repel salt-water intrusion into critical water supplies in the tidal river, including millions of people in the Greater Philadelphia Region and South Jersey.[67]

The withdrawal and export of surface water for use in fracking outside of the watershed deprives springs, lakes, tributaries, and the mainstem Delaware River of critical flows, quantity, and quality. The withdrawal and export of water from groundwater robs aquifers that feed water supply wells, reduces and disrupts natural groundwater flows, and potentially destroys essential hydrologic connections with wetlands and other water dependent systems. This harms water quality, degrades and diminishes aquifers and streams, adversely impacts aquatic life and flora and fauna, and threatens the safety of drinking water supplies.

In fact, the DRBC meticulously manages the water flows of the river with a goal of repelling the salt front.[68] That goal will be undercut if water and water resources are exported from the Delaware River Basin. This includes certain wastewaters[69] that could be cleaned and returned to the source subwatershed.

The impacts of water withdrawals from streams is not adequately regulated by most agencies. Approvals for water withdrawals, including DRBC, are based on a calculation using data from low flow periods, such as when there is little rainfall. Scientists warn that using the low flow as a "pass-by flow" that is based on using the Q7-10 (the flow which occurs for a period of seven consecutive days one time in 10 years—considered "drought flow") is not adequate to protect waterways and the life that depends on them[70] and can be expected to cause direct harm to the habitats and water quality of the stream.[71] For example, up to 70 percent of water can be taken from small streams for well development during low flow

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[65] NYSDEC, Division of Water Technical and Operational Guidance Series, "Incorporation of Flow-Related Conditions in Water Withdrawal Permits", APR 12 2017. P. 6. https://www.dec.ny.gov/docs/water_pdf/flowtogsfinal.pdf.

[66] https://www.nj.gov/drbc/library/documents/AA/NYSDEC_march2016.pdf; https://www.nj.gov/drbc/about/regulations/administrative-agreements.html

[67] https://www.nj.gov/drbc/programs/flow/salt-front.html

[68] https://www.nj.gov/drbc/programs/flow/salt-front.html

[69] Excluding HVHF wastewater, as made clear throughout this comment.

[70] Instream Flows for Riverine Resource Stewardship, Instream Flow Council, Cheyenne, Wyoming, 2004, p. 178

[71] *Id,* p. 178-179

conditions even with a buffer built in.[72] This basically dooms the stream to lower and more sluggish flows, negatively impacting many aquatic species.

Depletion of water from waterways has complex environmental impacts on stream life. For instance, the health of a stream relies on its maintenance of a natural flow regime, also called an ecological flow regime. The life in a stream or river is adapted to its habitat based on its seasonal fluctuation, oxygen and nutrients in the water, its rate of flow and resulting rippling effects, the temperature and depth of the water, the benthic creatures that provide the base of the food web and define the biodiversity of a stream, and many other elements that are sensitive to water withdrawals and depletion. Water withdrawals from water bodies have a cascade of degrading effects on stream life and quality that can be exacerbated by complete water loss or depletive use.

Water withdrawn from groundwater that is not returned to the subwatershed can, likewise, deplete groundwater, aquifers, and in turn reduce hydrologic contributions to wetlands, springs, and waterways. Pumping of groundwater can change natural groundwater flows, can move pollution plumes in unexpected directions, and can deplete existing water supply wells through interference. There is no mitigation that can undo these effects if the water use is depletive. The only way to protect the quality of our streams, groundwater, and river and the life and water supplies they support is to completely deny exports, preventing depletive loss.

Groundwater is being stressed not only by the withdrawals of water used for fracking but also by fracking into pores that are close to the fresh water/brackish water underground water tables and by the injection of waste. Fracking into pores and fractures to access trapped natural gas can mix fresh water with higher salinity brackish water at depth. Additionally, polluted wastewater injected for disposal underground can seep into groundwater that feeds aquifers. This can contaminate an aquifer and compromise water supplies with salinity and/or pollutants.

From a report from the scientific journal *Environmental Research Letters*:

> Groundwater resources are being stressed from the top down and bottom up. Declining water tables and near-surface contamination are driving groundwater users to construct deeper wells in many US aquifer systems. This has been a successful short-term mitigation measure where deep groundwater is fresh and free of contaminants. Nevertheless, vertical salinity profiles are not well-constrained at continental-scales. In many regions, oil and gas activities use pore spaces for energy production and waste disposal. Here we quantify depths that aquifer systems transition from fresh-to-brackish and where oil and gas activities are widespread in sedimentary basins across the United States. Fresh brackish transitions occur

[72] https://www.delawareriverkeeper.org/sites/default/files/CNA%20Impacts%20in%20DRB.8.15.pdf

> at relatively shallow depths of just a few hundred meters, particularly in eastern US basins. We conclude that fresh groundwater is less abundant in several key US basins than previously thought; therefore drilling deeper wells to access fresh groundwater resources is not feasible extensively across the continent. Our findings illustrate that groundwater stores are being depleted not only by excessive withdrawals, but due to injection, and potentially contamination, from the oil and gas industry in areas of deep fresh and brackish groundwater.[73]

The withdrawal and export of water from the watershed will have ancillary impact related to the infrastructure and transportation of the water. Pipelines can be used to carry water out of the basin for long distances. Drillers in Pennsylvania currently use pipelines to move water around for drilling and fracking in the Marcellus shale.[74] The myriad impacts of pipelines to the environment, both temporary and permanent, bring their own environmental damages. Transportation by truck adds air pollution, wear and tear to roadways, traffic congestion, and climate impacts, and increases incidents of accidents. Other impacts occur related to transfer stations and stream obstructions.

What would be the benefit to the Delaware River Watershed and the up to 17 million people who rely on the Delaware for water every day, to export Delaware River Basin water? Water supplies contribute 3.82 billion dollars in annual value to the regional economy and water quality brings $2.5M in annual economic benefit to the Basin, according to a study out of the University of Delaware.[75] When water is depleted, it has real economic impacts for the source watershed that has lost the value of that water.

Additionally, exporting water to drill and frack gas wells induces fracking in locations where it may not occur due to water shortages in overdrawn streams and it induces more fracking, which damages public health and the environment. It is outright wrong to induce fracking elsewhere when you have determined it is too dangerous to allow on your home watershed. DRBC has rightly banned fracking within the Delaware River Watershed. As stated on the DRBC website:

> As the scientific and technical literature and the reports, studies, findings and conclusions of other government agencies reviewed by the Commission have documented, and as the more than a decade of experience with HVHF in regions outside the Delaware River Basin have evidenced, despite the dissemination of industry best practices and government

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[73] Grant Ferguson *et al* 2018 *Environ. Res. Lett.,* ***13*** *114013,* "Competition for shrinking window of low salinity groundwater". https://iopscience.iop.org/article/10.1088/1748-9326/aae6d8

[74] https://www.ahs.dep.pa.gov/eFACTSWeb/searchResults_singleSite.aspx?SiteID=854164; https://www.ahs.dep.pa.gov/ePermitPublicAccess/Public/PublicAuthOverview?q=qd5DrfUI6Inn8B%2bgkLgh7QKcfnYFt5qTvYpiEd5ZXsw%3d

[75] Gerald J. Kauffman, Socioeconomic Value of the Delaware River Basin in Delaware, New Jersey, New York, and Pennsylvania", University of Delaware, 10.11.11, p. 26.

> regulation, HVHF and related activities have adversely impacted surface water and groundwater resources, including sources of drinking water, and have harmed aquatic life in some regions where these activities have been performed.[76]

It is not safe and has unmitigatable impacts to water, the environment, and public health.[77] Enabling fracking will also increase the emissions of the powerful greenhouse gas methane, worsening the climate crisis.[78]

2. *Classification of waste as non-hazardous increases the risk of pollution.*

The hazardous waste properties of wastewater produced by fracking are not recognized by the government, which allows fracking waste to be handled, transported, and disposed through less restrictive processing systems than would be required for contaminants classified as hazardous waste.

As "special" wastes, drilling fluids, produced water, and hydraulic fracturing fluids are unregulated toxic substances. They were re-named 'special' by the Bentsen amendment to the Resource Conservation and Recovery Act ("RCRA") in 1980 so that these wastes would not be regulated as the toxic materials that they are. RCRA takes a "cradle to grave" approach to ensure wastes are handled properly from the point of creation to transport to disposal. The Bentsen Amendment removed that regulatory oversight over oil and gas wastes. Additionally, that change isolated the gas and oil companies from the liability they would have if this waste were regulated as toxic under RCRA.[79]

The labeling of oil and gas waste as 'special' does not mean that it is not toxic—oil and gas waste is toxic and very harmful. The liquid wastes contain carcinogens, endocrine disrupting chemicals, heavy metals, poisonous hydrocarbons, radioactivity and extremely high salt content. Included in the mix are the toxic "BTEX" materials, benzene, toluene, ethylbenzene, and xylenes. It was recently revealed that highly toxic per- and polyfluoroalkyl substances ("PFAS") have been used in the fluids used in fracking in Pennsylvania and beyond. In its national study of fracking and drinking water, EPA identified 1,606 chemicals in fracking fluid or drilling wastewater including 1,084 identified in fracking fluid and 599

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[76] Extracted from DRBC website at: https://www.nj.gov/drbc/programs/natural/

[77] https://www.delawareriverkeeper.org/sites/default/files/DRN%20Comment%20on%20DRBC%20Draft%20Regulations%20w%20Attachments%20%282018-03-30%29_0.pdf

[78] See: IPCC Reports https://www.ipcc.ch/2021/08/09/ar6-wg1-20210809-pr/ and IPCC Sixth Assessment Report (AR6)1, Working Group I Summary for Policymakers, Section A. The Current State of the Climate, 2021. At A.1.1, SPM-5. https://www.ipcc.ch/report/ar6/wg1/#SPM. Also see: " Wall Street Journal, *The Leaks That Threaten the Clean Image of Natural Gas*, https://www.wsj.com/articles/the-leaks-that-threaten-the-clean-image-of-natural-gas-11565280375.

[79] U.S. Envtl. Prot. Agency, Special Wastes, EPA Website, https://www.epa.gov/hw/special-wastes

identified in wastewater, yet only 173 had toxicity values from sources that met EPA's standards for conducting risk assessments.[80]

The problem is that the waste generated by fracking IS hazardous and the lack of strict oversight of the contaminant in this wastewater has resulted in environmental pollution and human health impacts affecting communities where fracking occurs and everywhere that fracking wastewater goes.[81] The toxic chemicals and radioactive materials in fracking wastewater fit the definition of the hazardous wastes that must be handled with much stricter transportation, storage, processing, and disposal/discharge requirements but the longstanding artificial exemption of oil and gas wastes lets them pass as if they don't.

New York State adopted changes to its environmental conservation law in 2020 that require waste generated by oil and gas development, including drilling fluids and produced waters, to be considered as hazardous waste and handled according to the state's hazardous waste regulations. This "uniform treatment of waste" is an important closing of the hazardous waste loophole but regulations implementing this law have not been developed or adopted yet by New York. No other state in the Delaware River Watershed has reclassified wastewater produced by fracking as "hazardous" and subject to special hazardous waste handling regulation.

In Pennsylvania, oil and gas wastes are exempted from hazardous waste rules, as they are at the federal level. This is the most likely source of the fracking wastewater that would come to the Delaware River Watershed; Pennsylvania is the second largest gas producing state in the nation and almost all gas extraction uses fracking. According to a report by Environmental Health News "In Pennsylvania, these legislative loopholes have resulted in radioactive oil and gas waste at municipal landfills and sewage treatment plants that aren't equipped to handle it…"[82] Radioactivity, salts, and other dangerous toxins that are in the waste end up in highly polluted leachate.[83] Waterways, ecosystems, and fish and wildlife have been negatively impacted and long-term damage has been discovered.[84]

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[80] U.S. Envtl. Prot. Agency, Hydraulic fracturing for oil and gas: impacts from the hydraulic fracturing water cycle on drinking water resources in the United States. Washington, DC: Office of Research and Development; 2016, at ES-45 to ES-46 and 9-1. EPA Report # 600/R-16/236F. See https://www.epa.gov/hfstudy.

[81] Dusty Horwitt, "Fracking with Forever Chemicals" published by the Physicians for Social Responsibility, at https://bit.ly/3i06IUO. And Philadelphia Inquirer Editorial with investigative info: https://bit.ly/3JRRRch

[82] Kristina Marusic, "Should oil and gas companies be exempt from Pennsylvania's hazardous waste laws?" Environmental Health News, Oct. 6, 2021. https://www.ehn.org/radioactive-waste-oil-and-gas-2655217995.html

[83] Reid Frazier, "DEP Fines Landfill Near Pittsburgh for Problems Tied to Fracking Waste". Allegheny Front, Feb. 21, 2020. https://www.alleghenyfront.org/dep-fines-landfill-near-pittsburgh-for-problems-tied-to-fracking-waste/

[84] Kristina Marusic, "Fracking chemicals dumped in the Allegheny River a decade ago are still showing up in mussels: Study; 'This means it's entering the food chain,'" Environmental Health News, 9.5.2018. https://www.ehn.org/chemicals-from-fracking-in-pennsylvania-polluting-freshwater-mussels-2602333500.html and Geeza, et al, "Accumulation of Marcellus Formation Oil and Gas Wastewater Metals in Freshwater Mussel Shells", Environmental Science and Technology, 9.1.18. https://pubs.acs.org/doi/10.1021/acs.est.8b02727

As stated in a recent article:

> In Pennsylvania, these legislative loopholes have resulted in radioactive oil and gas waste at municipal landfills and sewage treatment plants that aren't equipped to handle it, being intentionally spread on roadways and farmland, and contaminating waterways used for drinking water, fishing, and swimming.
>
> The liquid waste is injected deep underground in injection wells, sent to recycling or treatment facilities for reuse by the industry, or repurposed into commercial products like pool salts and road de-icers (in addition to containing radioactive substances and heavy metals, fracking brine is also extremely salty). Contamination of soil and waterways has been documented from spills and leaks on well pads, trucking accidents, leaking injection wells, and road spreading. Efforts are currently underway to begin transporting fracking waste by barge, which advocates worry would pose additional risks to waterways.[85]

The waste is also going to landfills and sewage plants in Pennsylvania that cannot properly contain the radioactivity, salts, and other dangerous toxins that are in the waste and end up in highly polluted leachate.[86] If the waste were classified as "hazardous", it would have to be disposed of in landfills designed and permitted for accepting hazardous waste. This exemption from federal and state regulations poses a liability for the DRB because the import will be allowed under the draft regulations but the wastewater would not be handled as hazardous, increasing the potential for release through myriad pathways.

3. *Transportation to facilities within the Basin exposes the water resources to a high risk of pollution.*

Transportation into the Basin for processing, storage, reuse or other purposes threatens the release of dangerous fracking wastewater pollution. Allowing the import of frack wastewater into the Delaware River Watershed will mean a much greater opportunity for pollution incidents and the handling and transloading of this toxic fluid once it is in our watershed from tankers, containers, rail cars or other modes of mobile transport will increase the likelihood even more. The transportation of hazardous waste exposes

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[85] Kristina Marusic, "Should oil and gas companies be exempt from Pennsylvania's hazardous waste laws?" Environmental Health News, Oct. 6, 2021. https://www.ehn.org/radioactive-waste-oil-and-gas-2655217995.html

[86] Reid Frazier, "DEP Fines Landfill Near Pittsburgh for Problems Tied to Fracking Waste". Allegheny Front, Feb. 21, 2020. https://www.alleghenyfront.org/dep-fines-landfill-near-pittsburgh-for-problems-tied-to-fracking-waste/

communities and the environment to the risk of contamination should there be a spill to water or land as a result of an accident, sabotage or intentional unpermitted release.

Transportation also can cause an accumulation of incidental leaks that are never monitored or accounted for, even though the negative impacts are very real to the receiving waterway, groundwater, soil, vegetation, and species.

Transportation also emits pollutants to the air that deposit on land, soil, vegetation, or surface water and/or are breathed in by people and animals; this occurs from mobile emissions of carbon and air pollutants from engines as well as off-gassing from container tanks being used for transport.

EPA cites several reports regarding spills and leaks in its seminal report released in 2018 regarding oil and gas wastewater. [87] EPA reports that spills, leaks, and releases of frack wastewater occur, citing a study that says wastewater is one of the top three materials spilled in fracking activities, including during transportation of wastewater. EPA documents that these releases have negative impacts on water quality and aquatic life; the harm can persist for years after a spill. It reported that:

> [H]ealth effects associated with chronic oral exposure to these chemicals include carcinogenicity, neurotoxicity, immune system effects, changes in body weight, changes in blood chemistry, liver and kidney toxicity, and reproductive and developmental toxicity.[88]

EPA also states that studies show that the likelihood of spills increase as the volume of wastewater and number of trips increase.

> Another pathway for environmental releases of pollutants from disposal of O&G wastewater at CWTs is the potential for spills of wastewater during transportation from O&G wells or at treatment facilities. Spills of untreated wastewaters can negatively impact water quality and aquatic life, and those impacts can persist in the environment for years. Flowback water spills in the Marcellus Shale region have been shown to negatively impact aquatic life including fish and macroinvertebrates (Grant et al., 2016). Impacts from reported O&G wastewater spills in North Dakota persisted for up to four years after the spill events and included elevated TDS, contaminants (including selenium, lead, and ammonia), and accumulation of radium in soil and sediment (Lauer et al., 2016).
>
> The likelihood of spills during transportation increases as the volume of wastewater and number of trips increases (Belcher

[87] CWT Study, *supra* n. 41.
[88] *Ibid.*

> and Resnikoff, 2013; Rahm et al., 2013; Hansen, 2014). Maloney et al. (2017) studied accidental spills in Pennsylvania, New Mexico, Colorado, and North Dakota and determined that wastewater is one of the top three materials spilled in HF-related activities.[89]

Philadelphia Water Department (PWD) in their comment to PADEP regarding the application by Elcon to construct and operate a hazardous waste processing facility in Falls Township, Bucks County, PA on the Delaware River, stated that there is a substantial risk of drinking water contamination from release of hazardous waste during transport: "The Elcon facility will be attracting regional hazardous waste via railways and highways into one of the most densely populated areas on the East Coast."[90] The PWD expressed concern about the siting of a hazardous waste facility on the river: "The siting of the proposed Elcon facility in a navigable waterway, allows for the potential transport of hazardous waste on the Delaware River."[91]

PWD also cautioned PADEP about the release of hazardous waste in transport in the vicinity of urban areas where large numbers of people draw their water supply.

> In light of the extensive drinking water supply contamination in West Virginia caused by a chemical storage facility leak, Philadelphia Water would like PADEP to consider the precautionary principle when reviewing the Phase I Siting Permit for the proposed Elcon facility. The proposed facility location is within a twenty mile radius of large urban areas in both Pennsylvania and New Jersey that use the Delaware River as a drinking water supply. The proposed location along a tidal freshwater drinking water supply amplifies the consequence of any accidental release of hazardous waste, given a chemical plume takes many days to flow past the southern-most drinking water intake located in Philadelphia.[92]

Another consideration regarding the import of wastewater and its transportation footprint into the watershed is the potential for the use of pipelines to carry the wastewater into and/or out of the watershed and the myriad adverse impacts that would result. DRBC has not taken full jurisdiction of pipeline projects in its review of such projects under current regulations, despite the public's insistence that they must.

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[89] *Id*, p. 9-8
[90] https://water.phila.gov/pool/files/elcon-falls-twp-permit-comments.pdf
[91] *Ibid.*
[92] *Ibid.*

4. *Storage of HVHF wastewater poses serious risks to the Basin and its water resources.*

Storage of fracking wastewater is not prohibited in the Commission's Proposed Rulemaking. Storage, transfers/transloading and the requisite transportation around the watershed of these toxic and radioactive fluids, will result in emissions from venting, leaks, spills, and accidents. PADEP uses a lax General Permit [Residual Waste General Permit WMGR123] to govern the storage and transport for many fracking wastewater projects.

The proof of the ineffective control of the toxic pollution from frack wastewater can be found in the many studies and reports examining the effects of fracking-related spills and leaks on water resources, the longevity of the contaminants in sediments, soil, and streams and the adverse health effects in humans, fish and aquatic life. The longevity and toxic properties of spills from HVHF facilities is examined in a recent report published by the American Chemical Society:

> In the water samples from spill sites, the team found that high concentrations of salts, trace metals, and other toxic contaminants persisted from the spills. Selenium, thallium, and radium exceeded maximum contaminant levels for drinking water in some samples. Additionally, ammonium and selenium concentrations were above recommended levels for aquatic life. In soil and sediment samples downstream from the Blacktail Creek spill site, radium concentrations were up to 100 times as great as in samples upstream.[93]

In discussing another peer-reviewed article, a commenter noted that a spike in endocrine disrupting chemicals was recorded downstream of an HVHF wastewater storage facility:

> A research team at the University of Missouri traced a spike in endocrine-disrupting activity in a West Virginia stream to an upstream facility that stores fracking wastewater. Levels detected downstream of the waste facility were above levels known to create adverse health effects and alter the development of fish, amphibians, and other aquatic organisms. Endocrine-disrupting compounds were not elevated in upstream sections of the creek.[94]

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[93] "Toxic chemicals from fracking wastewater spills can persist for years", Chemical & Engineering News, ISSN 0009-2347, Copyright © 2021 American Chemical Society, 2021.
https://cen.acs.org/articles/94/web/2016/05/Toxic-chemicals-fracking-wastewater-spills.html

[94] DRBC Testimony Sandra Steingraber, Co-founder, Concerned Health Professionals of New York, Senior Scientist, Science and Environmental Health Network, 12.8.21. Referring to: Kassotis, C. D., Iwanowicz, L. R., Akob, D. M., Cozzarelli, I. M., Mumford, A. C., Orem, W. H., & Nagel, S. C. (2016). Endocrine disrupting activities of surface water associated with West Virginia oil and gas industry wastewater disposal site. *Science of the Total Environment, 557-558.* doi: 10.1016/j.sci.tenv.2016.03.113.
https://hero.epa.gov/hero/index.cfm/reference/details/reference_id/3317634

DRBC is supposed to prevent this kind of fragmented environmental regulation through its watershed-based oversight rather than a patchwork of state regulations that are not consistent and equally protective of water resources. The proposed rules undercut its effort to protect the whole.

Although not defined as "storage" by most regulations, injection wells are not addressed in the draft regulations and are not expressly prohibited. Therefore, injection wells are possible, depending on how "discharge to water or land" is defined, which is unclear. Injection of wastewater does not remove contaminants, it simply moves the potential for the toxic wastewater to cause environmental and water resource pollution and water quality degradation from one place and time to another place and time, behaving as storage that can escape its location. It also risks the migration of untreated wastewater to aquifers and surface water through leaks from the injection well and spills and accidental releases while being handled.[95] Injection wells are causing earthquakes in Oklahoma as well as other locations and are not leak-proof, exposing groundwater and aquifers to contamination from the toxic mix that constitutes fracking wastewater.[96]

Caverns are also not addressed in the draft regulations but are used for storage of liquids under state regulations. The problematic issues presented by injection wells apply to caverns used for storage of wastewater produced by fracking.

5. *Stormwater Runoff from storage, use and reuse of HVHF wastewater in manufacturing, utilities, and transfer poses a contamination risk to the Basin's water resources.*

Discharges to water or land are not the only way that pollution enters our environment and exposes us to harm—stormwater runoff can carry pollution into our water, spreading far into the environment and stretching impacts way into the future. Facilities that process, store, transfer, or handle wastewater produced by fracking have the potential to release these materials through leaks and spills to the surrounding area. Pollutants can accumulate on land, structures and vegetation from air deposition. These various means of release can end up in runoff from a site, causing toxic and radioactive stormwater pollution.

This is a pathway of pollution that could be opened wide if DRBC allows HVHF wastewater to be imported here for storage, processing, or reuse in other activities. The transfer of pollutants contained in wastewater produced by fracking to the environment can occur through indirect discharges that do not trigger the requirement for a NPDES permit or fall under a General Permit, escaping close regulatory scrutiny. Stormwater runoff can carry

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[95] Akob, D.M., Mumford, A.C., Orem, W., Engle, M.A., Klinges, J.G., Kent, D.B., & Cozzarelli I.M. (2016). Wastewater Disposal from Unconventional Oil and Gas Development Degrades Stream Quality at a West Virginia Injection Facility. *Environ. Sci. Technol.* 50, 5517–5525.

[96] Austin A. Holland, "Examination of Possibly Induced Seismicity from Hydraulic Fracturing in the Eola Field, Garvin County, Oklahoma", Oklahoma Geological Survey, August 2011 Open---File Report OF1---2011; Ellen M. Gilmer, E&E reporter, "EARTHQUAKES: Okla. drillers sued for quake swarm", EnergyWire, An E&E Publishing Service, August 7, 2014. http://www.energywire.com/

into surface water pollutants that are deposited by air on land and/or vegetation and by spills and leaks onto land. As stated in a report examining the development and operating practices of oil and gas operators, a stormwater expert states:

> Contamination of a surface water source may occur due to activity at a wellhead, but may also occur due to activity related to fluid storage and transportation that is not in proximity to a wellhead. Surface source waters can also be adversely affected by other industry related activities, such as stormwater and erosion and sediment issues related to construction.[97]
>
> Comprehensive long-term water quality monitoring of surface waters, including both chemical and biological monitoring at locations downstream of all gas development activities, is required to assure that water quality is maintained.[98]

The construction, operation, and maintenance of a fracking wastewater storage project or processing facility that has no direct discharge to water or land, can still expose surface and groundwater, air, fish and wildlife, and people to fracking-related pollution. However, without DRBC permitting that involves a direct discharge, the project may not be reviewed or monitored by DRBC. It is important to realize that if a project is not under DRBC jurisdiction, the regulations of the state where the project is located will apply. A major flaw in current DRBC policy and regulations is that the states each have their own stormwater regulations, implementing the NPDES-2 nonpoint source pollution prevention program based on their own interpretations of the federal Clean Water Act. There is no unified stormwater best management practice manual or regulatory regime at the DRBC level that would ensure strict adherence to, for instance, the Special Protection Waters program mandate of "no measurable change" in the outstanding water quality of the anti-degradation waters of the Delaware River Basin.

Compounding the difficulties associated with handling highly toxic and radioactive wastewater at a storage, processing, or reuse site is the problem of not knowing all the constituents of the wastewater.[99] This make the effective handling of an emergency spill extremely challenging, potentially causing pollution to go unabated or improperly addressed. It exposes impacted members of the public, first responders, fire personnel, and workers to dangerous but unknown harms - which can delay or misinform first aid and treatment. It also means that specific monitoring requirements and testing criteria cannot be established on a proactive basis in Pollution Prevention Plans to catch and identify pollutants. You cannot find what you cannot measure. The result is that pollution may escape

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[97] "Unsafe & Unsustainable: *Experts Review the Center for Sustainable Shale Development's Performance Standards for Shale Gas Development*", Michele Adams, P.E., Prepared for the Delaware Riverkeeper Network, 2014, p.14.
[98] *Ibid.*
[99] *See* Section III.B.8, *infra*.

detection and spread into water and the surrounding environment, impacting people, animals and ecosystems on both a short term and long-range time frame.

6. *Reuse and "beneficial use" of HVHF wastewater threatens toxic pollution without a discharge.*

Without prohibiting HVHF-related activities and acceptance of wastewater produced by HVHF in the Basin, the use and reuse of this wastewater will be allowed and DRBC may not review or docket these projects if they do not involve a discharge or a withdrawal, leaving these projects outside of the DRBC's jurisdiction. Without review for compliance with the DRBC's Comprehensive Plan, there is no means to assure that projects meet the anti-degradation policies, water quality standards, and improvement programs that DRBC implements in its management of the water resources of the basin.

These reuses of wastewater produced by HVHF that could occur without DRBC review and oversight include cooling water in manufacturing and by utilities; construction such as cement making; and use as ingredients in other products, such as road salts and pool salts, deemed as a "beneficial use" under state regulations. Storage facilities and transfer stations handling HVHF wastewater will also not be prohibited. These activities will deliver fracking pollution through air emissions that deposit on water, soil, vegetation, fish and aquatic life. They will also deliver pollution through other pathways such as stormwater runoff, leaks and spills and through the degradation of products that contain the reused waste.

"Beneficial" reuse of waste can gravely endanger air, water, human and nonhuman communities, and the larger environment with potential pollution. A beneficial reuse such as recycling of products like paper and plastic is a plus when the products or practices deliver environmental benefits and don't carry contamination. The crucial factor is whether the product to be recycled contains toxic and/or hazardous materials and whether the processing releases contamination to the environment.

Many beneficial reuses of wastewater do not involve a discharge to water or land. However, many do release pollution to the air or other environmental media. Under the proposed regulations, the policies governing reuse in the watershed states would govern how reuse is carried out.

PADEP issued a guidance manual regarding the reuse of wastewater that set the foundation for many practices in use now. Reuses allowed include wastewater for industrial processes, cement manufacturing and other construction activities, evaporative cooling water, boiler feed water, and processing aggregate. Stated in PADEP's guidance manual: "Development in a Special Protection Watershed requires the evaluation of non-discharge alternatives for wastewater treatment. Reuse of treated wastewater can provide these non-discharge alternatives, while still allowing development to occur."[100] This statement clarifies

[100] Pa. Dep't of Envtl. Prot., *Reuse of Treated Wastewater Guidance Manual*, #385-2188-002, 2012, PDF p. 9 http://www.depgreenport.state.pa.us/elibrary/PDFProvider.ashx?action=PDFStream&docID=7415&chksum

that wastewater produced by fracking can be reused without "discharge", but it doesn't mean that the reuse does not release pollution through air emissions or other pathways of pollution, including degradation of the final product.

New Jersey issued a guidance manual in 2005 with its program "Reclaimed Water for Beneficial Reuse", which began in 1999 and has greatly expanded. The manual strongly encourages that reclaimed or reused water should be the preferred source of water for projects, particularly for non-potable uses.[101] Closed loop systems that may not require a discharge include non-contact cooling water and boiler makeup water. Refineries and municipal utility authorities in New Jersey use reclaimed wastewater as non-contact cooling water.

EPA includes "produced water from natural resource extraction activities" as one of the acceptable sources of wastewater that can be "beneficially reused".[102] The agency adds as acceptable the reuse of this wastewater in "process water for power plants, refineries, mills, and factories".[103] EPA states that since most states maintain primary regulatory authority in allocating and developing water resources, decisions about reuse are not made by the federal government.[104] Under the Proposed Rulemaking, the reuse that does not discharge to water or land would also not be regulated by DRBC, but would fall under state control.

To grasp the extent of the danger posed by the "beneficial reuse" of fracking wastewater, examining the regulatory landscape for fracking is useful. Fracking itself is exempted from regulation under the federal Safe Drinking Water Act.[105] Dubbed the "Halliburton Loophole," the 2005 Energy Policy Act specifically provided this loophole and has allowed fracking to escape needed federal regulation that would prevent or control the injection of fracking's toxic chemicals into the ground to extract gas. Wastewater produced by fracking operations, on the other hand, *is* subject to the Safe Drinking Water Act, requiring permits for underground injection wells ("Class II-D" wells) that are used by the industry for disposal. Unfortunately, this permitting system has not provided adequate environmental protection from pollution and earthquakes where these wells are being used.[106] Injection well permits can be obtained from the EPA or the state if they meet certain

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=&revision=0&docName=385-2188-002.pdf&nativeExt=pdf&PromptToSave=False&Size=426042&ViewerMode=2&overlay=0

[101] https://www.nj.gov/dep/dwq/techmans/reuseman.pdf

[102] https://www.epa.gov/waterreuse/basic-information-about-water-reuse

[103] *Id.*

[104] https://www.epa.gov/waterreuse/basic-information-about-water-reuse#uses

[105] "The Safe Drinking Water Act is the main federal law that ensures the quality of Americans' drinking water. EPA regulates the injection of fluids underground through the Underground Injection Control (UIC) Program. In 2005, the Energy Policy Act amended SDWA to specifically exempt hydraulic fracturing from the UIC program, except in instances where diesel fuel is injected as part of the hydraulic fracturing. Therefore, the process of injecting fracturing fluid into the target formation as part of oil or gas production is exempt from these requirements unless the fluid contains diesel." https://www.watershedcouncil.org/hydraulic-fracturing---regulations-and-exemptions.html

[106] https://www.fractracker.org/2021/02/pas-waste-disposal-wells-a-tale-of-two-datasets/

requirements.[107,108] It is possible they could even be allowed under the Proposed Rulemaking.[109]

Wastewater produced by fracking that is reused in further fracking of wells is not subject to federal regulation.[110] In Pennsylvania, fracking wastewater that is reinjected or "recycled" to frack another well is considered a beneficial use and can be performed under a General Permit issued by PADEP.[111] A General Permit requires less monitoring and oversight than individual permits and the mechanism is used to allow many other beneficial uses of fracking wastewater. General Permit WMGR123[112] is liberally used throughout Pennsylvania's fracked regions to reinject fracking wastewater to extract gas, allowing for another way the industry can get rid of wastewater with relaxed regulatory oversight.[113] The environmental problems created by this "beneficial reuse" are many, including the eventual production of a highly concentrated residual waste that can be toxic and radioactive.[114]

Will this residual wastewater loaded with concentrated pollutants be imported into the Delaware River Watershed for processing, disposal, storage or even a new reuse here? Residuals and partially treated wastewater are allowed to be used in some beneficial reuses. As explained in a report on waste produced by fracking:

> Treatment generates treated water, which may be discharged, shipped back to the well site for reuse, or diverted for beneficial reuse or resource extraction (top right). Finally, residuals generated during treatment, either concentrated liquid wastes

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[107] Rebecca Hammer, Jeanne VanBriesen, Ph.D., PE, "In Fracking's Wake: New Rules are Needed to Protect Our Health and Environment from Contaminated Wastewater", Natural Resources Defense Council, d:12-05-A, May 2012. PDF p. 79.

[108] There are a handful of injection wells permitted in Pennsylvania and it is not clear if the draft fracking regulations would allow injection wells for fracking wastewater because of the unclear definition of "discharge". For a discussion of Pennsylvania's injection wells, go to: https://www.fractracker.org/2021/02/pas-waste-disposal-wells-a-tale-of-two-datasets/

[109] Much of the Marcellus shale wastewater produced in Pennsylvania has gone to wells in Ohio and West Virginia. As many of these wells have become overfilled during the fracking boom, some have shut down, creating a choke point for frack wastewater, one of the reasons the industry is now looking to the Delaware River Watershed to get rid of its wastewater.

[110] Rebecca Hammer, Jeanne VanBriesen, Ph.D., PE, "In Fracking's Wake: New Rules are Needed to Protect Our Health and Environment from Contaminated Wastewater", Natural Resources Defense Council, d:12-05-A, May 2012. PDF p. 78.

[111] *Id,* PDF p. 179

[112] Pennsylvania Department of Environmental Protection, "General Permit WMGR123: Processing and Beneficial Use of Oil and Gas Liquid Waste," March 14, 2012, http://files.dep.state.pa.us/Waste/Bureau%20of%20Waste%20Management/WasteMgtPortalFiles/SolidWaste/Residual_Waste/GP/WMGR123.pdf.

[113] Rebecca Hammer, Jeanne VanBriesen, Ph.D., PE, "In Fracking's Wake: New Rules are Needed to Protect Our Health and Environment from Contaminated Wastewater", Natural Resources Defense Council, d:12-05-A, May 2012. PDF p. 79. *See also* "Attachment B", a comment from DRN submitted to PADEP regarding proposed modifications to WMGR123.

[114] *Ibid,* PDF p. 79.

> (brines) or solid waste, can be sent to disposal (deep well or landfill) sites or diverted for beneficial reuse (bottom right).[115]

If wastewater is accepted into the Basin as DRBC proposes, then the residuals could be brought here as well. The chain of loopholes and "beneficial uses" that produced this dangerous wastewater are imbedded in federal and state laws and regulations, often "greenwashed" as if they are helpful to the environment. We conclude that the wastewater that would be accepted is minimally controlled, analyzed or monitored and once it enters the watershed each state's regulatory system would apply if there is no discharge to water or land. Regarding state general permitting for beneficial use or reuse such as in Pennsylvania, the regulation is inadequate.

An example of how so-called "beneficial use" of fracking wastewater can cause pollution is the spreading of wastewater (from "conventional" natural gas wells[116]). The wastewater "brine" (salty wastewater) used in Pennsylvania and New York on roadways is from conventional wells, not HVHF wells. The Commission's draft regulations apply only to HVHF wastewater, inferring that wastewater from "conventional" wells can be discharged to water and land. By extension, "conventional" well wastewater could be spread on roadways in the watershed, if the well that produced the wastewater does not meet the Commission's definition of HVHF, including employing under 300,000 gallons of water to fracture the well. Even if the Commission intends to ban all liquid brine spreading on roadways, the use of solids or salts may escape the meaning of "discharge", particularly because discharge is not defined in the draft regulations, as discussed previously in this comment. The Commission's draft regulations, therefore, may allow fracking wastewater to be applied to roadways as solids such as crystals or hard salts produced from the processing of HVHF wastewater brine. These activities pose a serious threat to the watershed and its water resources, and living communities, particularly aquatic species.

A study of the spreading of gas and oil extraction wastewater in Pennsylvania and Ohio by Penn State University scientists was published in a peer-reviewed journal in 2018. The issue of the source of the wastewater, from conventional natural gas wells or HVHF, was addressed.

> The O&G wastewaters spread on Pennsylvania roads are primarily from conventionally drilled wells. Before the increase in high volume hydraulic fracturing (HVHF) in 2008, Pennsylvania's O&G industry historically drilled vertical wells

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[115] Rebecca Hammer, Jeanne VanBriesen, Ph.D., PE, "In Fracking's Wake: New Rules are Needed to Protect Our Health and Environment from Contaminated Wastewater", Natural Resources Defense Council, d:12-05-A, May 2012. PDF p. 20.

[116] Pennsylvania defines a conventional gas well as "A conventional gas well, also known as a traditional well, is a well that produces oil or gas from a conventional formation. Conventional formations are variable in age, occurring both above and below the Elk Sandstone. While a limited number of such gas wells are capable of producing sufficient quantities of gas without stimulation by hydraulic fracturing, most conventional wells require this stimulation technique due to the reservoir characteristics in Pennsylvania." See: https://www.dep.pa.gov/Business/Energy/OilandGasPrograms/Act13/Pages/Act-13-FAQ.aspx

> into permeable sandstone reservoirs, referred to as conventional.
>
> In comparison, low permeability unconventional O&G formations are developed using directional drilling and HVHF. Current regulations for Colorado, New York, Ohio, Pennsylvania, and West Virginia state that no produced waters from formations developed with HVHF can be spread on roads (Table S4). Conventional and unconventional O&G wastewaters have organic and inorganic constituents that are similar. However, wastewaters from unconventional O&G development may also include chemicals from the HVHF process that could be potentially more toxic than the formation specific constituents.[117]

The report found that the practice is viewed as a free alternative to chloride and salt brines because O&G wastewater has a high salt content that is effective in retaining road moisture for suppressing dust or lowering freezing points for deicing. However, it was also found that these contaminants may threaten environmental and public health by leaching into surface or groundwater, containing radium, salinizing freshwater, accumulating around roads, modifying adjacent soil chemistry, migrating in air and dust, and causing toxic effects to fish and aquatic wildlife.[118]

From 2008 to 2014, road spreading may have released over 4 times more radium to the environment than O&G wastewater treatment facilities and potentially over 200 times more radium than spill events.[119] Radium is a known carcinogen, and the organic compounds in O&G wastewaters may exhibit human toxicity because two of the receptors found are known to cause hepatotoxicity and liver tumors in laboratory animals.[6] Finally, the O&G wastewater samples were also shown to be toxic to *Daphnia magna*. *Daphnia magna*, the water flea, is an important aquatic organism in freshwater ecosystems.[120]

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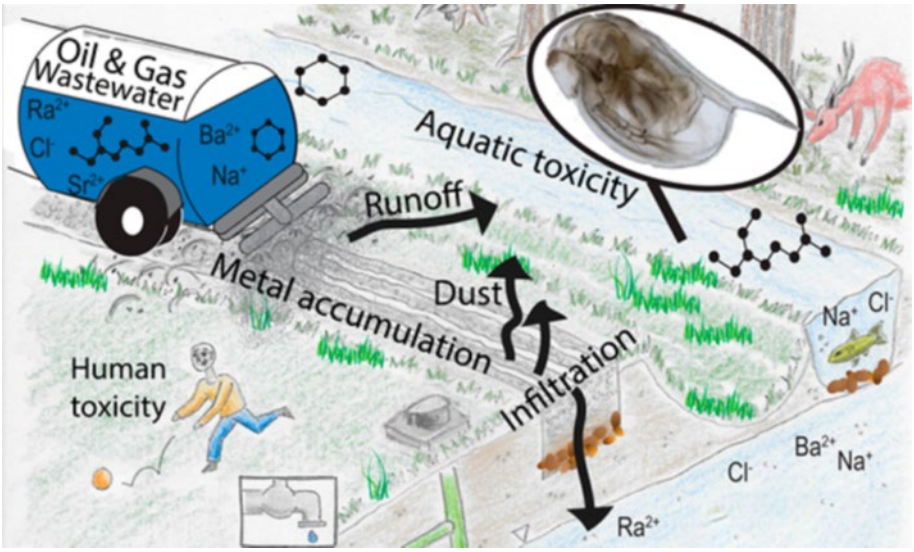
[117] Tasker et al. (2018). Environmental and Human Health Impacts of Spreading Oil and Gas Wastewater on Roads. Environ. Sci. Technol. (52) 7081-7091. p. 5. Retrieved from https://www.lakeeriefoundation.org/wp-content/uploads/2018/09/Oil-and-Gas-Waste-Roads-Pennsylvania-and-Ohio-others.pdf
[118] *Id*. at 7082.
[119] *Id*. at 7087.
[120] *Id*. at 7089.

Illustration from the report:[121]



In an article by Justin Nobel for Rolling Stone magazine, the radioactivity of wastewater brine from the gas extraction process is reported to be causing pollution of water and air in communities. From the article:

> Radioactive oil-and-gas waste is purposely spread on roadways around the country. The industry pawns off brine — offering it for free — on rural townships that use the salty solution as a winter de-icer and, in the summertime, as a dust tamper on unpaved roads.
>
> Brine-spreading is legal in 13 states, including the Dakotas, Colorado, much of the Upper Midwest, northern Appalachia, and New York. In 2016 alone, 11 million gallons of oil-field brine were spread on roads in Pennsylvania, and 96 percent was spread in townships in the state's remote northwestern corner, where Lawson lives. Much of the brine is spread for dust control in summer, when contractors pick up the waste directly at the wellhead, says Lawson, then head to Farmington to douse roads. On a single day in August 2017, 15,300 gallons of brine were reportedly spread.[122]

The report continues:

> But conventional-well brine can be every bit as radioactive, and Burgos' paper found it contained not just radium, but cadmium,

[121] *Id,* Abstract
[122] Justin Nobel, "America's Radioactive Secret", Rolling Stone**,** January 21, 2020. p. 9. https://www.rollingstone.com/politics/politics-features/oil-gas-fracking-radioactive-investigation-937389/

> benzene, and arsenic, all known human carcinogens, along with lead, which can cause kidney and brain damage.
>
> And because it attaches to dust, the radium "can be resuspended by car movement and be inhaled by the public," Resnikoff wrote in a 2015 report. Research also shows that using brine to suppress dust is not only dangerous but pointless. "There appears to be a complete lack of data indicating the practice is effective," reads a 2018 paper[123] published in the *European Scientific Journal.* In fact, it notes, the practice is "likely counterproductive for dust control." As Lawson puts it, 'It is a complete fucking myth that this works. After brine, the roads are dustier.'[124]

The report explains how the "beneficial use" label has allowed the pollution to continue:

> "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."[125]
>
> "'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." But Ohio's Department of Health concluded AquaSalina poses a "negligible radiological health and safety risk.'"[126]

7. Contaminants used in HVHF and its wastewater.

The chemicals and hazardous properties of the materials used in HVHF that have caused and continue to cause pollution are not limited to the location of the gas well or extraction site. The EPA explains in its comprehensive report on wastewater produced by oil and gas extraction that HVHF fluids and source geologic formation constituents end up in fracking wastes.[127] "Oil and Gas wastewaters contain a variety of chemicals, from sources

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[123] B. Payne, *Oil and Gas Well Brines for Dust Control on Unpaved Roads – Part 2: Environmental and Health Impacts*, European Sci. J. (Oct. 31, 2018), available at https://eujournal.org/index.php/esj/article/download/11354/10891
[124] *Id,* p. 12.
[125] *Id,* p. 12.
[126] *Id,* p. 13.
[127] CWT Study, *supra* n. 41.

such as HF fluid additives, well stimulation and well maintenance activities," states the report.[128] This means that materials such as toxic chemicals and PFAS compounds used in HVHF fluids and other contaminants such as naturally occurring radioactive materials ("NORM") and other deep geology pollutants can carry through to wastewater that would be transferred to the Delaware River Basin, if the DRBC were to allow frack wastewater to be imported and stored, processed, or reused here.

As an example of a highly toxic family of chemicals that are used in HVHF that would be brought into the watershed in HVHF wastewater and potentially released are PFAS. PFAS are already a worldwide pollution problem of epic proportions as scientists and governments struggle to locate contamination and contain its spread. They are called "Forever Chemicals" because they never biodegrade and they persist indefinitely in the environment; they are highly water soluble and bioaccumulative. PFAS accumulate in the natural world (including in fish and wildlife - see Do Not Eat fish consumption advisory issued by PADEP for PFAS in the Neshaminy Creek[129] and NJ's recent fish consumption advisories covering PFAS statewide[130]) and in the human body, are highly toxic even in very tiny doses, and are linked to several diseases and adverse health conditions, including cancers. The fetus, infants, children, women of childbearing age, and immune compromised individuals are the most vulnerable to PFAS health damages.

A report "Fracking with Forever Chemicals" published by the Physicians for Social Responsibility, exposes that PFAS have been used extensively in drilling and fracking gas and oil wells and that the public is unaware of this pathway of pollution.[131] The data in the report shows PFAS, and/or substances that can degrade into PFAS have been used in fracking in more than 1,200 wells in six U.S. states between 2012 and 2020.[132] An analysis of public data by the Philadelphia Inquirer editorial board identified the use of one of these "forever chemicals" in at least eight Pennsylvania fracking wells between 2012 and 2014.[133] The "forever chemical" identified by the board is polytetrafluoroethylene, commonly known as Teflon — which PubChem reports is "reasonably anticipated to be a human carcinogen."[134] It can be anticipated that highly toxic PFAS could be imported into the watershed in HVHF wastewater, where it will pose a "forever" contamination problem. This is one example of the HVHF wastewater pollutants that threaten water quality, public health, and species.

In a discussion on the Natural Resources Defense Council website, regarding reports on pollution and poor regulation of fracking, including HVHF wastewater, it was stated:

> Fracking sites release a toxic stew of air pollution that includes chemicals that can cause severe headaches, asthma symptoms,

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[128] *Id*. p. 9-36

[129] https://www.dep.pa.gov/About/Regional/SoutheastRegion/Community%20Information/Pages/Neshaminy-Creek-Fish-Advisory.aspx

[130] https://www.nj.gov/dep/dsr/njmainfish.htm

[131] https://www.psr.org/wp-content/uploads/2021/07/fracking-with-forever-chemicals.pdf

[132] *Id*.

[133] https://www.inquirer.com/opinion/editorials/fracking-pennsylvania-pfas-toxic-chemicals-water-20210805.html

[134] *Id.*

> childhood leukemia, cardiac problems, and birth defects. In addition, many of the 1,000-plus chemicals used in fracking are harmful to human health—some are known to cause cancer.[135]

A report issued in 2018 documented that EPA has found that chemicals used in drilling and fracking have serious health risks; these chemicals make their way into the wastewater that is produced by the fracked well. A look by EPA at 126 of the chemicals proposed for use in fracking resulted in their expressing health concerns about 109. Regardless, EPA approved 62 of them for fracking and drilling oil and gas wells. The health effects noted by EPA include "irritation to the eye, skin, and mucous membranes," kidney toxicity, liver toxicity, neurotoxicity, and developmental toxicity.[136]

> The records obtained by PFPI from the EPA show that non-disclosure of fracking chemical identities may leave people unknowingly exposed to harmful substances. Between 2003 and 2014, the EPA identified health concerns about 109 of 126 new chemicals proposed for use in oil and gas drilling and fracking. The chemicals' manufacturers submitted information about the chemicals for review under a program that requires EPA to screen and regulate new chemicals for health and environmental impacts before they are used commercially. Despite concerns by EPA scientists about the chemicals' health effects, EPA approved most of the 109 chemicals for use, and 62 were later used in or likely used in oil and gas wells. Manufacturers took advantage of trade secret protections that are permitted by federal law to conceal 41 of the 62 chemicals' identities. "Concern for liver and kidney toxicity" read an EPA review of one chemical that the agency approved in 2013 for use in "downhole treatment of oil and gas wells." The chemical's identity and the manufacturer's name were confidential.[137]

Scientific reports confirm that pollution from fracking wastewater can contain contaminants that will volatize to the air. Air pollutants are released during at least 15 different parts of the oil and gas development process.[138] Many of the chemicals used in fracking are known air pollutants, and wastewater produced from fracking operations

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[135] "Reduce Fracking Health Hazards", Natural Resources Defense Council website, 2021. https://www.nrdc.org/issues/reduce-fracking-health-hazards

[136] "Keystone Secrets: Records Show Widespread Use of Secret Fracking Chemicals Is a Looming Risk for Delaware River Basin, Pennsylvania Communities", Dusty Horwitt, Partnership for Policy Integrity (PFPI), September 11, 2018. p. 4 https://www.pfpi.net/wp-content/uploads/2018/09/PASecretFrackingChemicalsReportPFPI9.10.2018.pdf

[137] *Id,* p. 4-5.

[138] Tanja Srebrotnjak and Miriam Rotkin-Ellman, Natural Resources Defense Council, *Fracking Fumes: Air Pollution from Hydraulic Fracturing Threatens Public Health and Communities*, December 2014. p. 4

includes volatile compounds that can evaporate into the air, and have been linked to human health problems.[139]

Additionally, there are dangerous constituents in wastewater produced by fracking that are not required to be tested for. New York's 2009 DSGEIS identified 154 of these dangerous parameters in Marcellus shale wastewater.[140] Many are hazardous, some have known harmful health impacts, and some are carcinogenic.

In June 2020 Pennsylvania's 43rd Statewide Investigating Grand Jury Report #1 on the unconventional oil and gas industry was publicly released by the Attorney General. The report documents the unprecedented damage to the environment and human health that the "fracking boom" brought to communities where fracking occurred throughout the last decade in the Commonwealth.[141] Speakers at a video forum produced by the Delaware River Frack Ban Coalition examined the Grand Jury Report and explained how its documentation confirms what we and other members of the public have submitted to the DRBC in support of a full fracking ban.[142]

The actions that caused fracking to pollute the water and air in Pennsylvania include fracking to extract shale gas but also include pollution from waste produced by fracking. According to the Grand Jury report:

> The dangerous chemicals used to drill and hydraulically fracture unconventional wells end up in drill cuttings and millions of gallons of wastewater produced by each individual well. Managing the millions of gallons of wastewater generated by unconventional oil and gas operations, in particular, presents an extremely challenging problem. The fracking industry has never had a good solution for this problem, and it persists today.[143]

Operations related to fracking and drilling, in combination or individually are impacting residents who live near them, which include fracking wastewater processing and storage facilities. From the report:

> Pennsylvania's laws further aggravate the problem by not accounting for the aggregate effects of fracking operations. When numerous gas sites exist in a relatively small area, their collective effect is not measured or acknowledged in the

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[139] *Id,* p. 6

[140] NYSDEC Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas, and Solution Mining Regulatory Program (DSGEIS), 2009, Tables 5-8 and 5-9, p. 5-109.

[141] Office of the Attorney General, "Report 1 of the Forty-Third Statewide Investigating Grand Jury", June 22, 2020. P. 20-21. Available at: https://www.attorneygeneral.gov/wp-content/uploads/2020/06/FINAL-fracking-report-w.responses-with-page-number-V2.pdf

[142] Video of virtual forum recording "Lessons from the PA Grand Jury: *Why the DRBC must fully ban fracking NOW*" can be found here: https://youtu.be/ve_eDb3rJWo

[143] Office of the Attorney General, Commonwealth of Pennsylvania, "Report 1 of the Forty-Third Statewide Investigating Grand Jury", June 22, 2020. p. 19

> governing regulatory scheme. Many homeowners described living near a combination of well pads, pigging stations, gas processing plants, compressor stations, and impoundments. The DEP regulates these sites only individually, however, and by each individual company associated with them. Therefore, two oil and gas companies may own and operate adjacent pigging stations, but so long as each is compliant with emissions limits, Pennsylvania law is met. Meanwhile, a nearby homeowner is exposed to the collective effect of the emissions from both pigging stations, in addition to other nearby well pads and industry operations, but there is no recognition of the heightened risk posed by the collective emissions from multiple sites.[144]

The report describes the degradation that people have experienced who live in proximity to not only frack wells but also storage facilities, impoundments, and other fracking-related operations.

> They could not sell their home, however, because it was unsafe, but also could not afford the cost of maintaining their mortgage and paying to live somewhere else. Thus, they were stuck with the option of financial ruin or trying to carry on living in a home where they feared for their health and the long term wellbeing of themselves and their children. These were decisions born from desperation, and several homeowners shared with us the heartbreaking moment they realized they had no option but to leave.[145]

The Grand Jury exposed the lack of disclosure of the chemicals that are involved in fracking and frack wastewater, based on a special exemption:

> Remarkably, the shale gas industry, despite using and transporting dangerous chemicals in their everyday operations, is largely excused from SARA Title III's oversight regime. No other industry enjoys such comparable exemptions. Because of these federal exemptions, the states almost exclusively govern the fracking industry's obligations to publicly disclose the dangerous chemicals it uses. In Pennsylvania, the industry self-reports and publicly posts the chemicals used in hydraulically fracturing an unconventional well on a website called "FracFocus."
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> There is a significant gap in reporting, however, because the industry is not obligated to identify or provide information

[144] *Id,* p. 40
[145] *Id,* p. 43

> about chemicals they classify as proprietary trade secrets. While the industry must disclose trade secret chemicals to the DEP, the public and first responders cannot access them. Keeping these proprietary chemicals secret leaves firefighters and Hazmat teams incapable of effectively or safely responding to emergencies at unconventional gas sites. Communities, industry employees, and others who find themselves in close proximity are likewise kept in the dark. This risk is unacceptable. Only full public disclosure is sufficient.[146]

The Grand Jury pointed out that one of the most difficult and dangerous aspects of the wastewater produced by fracking is the "produced water" that slowly returns to the surface while the well is in production. This fluid is in addition to the immediate flowback that is the contaminated wastewater that drillers must dispose of or reuse. From the report:

> In addition to gas, wells expel 'produced water,' which consists of fracking fluid that did not initially exit the well as flowback, but steadily exits a well during production. Because produced water has remained in the subsurface far longer than flowback, it is more contaminated, and will typically contain high levels of sodium chloride (salt), bromide, lithium, boron, iron, manganese, arsenic, and radioactive radium. An unconventional well can produce from half a million to over three and a half million gallons of flowback and produced water over the first five to ten years of production.[147]

8. *The HVHF industry fails to disclose the chemicals used in its processes.*

Drilling companies employ secret chemicals to frack gas and oil wells, keeping the ingredients of fracking formulas hidden claiming "Trade Secret" protections. Regulations at the federal and state level allow for the information about the chemicals injected into drilled wells to be kept from the public and, in some cases, even from emergency responders and regulatory agencies.

Wastewater produced by fracking contains chemicals that were contained in fracturing fluid and in drilling operations for both "conventional" (low volume) and "unconventional" (HVHF). These chemicals, as explained previously in this comment (page 9), carry through to the wastewater that is produced. As explained further in another report:

> Companies are not mandated by federal regulations to disclose the identities or quantities of chemicals used during hydraulic fracturing operations on private or public lands. These

[146] *Id,* p. 17
[147] *Id,* p. 15

> chemicals can volatilize into the air from tanks and wastewater impoundments and contribute to air pollution.[148]

This means that the constituents in the wastewater must be monitored and treated to remove harmful air pollutants. However, this is not possible to do unless the chemicals used are known and can be sampled for. This is not the case for drilling and fracking operations.

A report examining the disclosure of chemicals used in drilling and fracking in Pennsylvania documents that drilling companies have extensively used loopholes in Pennsylvania rules that allow companies to withhold chemical identities as trade secrets.

> Between 2013 and 2017, drilling companies injected at least one hydraulic fracturing ("fracking") chemical with an identity kept hidden from the public into more than 2,500 unconventional natural gas wells drilled in Pennsylvania, amounting to 55 percent of the more than 4,500 unconventional gas wells drilled in the state during the five-year period, primarily in the Marcellus and Utica shale formations. In total, companies injected secret fracking chemicals 13,632 times into 2,515 wells. Exemptions in Pennsylvania law virtually guarantee that the use of secret chemicals in the state's oil and gas wells was higher than detailed in this report.[149]

Southwest Pennsylvania (Washington County) and northeast Pennsylvania near the Delaware River Basin (Susquehanna County) were the counties with the most use of secret chemicals, according to the data. The second greatest number of wells injected with secret chemicals was 279, by Cabot Oil and Gas Corporation (the greatest was Range Resources at 396). Secret chemicals were injected by Cabot 1,587 times with an average of 5.7 secret chemicals per well. Cabot operates heavily in northeastern Pennsylvania and would be a likely source of fracking wastewater should DRBC allow its import to the Basin. (Shown on Table 2)[150] Range Resources announced on February 22, 2022 that it plans to develop new wells in northeastern Pennsylvania, where it previously had leases.[151]

Many of the secret chemicals are known to have adverse health effects. In the report:

> Records released by the [EPA] in response to a Freedom of Information Act request indicate that these chemicals could

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[148] "Fracking Fumes: Air Pollution from Hydraulic Fracturing Threatens Public Health and Communities", Natural Resources Defense Council, 2014. https://www.nrdc.org/resources/fracking-fumes-air-pollution-fracking-threatens-public-health-and-communities

[149] Dusty Horwitt, "Keystone Secrets: Records Show Widespread Use of Secret Fracking Chemicals Is a Looming Risk for Delaware River Basin, Pennsylvania Communities", Partnership for Policy Integrity (PFPI), 2018. https://www.pfpi.net/wp-content/uploads/2018/09/PASecretFrackingChemicalsReportPFPI9.10.2018.pdf p. 4

[150] *Id.* p. 14-15

[151] https://ir.rangeresources.com/news-releases/news-release-details/range-announces-fourth-quarter-2021-results-2022-guidance

> have serious health effects including irritation to skin and lungs, liver toxicity, developmental toxicity and neurotoxicity. The widespread use of secret fracking chemicals therefore poses serious health risks for people living near Pennsylvania's unconventional gas wells and for 15 million people who rely on the Delaware River Basin for drinking water. Pennsylvania law suggests that in at least some cases no one – not even first responders acting in an emergency – would be able to learn the chemicals' identities.[152]

The report goes on to report that the number of wells where secret chemicals were used is likely much greater because of regulatory loopholes that don't require reports or readily accessible records of all drilling and fracking. For instance, information about secret chemical use in the fracking of "conventional" wells is hard to access due to out of date filing practices. And no *drilling* chemicals used in either conventional or unconventional wells are required by Pennsylvania to be disclosed at all.[153]

At the federal level, some chemical manufacturers have declared their drilling chemical identities trade secrets, despite the EPA finding that some of these chemicals have serious health risks. Chemical manufacturers use loopholes in the federal Toxic Substances Control Act to withhold CAS numbers as trade secrets, keeping that information hidden at both the federal level and when drillers file required reports with FracFocus, the chemical disclosure database used by the industry and by states such as Pennsylvania. FracFocus data was used in the "Keystone Secrets" report.[154]

What makes information even more hidden, if the trade secret claims are asserted by the chemical manufacturers themselves, is that Pennsylvania law appears to allow complete secrecy. An exemption for chemical manufacturers that relieves them of reporting to drillers or other entities the complete ingredients in their formulas leaves a huge knowledge gap that keeps the public, regulators such as DEP, emergency personnel and first responders, health professionals, and even the drillers themselves in the dark. Industrial manufacturers have total control over this essential information. Some states, including Pennsylvania, have enacted regulations regarding disclosure and there are some federal regulations. However, the regulations are not specific enough to be meaningful for sampling and detecting and treating for these chemicals. As explained by the "Keystone Secrets" report:

> When companies drill unconventional gas wells and designate a chemical as a trade secret, Pennsylvania requires that they must provide the public with a rough idea of what chemical was used by disclosing the chemical's "chemical family or similar description associated with the chemical." The federal Toxic Substances Control Act has a similar provision. However, these disclosures are inadequate because even chemicals within the

[152] *Id.* PDF p. 4
[153] *Id*. p. 5
[154] *Id,* p. 16

same family can have very different toxicities and health effects. Toluene, for example, is part of the chemical families known as "hydrocarbons" and "volatile organic compounds." It is a naturally occurring chemical in petroleum and has also been used in hydraulic fracturing fluid. It can cause nervous system, kidney and liver problems and is toxic in drinking water at levels greater than 1 part per million. Benzene is in the same chemical families, is found naturally in petroleum, and has also been used in hydraulic fracturing fluid. Unlike toluene, it is a known human carcinogen, and it is 200 times more toxic than toluene. Benzene is considered unsafe in drinking water at levels greater than 5 parts per billion. This level of toxicity means that just one gallon of benzene could contaminate about 200 million gallons of drinking water, or two-thirds the quantity treated each day by the city of Philadelphia. Therefore, while the public can know the chemical families of fracking chemicals declared confidential, these disclosures may not be meaningful in regard to chemicals' health effects and toxicities. Only full disclosure of chemicals' identities, especially their CAS numbers, can begin to inform the public adequately about chemical risks from hydraulic fracturing and drilling.[155]

9. *HVHF wastewater is often radioactive.*

Another highly dangerous property of wastewater produced by fracking is radioactive materials. Marcellus Shale is known to be highly radioactive. The radioactivity stays with the produced wastewater that would be imported into the watershed. The half-life of Radium-226 is 1600 years. Radioactive concentrations in the Marcellus Shale formation are at concentrations 20 to 25 times background, making shale gas wastewater extremely radioactive.[156]

PADEP's report on the radioactivity of fracking waste, states that combined Radium-226 and 228 measures as high as 28,500 picocuries per liter.[157] This is the highest reported level of tested shale gas plays in the United States. Additionally, each time fracking wastewater is "recycled" or reused, the radium is concentrated, resulting in TENORM, or Technically Enhanced Naturally Occurring Radioactive Materials.[158] The wastewater from Marcellus Shale formations is highly radioactive and the levels of radioactivity could be enhanced in the wastewater that would be sent for storage to the Delaware River watershed

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[155] *Id,* p. 19-20

[156] US General Accountability Office, *Information on the Quantity, Quality, and Management of Water Produced During Oil and Gas Production*, GAO-12-56, January 2012.

[157] Pennsylvania DEP, Technologically Enhanced Naturally Occurring Radioactivity Materials Study Report, 2016. http://www.depgreenport.state.pa.us/elibrary/GetFolder?FolderID=4238

[158] Radioactive Waste Management Associates, "Comments on Marcellus Shale Development", Marvin Resnikoff, Ph.D., October 2011.

due to the common practice in Pennsylvania to reuse frack fluids in multiple frack jobs, creating TENORM, which can be even more dangerous than Radium-226.

Sampling by New York State of wastewater produced by fracking in Pennsylvania and West Virginia detected radiological parameters in Marcellus Shale flowback, including Radium-226. Gross Alpha, Gross Beta, Total Alpha Radium and Radium-228 were also found.[159] Frack wastewater containing TENORM is not properly regulated by the federal government or the states due to lack of requirements for monitoring/testing for TENORM at crucial junctures in the waste stream where it should be targeted for detection and removal.

As stated by the Pennsylvania Attorney General's Grand Jury report, the radioactivity escapes the regulation it requires and the result is contamination of the environment by drilling and fracking wastewater in Pennsylvania, including by radioactive materials.

> This wastewater may be composed mostly of brine and relatively harmless constituents, or it may be full of extremely dangerous chemicals or highly radioactive. There is no way to tell, however, because the industry is not required to identify or manage its wastewater for what it actually contains. Due to exemptions under federal law, trucks carrying fracking wastewater in Pennsylvania are not placarded as hauling hazardous waste, even though they may be carrying hazardous waste.[160]

In December 2015, a critique of Pennsylvania's study of TENORM was published by Delaware Riverkeeper Network. The critique concludes that PADEP failed to fully evaluate and take action regarding the impacts on the public, workers, and the environment of dangerous levels of radioactivity in materials produced by hydraulic fracturing of Marcellus Shale gas wells in Pennsylvania.[161]

The critique concluded that dangerous radioactive liquids, gasses, and solids are entering the environment and potentially contaminating water supplies through practices used in gas well development, storage of produced fluids, and the transport and disposal of drilling wastes. The radioactive materials are then available to be taken in by people and can increase the likelihood of cancers in those exposed.[162]

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[159] New York State Department of Environmental Conservation, Revised Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas, and Solution Mining Regulatory Program, Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and other Low-Permeability Gas Reservoirs, September 2011, Table 5.24.
[160] Office of the Attorney General, "Report 1 of the Forty-Third Statewide Investigating Grand Jury", June 22, 2020. P. 20-21. Available at: https://www.attorneygeneral.gov/wp-content/uploads/2020/06/FINAL-fracking-report-w.responses-with-page-number-V2.pdf
[161] Marvin Resnikoff, Ph.D.. Radioactive Waste Management Associates, "Review of Pennsylvania Department of Environmental Protection Technologically Enhanced Naturally Occurring Radioactivity Materials (TENORM) Study Report". December 2015. Available at: http://bit.ly/22fg7a7.
[162] *Id,* p. 2.

The critique examines the failings of the TENORM Report that include:

- Inaccurate radon measurements at drilling sites
- Invalid and/or incomplete sampling for radium-226 in rock cuttings
- Invalid and/or incomplete sampling for radium-226 in wastewater
- Invalid methodology for sampling of buried drill cuttings, including closed pits at individual well sites, sometimes located in the back yards of homes or on active farmland
- Lack of clarity as to whether the concentrated non-recycled drilling fluids and sludges were sampled
- No testing of stream water quality, sediments and in-stream habitats
- Lack of planning to sample fluid production pipes, feeder lines, separator and condensate tanks where radioactive scale can build up over time

The critique criticizes PADEP for failing to take needed action on alarming findings contained in the TENORM Report, including:

- Radium was detected in all landfill leachate samples gathered for the TENORM Report. Since radium-226 is not routinely sampled for or removed by leachate or wastewater treatment systems, radium-226 could be contaminating waterways and drinking water sources where the effluent is discharged. The long life of radium-226 (half-life of 1600 years) elevates the severity of this pollution legacy that has the potential to contaminate the environment and deliver harmful health effects from the present through to generations to come. This demands action by PADEP to conduct a comprehensive investigation of all discharges of leachate from landfills that accept gas well drill cuttings.
- Brine or wastewater transport is not properly regulated because of lack of proper packaging, placarding, and insurance that accurately reflects the measured level of radioactivity in waste fluids transported by trucks. Immediate action must be taken by PADEP to protect the public and workers from radiation exposure by requiring radium sampling of each transported batch, adequate monitoring and reporting of samples, proper packaging based on sample data, and correct truck placarding of the contents. PADEP must also assure that adequate insurance coverage of trucking is in place to address spills, accidents, and other releases that may occur during transport.
- Wastewater contaminated with radioactivity is routine in the Marcellus shale. The public will be exposed to these radioactive wastes in wastewater if it allowed to enter the Delaware River watershed. This can increase the risk of developing adverse health effects, including cancer.[163]

Human health impacts from exposure to radioactivity are being assessed near fracking activities, including wastewater facilities. The Compendium of reports that is

[163] https://semspub.epa.gov/work/HQ/176335.pdf

regularly updated has been published most recently in 2018, 2019 and 2020. The eighth Edition is expected to be released in early 2022. From the 2018 Compendium:

> Exposure to increased radiation levels from fracking materials is a risk for both workers and residents. A study demonstrated that radon levels in Pennsylvania homes rose since the advent of the fracking boom, and buildings in heavily drilled areas had significantly higher radon readings than areas without well pads—a discrepancy that did not exist before 2004. University of Iowa researchers documented a variety of radioactive substances including radium, thorium, and uranium in fracking wastewater and determined that their radioactivity increased over time; they warned that radioactive decay products can potentially contaminate recreational, agricultural, and residential areas.
>
> The New York State Department of Environmental Conservation's "Findings Statement" noted that naturally occurring radioactive materials (NORM) are brought to the surface "in the cuttings, flowback water and production brine. . . . [T]he build-up of NORM in pipes and equipment has the potential to cause a significant adverse impact because it could expose workers handling pipes, for cleaning or maintenance, to increased radiation levels." (See footnotes 333, 347-371.)[164]

The Compendium Seventh Edition concluded that:

> In sum, the vast body of scientific studies now published on hydraulic fracturing in the peer-reviewed scientific literature confirms that the climate and public health risks from fracking are real and the range of environmental harms wide. Our examination uncovered no evidence that fracking can be practiced in a manner that does not threaten human health directly and without imperiling climate stability upon which public health depends. The rapidly expanding body of evidence compiled here is massive, troubling, and cries out for decisive action. Across a wide range of parameters, the data continue to reveal a plethora of recurring problems that cannot be sufficiently averted through regulatory frameworks. The risks and harms of fracking are inherent to its operation. The only method of mitigating its grave threats to public health and the climate is a complete and comprehensive ban on fracking.

[164] Concerned Health Professionals of New York (www.concernedhealthny.org) and Physicians for Social Responsibility (www.psr.org), "The Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking", Fifth Edition, March 2018. Available at: https://concernedhealthny.org/compendium/ p. 23-24.

> Indeed, a fracking phase-out is a requirement of any meaningful plan to prevent catastrophic climate change.[165]

10. Human health impacts of HVHF and related activities are devastating.

The mounting evidence of human health harms from HVHF operations over recent years, has been documented in many independent reports and peer-reviewed journals. Some studies relate the human health outcomes to not only the gas well, but to the wastewater handling, processing, and storage facilities that comprise "Unconventional Oil and Gas Development" (UOGD), which include HVHF operations.

A categorical review of health reports regarding UOGD reviewed scientific and health reports regarding fracking impacts published between January 1, 2016 and December 31, 2018 showed that health effects are continuing and in some cases escalating in fracked regions.[166] Early life exposure, including prenatal exposure has been the most studied topic. Researchers have documented relationships between UOGD and is associated with adverse birth outcomes and morbidity in children. A Pennsylvania study showed developmental, structural and functional birth defects were found to result from proximity to UOGD. Pennsylvania studies have also measured preterm birth (<37 weeks). These studies and others from Pennsylvania populations have also documented low birth weight due to prenatal exposures. Fetal death and early infant mortality have also both been epidemiologically linked to UOGD.[167]

Pennsylvania epidemiologic research has also shown that exposure to UOGD is associated with respiratory outcomes including asthma exacerbation in children and adults. A relationship was found between UOGD and oral corticosteroid orders, asthma emergency department (ED) visits, and hospitalization. Pennsylvania hospitalization rates show relationships of exposure to UOGD and acute myocardial infarction (MI), chronic obstructive pulmonary disease (COPD), pneumonia, and other upper respiratory disorders. More research from Pennsylvania showed impacts including current chronic rhinosinusitis, migraines, fatigue, all related to neurological impacts.[168]

An article published this spring by author and Pennsylvania resident Eliza Griswold examines how wastewater produced by fracking is endangering the health of residents, focusing on children who have developed a rare form of cancer. From the article:

> The problem posed by fracking waste in the region's waterways came to the public's attention in 2008, when the Monongahela River, which provides drinking water to some three hundred thousand people, suddenly acquired a salty taste. It turned out

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[165] Concerned Health Professionals of New York, & Physicians for Social Responsibility. (2020, December). Compendium of scientific, medical, and media findings demonstrating risks and harms of fracking (unconventional gas and oil extraction) (7th edition). http://concernedhealthny.org/compendium/ PDF p. 7.
[166] FracTracker Alliance, "Categorical Review of Health Reports on Unconventional Oil and Gas Development; Impacts in Pennsylvania", 2019.
[167] *Id.*
[168] *Id.*

> that waste haulers were trucking millions of gallons of fracking wastewater to municipal sewage plants along the river . . . . Many of these towns were poor and welcomed the cash that they received from fracking companies for taking the waste, until they realized that their facilities could not properly process it before sending it into the river.[169]

The relationship between cancer and proximity to UOGD has also been established in the Pennsylvania literature. Cancer types include all childhood leukemia subtypes, urinary bladder cancer, and thyroid cancer, and research in Colorado discovered correlations with acute lymphoblastic leukemia and Non-Hodgkin's lymphoma.[170]

In May 2019, the Pittsburgh Post-Gazette published an in-depth report on the paper's investigation into a spike in rare childhood cancers (primarily Ewing's sarcoma) in southwestern Pennsylvania.

> There are high numbers of childhood cancers — some of them rare — in mostly rural areas of southwestern Pennsylvania, and no one knows why.
>
> Many parents, health advocates and public officials point to the proliferation of natural gas wells that have been drilled throughout these mostly rural counties over the last 15 years. Nearly 700 chemicals are used in fracking, which involves extracting oil and gas from rock by blasting chemicals, sand and water into drilled wells. Pollution emissions also occur through a network of pipes and other operations to process the oil or gas.[171]

In June 2019, more than 100 organizations and nearly 900 individuals submitted a letter Pennsylvania Governor Tom Wolf in response to reports that at least 67 diagnoses of rare cancers in children in four rural counties where fracking began in the state.[172]

The Post-Gazette editorialized saying:

> More than 100 organizations and 800 people asked Gov. Tom Wolf to order an investigation into the possible health effects of natural gas production. He stopped short of giving them what they wanted but did what his administration described as the most he could do: He directed the health department to seek out

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[169] Eliza Griswold, "When the Kids Started Getting Sick" at https://www.newyorker.com/news/dispatch/when-the-kids-started-getting-sick

[170] FracTracker Alliance, "Categorical Review of Health Reports on Unconventional Oil and Gas Development; Impacts in Pennsylvania", 2019.

[171] https://newsinteractive.post-gazette.com/childhood-cancer-pittsburgh-pennsylvania-canon-mcmillan-pollution/

[172] For more information see: https://www.betterpathcoalition.org/investigate-swpa-childhood-cancers

> others who could perform the study. Mr. Wolf and health Secretary Rachel Levine should be given time to beat the bushes, but those advocating for the study should keep the pressure on. Mr. Wolf and Dr. Levine are responsible for public health in Pennsylvania, and they cannot punt, pass the buck or leave concerned Pennsylvanians hanging. The people who live in fracking country feel a sense of urgency, and Pennsylvania's top officials must feel it, too.[173]

In November 2019, Pennsylvania Governor Tom Wolf ordered a study into the childhood cancer cluster to be performed by the state Department of Health.[174] In March 2020, the Department of Health published the report focusing on cases of Ewing's sarcoma in four southwestern Pennsylvania counties.

In December 2020, a contract was awarded to University of Pittsburgh Graduate School of Public Health for a broader study into the potential health effects of hydraulic fracturing in Pennsylvania.[175]

In an article published in March, 2021, author and Pennsylvania resident Eliza Griswold examines cancer among children. She addresses Ewing's Sarcoma and the fact that investigators suspect exposure to fracking wastewater is a potential source. Perhaps the biggest lesson so far from this health nightmare can be summed up by one of the parents, Gerald Jackson, speaking to Griswold:

> In 2011, his son, Casey, a soldier in the Army, had been diagnosed with Ewing's sarcoma. He passed away the next year, at age twenty-one…"What do you say when your son tells you he is scared of dying?" he asked me. "There are no words for that."
>
> And as a supervisor for a town on the Monongahela River that refused to continue to take fracking wastewater due to the local cancers said to Griswold in 2019, 'No amount of money was worth kids' health'.[176]

Testimony regarding the heartbreaking story of a family's loss of a child to cancer in the southwestern fracking region of Pennsylvania was presented by the Delaware River Frack Ban Coalition this past summer. Also included was testimony regarding the findings of

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[173] https://www.post-gazette.com/opinion/editorials/2019/06/26/Meanwhile-parents-fret-Wolf-Levine-must-move-quickly-on-fracking-study/stories/201906220022?fbclid=IwAR1U69uOkq8h4OLOLO8t37Z_fimbkcPiAgtseJLS9wUbcH8oZJNiMNYy8m8

[174] https://www.bizjournals.com/pittsburgh/news/2019/11/22/wolf-orders-study-into-health-impact-of-hydraulic.html

[175] https://www.media.pa.gov/pages/health-details.aspx?newsid=1215

[176] Eliza Griswold, "When the Kids Started Getting Sick" at https://www.newyorker.com/news/dispatch/when-the-kids-started-getting-sick

recent blood studies showing high concentrations of certain fracking-related contaminants.[177]

As the stories of human health harms from fracking continue to be shared and more scientific and health research is conducted, the specific health effects of fracking wastewater and related operations is being studied and the evidence of the enormous risks to public health has emerged. The risk of exposing the residents and living resources of the Delaware River Watershed to toxic and radioactive wastewater is unacceptable. Preventing its import categorically is the only certain means of eliminating these dangers.

11. *The Proposed Rulemaking promotes activity that will exacerbate climate change and jeopardize the Basin and its water resources.*

The Delaware River Basin Commission established the Advisory Committee on Climate Change ("ACCC") in December 2019. The ACCC is now functioning.[178] Resolution 2019-8, adopted to form the committee, recognizes that climate change is connected to water resources and that these changes are impacting the Delaware River Basin:[179]

> WHEREAS, the Third National Climate Assessment[180] summarized climate change impacts on the water cycle as follows:
>
> "Water cycles constantly from the atmosphere to the land and the oceans (through precipitation and runoff) and back to the atmosphere (through evaporation and the release of water from plant leaves), setting the stage for all life to exist. The water cycle is dynamic and naturally variable, and societies and ecosystems are accustomed to functioning within this variability. However, climate change is altering the water cycle in multiple ways over different time scales and geographic areas, presenting unfamiliar risks and opportunities.[181]
>
> WHEREAS, in both its 2019 State of the Basin Report and DRBC-authored sections of the Partnership for the Delaware Estuary's 2019 Comprehensive Conservation and Management Plan

[177] See copy of the recording: https://youtu.be/ix2uoU1sviI.
[178] https://www.nj.gov/drbc/library/documents/kavanagh_ACCCforNJWMC012622.pdf
[179] DRBC RESOLUTION NO. 2019 – 8 https://www.nj.gov/drbc/library/documents/Res2019-08_EstablishesACCC.pdf
[180] The Third National Climate Assessment was a three-year analytical effort by a team of over 300 experts, overseen by a broadly constituted Federal Advisory Committee of 60 members. The group's 2014 report was subjected to extensive review by the public and by scientific experts in and out of government, including a special panel of the National Research Council of the National Academy of Sciences. *See* the full report at: https://nca2014.globalchange.gov/report/sectors/water
[181] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp. doi:10.7930/J0Z31WJ2. Page 71.

(CCMP) for the Delaware River Estuary, the Commission has recognized potentially significant impacts and threats to the Basin's water resources posed by climate change; and

WHEREAS, evaluations and projects conducted and being conducted by the Commission,[182] United States Army Corps of Engineers,[183] United States Geological Survey[184] and others have shown the potential for changes in the seasonality and volume of streamflows, as well as the potential for sea level rise to impact the location of the salt front and the availability of storage to manage salinity in the Delaware River Estuary;[185]

The 2019 Intergovernmental Panel on Climate Change ("IPCC") report from the United Nations describes how the ocean and cryosphere have and are expected to change with ongoing global warming, the risks and opportunities these changes bring to ecosystems and people, and mitigation, adaptation and governance options for reducing future risks.[186] The 2019 IPCC report says limiting warming to 1.5C will require reducing greenhouse gases by 45% from 2010 levels by 2030 and that there can be no carbon emissions from energy production by about 2050.[187]

The Sixth Assessment Report of the IPCC issued in 2019 details alarming trends on both the current state and possible future of global warming.[188] According to the report, observed increases in well-mixed greenhouse gas (GHG) concentrations since around 1750 are unequivocally caused by human activities. Since 2011, concentrations have continued to increase in the atmosphere, reaching annual averages of 410 ppm for carbon dioxide (CO2),

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[182] Shallcross, Amy. (2017). Analyzing Climate Change Impacts to Water Resources in the Delaware River Basin - Big Picture Risks. https://www.nj.gov/drbc/library/documents/Shallcross_climate-change-wrm_WRADRBnov2018.pdf

[183] Johnson, Billy H., (2010). Report prepared for: U.S. Army Engineer District, Philadelphia: Application of The Delaware Bay and River 3d Hydrodynamic Model to Assess the Impact of Sea Level Rise on Salinity. Available from U.S. Army Engineer District, Philadelphia or Delaware River Basin Commission.

[184] Williamson, T.N., Lant, J.G., Claggett, P.R., Nystrom, E.A., Milly, P.C.D., Nelson, H.L., Hoffman, S.A., Colarullo, S.J., and Fischer, J.M., 2015, Summary of hydrologic modeling for the Delaware River Basin using the Water Availability Tool for Environmental Resources (WATER): U.S. Geological Survey Scientific Investigations Report 2015–5143, 68 p., http://dx.doi.org/10.3133/sir20155143.

[185] DRBC RESOLUTION NO. 2019 – 8 https://www.nj.gov/drbc/library/documents/Res2019-08_EstablishesACCC.pdf

[186] *Intergovernmental Panel on Climate Change, Summary for Policymakers, Revised on January 2019 by the IPCC, Switzerland, ISBN 978-92-9169-151-7*, downloaded at: https://www.ipcc.ch/sr15/

[187] *Ibid*.

[188] IPCC, 2021: Summary for Policymakers. In: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L.Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press. Retrieved from https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf

1866 ppb for methane (CH4), and 332 ppb for nitrous oxide (N2O) in 2019.[189] Each of the last four decades has been successively warmer than any decade that preceded it since 1850.

The report states that the scale of recent changes across the climate system as a whole and the present state of many aspects of the climate system are unprecedented over many centuries, perhaps over many thousands of years.[190] The report also states that human-induced climate change is already affecting many weather and climate extremes in every region across the globe. Evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones, and, in particular, their attribution to human influence, has strengthened in recent years since the last IPCC report.[191]

The report also relays that global surface temperatures are projected to continue to increase until at least the mid-century under all emissions scenarios considered in the report. Global warming of 1.5°C and 2°C will be exceeded during the 21st century unless deep reductions in CO2 and other greenhouse gas emissions occur in the coming decades.[192] With further global warming, every region is projected to increasingly experience concurrent and multiple changes in climatic impact-drivers. The report concludes that strong, rapid and sustained reductions in CH4 (methane) emissions would limit the warming effect resulting from declining aerosol pollution and would improve air quality.[193]

Scientists estimate that at least 45% - 50% reduction of greenhouse gases must be achieved by 2030 in order to effectively limit atmospheric warming. "Emissions need to be halved by 2030 to limit warming to 1.5 degrees Celsius but temperatures are on track to reach double that by the end of the century even if countries' current plans are fully implemented, research by scientists shows."[194]

By providing water to the gas development industry from the Delaware River Watershed, the draft regulations will encourage more fracking, enable the water-intensive use of water and be part of the wasting of the limited waters upon which the watershed depends. The fracking that would result in more methane being released to the atmosphere. Greenhouse gas emissions must address methane, which means curtailing natural gas development. According to recent report tracking greenhouse gasses, "However, energy-related carbon dioxide emissions were at a record high last year and new renewable power capacity has stalled after years of strong growth. At the same time, methane, a more potent greenhouse gas than carbon dioxide, has risen in recent years due to oil and gas production, including fracking."[195]

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[189] *Id*. at 5.
[190] *Id*. at 9.
[191] *Id*. at 10.
[192] *Id*. at 17.
[193] *Id*. at 36.
[194] https://climateactiontracker.org/publications/warming-projections-global-update-dec-2018/
[195] https://www.insurancejournal.com/news/international/2019/06/19/529839.htm

Atmospheric methane levels rose steadily during the last few decades of the 20th century before leveling off for the first decade of the 21st century.[196] Since 2008, however, methane concentrations have again been rising rapidly. This increase, if it continues in coming decades, will significantly increase global warming and undercut efforts to reach the COP21 target of < 2 degrees C above the pre-industrial baseline by 2021.[197] Limiting warming to 1.5C will be even more difficult, if not impossible.

The composition of natural gas is about 95% methane. Methane leaks or is vented or flared at all stages of the natural gas process (extraction/production, gathering, processing, transmission, storage, local distribution and consumption). Methane is 86 times more efficient than CO2 at trapping heat over a 20-year period.[198] Unless methane emissions are dramatically and intentionally reduced, it will be impossible to meet the required 45% reduction of greenhouse gasses that the IPCC and other scientists have concluded is necessary to meet climate goals.

Natural gas systems emit more anthropogenic methane than any other source in the United States, and are the third highest source for carbon dioxide emissions nationally.[199] Natural gas, considered "clean" or a "bridge fuel" is, in fact, a bigger problem than other fossil fuels due to uncontrolled and uncontrollable leaks, intentional flaring and venting. From a 2019 article:

> Methane is far more potent than carbon dioxide in contributing to climate change. That makes it particularly harmful to the environment when it is discharged into the atmosphere. In the U.S. alone, the methane that leaks or is released from oil and gas operations annually is equivalent to the greenhouse gas emissions from more than 69 million cars, according to a Wall Street Journal analysis using conversion formulas from the Environmental Protection Agency and emissions estimates for 2015 published last year in the journal Science.[200]

Methane's impact on atmospheric warming is much shorter and simpler than carbon, as explained in a VOX.com article:

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[196] Howarth, R. (2019). Ideas and perspectives: is shale gas a major driver of recent increase in global atmospheric methane? *Biogeosciences* (16), 3033-3046. Retrieved from https://www.biogeosciences.net/16/3033/2019/bg-16-3033-2019.pdf

[197] *Ibid*.

[198] Myhre, G. et al. 2013. Anthropogenic and Natural Radiative Forcing. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Stocker, T.F., D. Quin, G.K. Plattner, M.Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P.M. Midglet (eds). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. and https://en.wikipedia.org/wiki/Global_warming_potential

[199] EPA 2016.Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014. https://www.epa.gov/ghgemissions/us-greenhouse-gas-inventory-report-1990-2014

[200] Wall Street Journal, *The Leaks That Threaten the Clean Image of Natural Gas*, https://www.wsj.com/articles/the-leaks-that-threaten-the-clean-image-of-natural-gas-11565280375

> Reduced emissions [of methane] have an almost immediate climate impact. It's a short-term climate lever, and if the countries of the world are going to hold rising temperatures to the United Nations' target of "well below" 2 degrees Celsius above the preindustrial baseline, they're going to need all the short-term climate levers they can get.[201]

According to Dr. Howarth of Cornell University, the planet is going to continue to warm to 1.5 degrees C in 12 years and to 2 degrees C in 35 years or less unless we substantially cut methane emissions.[202] He points out that the planet responds much faster to methane than carbon dioxide. There is already so much carbon in the atmosphere that the ONLY hope of meeting global climate targets is to address methane because that can quickly reduce greenhouse gasses and slow the warming of the atmosphere.[203]

How is climate change impacting water resources?

Rising air and water temperatures and changes in precipitation are intensifying droughts, increasing heavy downpours and flooding, reducing snowpack, and causing declines in surface water quality, with varying impacts across different regions of the country.[204] Changes in temperature and precipitation are increasing air quality and health risks from wildfire and ground-level ozone pollution. All of these climate change impacts effect water resources, including river flows, temperature, and seasonal variability, reservoir levels, water quality and the concentration of pollutants in bath ground and surface water, Delaware River Watershed species (both flora and fauna) and their habitats, recreation, economic values, and human health.

Climate change has already had observable impacts on biodiversity, ecosystems, and the benefits they provide to society. These impacts include the migration of native species to new areas and the spread of invasive species, which will worsen and could affect ecological balance.[205] Yields from major U.S. crops are expect-ed to decline as a consequence of increases in temperatures and possibly changes in water availability (drought conditions), soil erosion, and disease and pest outbreaks.[206]

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[201] https://www.vox.com/energy-and-environment/2019/8/15/20805136/climate-change-fracking-methane-emissions

[202] Dr. Robert Howarth, Cornell University, "COP21 Reflections on the Historic Paris Climate Agreement", http://events.cornell.edu/event/cop21_reflections_on_the_historic_climate_agreement

[203] *Ibid*.

[204] *Intergovernmental Panel on Climate Change, Summary for Policymakers, Revised on January 2019 by the IPCC, Switzerland, ISBN 978-92-9169-151-7*, downloaded at: https://www.ipcc.ch/sr15/

[205] USGCRP, 2018: *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II: Report-in-Brief* [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 186 pp. Retrieved from https://nca2018.globalchange.gov/ at 16.

[206] *Id*. at 14.

The Fourth National Climate Assessment looks at the Northeast region climate impacts. These are among expected changes in the near term:

- Less distinct seasons with milder winter and earlier spring conditions are already altering ecosystems and environments in ways that adversely impact tourism, farming, forestry, and other economies.[207]
- Warmer ocean temperatures, sea level rise, and ocean acidification threaten ocean habitats, ecosystem services, and livelihoods.[208]
- Major negative impacts on critical infrastructure, urban economies, and nationally significant historic sites are already occurring and will become more common with a changing climate.[209]
- Changing climate threatens the health and well-being of people in the Northeast through more extreme weather, warmer temperatures, degradation of air and water quality, and sea level rise.[210]

Weather events have become more frequent and more intense. Anthropogenic climate change has increased precipitation, winds, and extreme sea level events associated with a number of observed tropical- and extra-tropical cyclones.[211]

Extreme El Niño and La Niña events are likely to occur more frequently with global warming and are likely to intensify existing impacts, with drier or wetter responses in several regions across the globe, even at relatively low levels of future global warming.[212]

How does this effect the Delaware River Watershed?

Sea level rise translates into river level rise in the tidal Delaware River. The rising of the seas moves upriver from the ocean, the Bay, the estuary and into tidal reaches of the river, raising the river's level and the level of the river's freshwater tributaries. In the nontidal river and its watershed, extreme weather events cause inland flooding and its cascade of impacts to natural ecosystems, streams, habitats, infrastructure and the human environment, and to the hydrology of waterways and the hydrologic cycle, which is altered by increased stormwater runoff, wetland disruption and less natural infiltration and natural floodplain functions.

Sea level rise is a dramatic and measurable impact of climate changes. Impacts will be exacerbated in cases of land reclamation and where anthropogenic barriers prevent inland migration of marshes and mangroves and limit the availability and re-location of sediment.[213] In the absence of adaptation, more intense and frequent extreme sea level

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[207] *Id*. at 116.
[208] *Id*. at 117.
[209] *Id*.
[210] *Id*.
[211] IPCC (2019). The Ocean and Cryosphere in a Changing Climate. Intergovernmental Panel on Climate Change. Retrieved from https://report.ipcc.ch/srocc/pdf/SROCC_FinalDraft_FullReport.pdf at 6-3.
[212] *Id*. at 6-4.
[213] *Id*. at 4-5.

events, together with trends in coastal development, will increase expected annual flood damages by 2-3 orders of magnitude by 2100.[214]

Since the early 1980s, the occurrence of harmful algal blooms (HABs) and pathogenic organisms (e.g. *Vibrio*) has increased in coastal areas in response to warming, deoxygenation and eutrophication, with negative impacts on food provisioning, tourism, the economy, and human health.[215]

Rutgers University's report published in 2019 points out that "New Jersey has already been disproportionately affected by climate change—sea-level rise projections in New Jersey are more than two times the global average."[216] This is consistent with the findings of other reports that from Virginia northward, sea level rise is having greater effects. New Jersey's condition is exacerbated by the fact that, as the Rutgers Study explains, "Over the last four thousand years, the dominant long-term driver of SLR in New Jersey has been the sinking of the land as part of the ongoing response to the disappearance of the North American ice sheet."[217]

In a report published last year by the Rhodium Group, New Jersey damages from climate change were examined and calculated. In addition to the growing extent and costs of coastal flooding, the report points out:

> While New Jersey's coastal communities face the bulk of hurricane-driven flood risk, the potential for wind damage from these storms extends inland. Four decades ago, the odds that an average New Jersey home outside the state's coastal counties would experience hurricane-force winds in a given year was less than 1-in-200. That has grown to between 1-in-30 and 1-in-100.[218]
>
> Global average temperatures have risen by 2° Fahrenheit since the late nineteenth century and by more than 1° Fahrenheit over the past four decades, with the pace of warming accelerated as concentrations of carbon dioxide (CO2) and other greenhouse gases in the atmosphere have increased. Oceans are also responding to these changes. Sea surface temperature in the Northeast US has warmed faster than 99% of the global ocean

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[214] *Id*.
[215] *Id*. at 5-5.
[216] Kopp, R.E., C. Andrews, A. Broccoli, A. Garner, D. Kreeger, R. Leichenko, N. Lin, C. Little, J.A. Miller, J.K. Miller, K.G. Miller, R. Moss, P. Orton, A. Parris, D. Robinson, W. Sweet, J. Walker, C.P. Weaver, K. White, M. Campo, M. Kaplan, J. Herb, and L. Auermuller. New Jersey's Rising Seas and Changing Coastal Storms: Report of the 2019 Science and Technical Advisory Panel. Rutgers, The State University of New Jersey. Prepared for the New Jersey Department of Environmental Protection. Trenton, New Jersey. p. 1 https://bloustein.rutgers.edu/njdep-releases-report-on-sea-level-rise-building-on-previous-rutgers-studies/
[217] *Id*. at 9.
[218] RHODIUM GROUP, "NEW JERSEY'S RISING COASTAL RISK", October 2019. p. 2 https://rhg.com/wp-content/uploads/2019/10/Rhodium_NJCoastalRisk_Oct2019final.pdf

> since 2004, and projections indicate that this area will continue to warm more quickly than other ocean regions through the end of the century.5 2018 also marked the warmest year on record for ocean heat content, surpassing a record set in 2017.6 Warming oceans take up more space, a process known as thermal expansion, which contributes—along with melting glaciers and ice sheets—to sea-level rise.[219]

The damage to buildings in all the counties along Delaware River tidal waters has increased due to climate impacts since 1980 according to the Rhodium Group study. Mapping shows the greatest increases for the Delaware estuarine waters to be Cape May County (from 20.9% to 27% - both from the Delaware Bay and the Atlantic Ocean) and Salem County (12.5% to 15.3%).[220]

The "increase in expected average annual loss, as a percent of county output, due to changes in sea level and expected hurricane activity since the 1980s" is greatest in Cape May, Hudson, and Salem Counties of all New Jersey counties, according to the Rhodium study.[221] This is a significant cost for these two Delaware River Basin counties.

Storm surge exacerbates the flooding from storm-induced flooding and was an important factor in the damages caused by Hurricane Sandy in 2012.[222]

The Delaware Valley Regional Planning Commission ("DVRPC") reports "…water levels of the tidal section of the Delaware River will rise as sea level rises along the Atlantic Coast. These rising water levels will be a permanent change to the landscape and will introduce new flooding vulnerabilities along the Delaware that communities will need to address."[223]

In the National Oceanic and Atmospheric Administration ("NOAA") Technical Report on global and relative sea level rise, it is concluded that seas will continue to rise due to climate change even if substantial action is taken now to address climate change impacts. These impacts include:

> Significant, direct impacts of long-term [relative sea level] (RSL) rise, including loss of life, damage to infrastructure and the built environment, permanent loss of land (Weiss et al., 2011), ecological regime shifts in coastal wetlands and estuary systems (Kirwan et al., 2010), and water quality impairment (Masterson

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[219] *Id*. at 3, 4.
[220] *Id*. at 7, Fig. 4.
[221] *Id*. at 8, Fig. 12.
[222] *Id*. at 7.
[223] DVRPC, Coastal Effects of Climate Change in Southeastern PA, Introduction and Project Background, November 5, 2019.

> et al., 2014), also occur when key thresholds in the coastal environment are crossed (Wong et al., 2014).[224]

In an earlier DVRPC report, the study on the effects of sea level rise concluded:

> The study concludes that a three- to four-foot rise in sea level during the next 100 years will have a wide range of impacts. Rising seas will inundate almost all of Pennsylvania's 1,500 acres of tidal wetlands. The salt line in the Delaware River will migrate further upstream, threatening Philadelphia's drinking water supply. The pollutants found in contaminated sites may be released into estuary waters. Efforts to increase public access to the waterfront may be jeopardized by rising waters.[225]

The overwhelming evidence points to the conclusion that climate change is having enormous impacts on the Delaware River Watershed and that DRBC should be part of the solution by addressing this growing crisis by not adopting regulations that induce and enable fracking by allowing water to be exported for use in fracking.

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[224] National Oceanic and Atmospheric Administration, U.S. DEPARTMENT OF COMMERCE, National Ocean Service Center for Operational Oceanographic Products and Services, "GLOBAL AND REGIONAL SEA LEVEL RISE SCENARIOS FOR THE UNITED STATES", NOAA Technical Report NOS CO-OPS 083, Silver Spring, Maryland, January 2017. P. 1

[225] DVRPC, "Sea Level Rise Impacts in the Delaware Estuary of Pennsylvania", Product No.: 04037, 6/2004, Abstract. https://www.dvrpc.org/Products/04037/

IV. Conclusion

The record is clear—HVHF-related activities pose substantially the same ecological and human health harms posed by HVHF itself, as the Commission has already concluded in its HVHF Rulemaking Process. The Commission must act now to prohibit HVHF-related activities, including the acceptance of HVHF wastewater into the Basin, and the exportation of Basin water to support HVHF and HVHF-related activities, which typically result in a permanent loss of water to the hydrologic cycle. DRN requests that the Commission adopt the regulatory language proposed in this comment.

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Enclosures

Attachment A

February 5, 2018 Submitted electronically and by mail

Pennsylvania Department of Environmental Protection
RA-EpncEpiphany@pa.gov

Re: Water Quality Mgmt. Part II, Industrial Wastewater Facility permit application (Water Quality Management application # 5317201; Epiphany Allegheny, LLC, Centralized Water Treatment Facility, Eulalia Township, Potter County

Delaware Riverkeeper Network (DRN) submits these comments on behalf of our members and for the protection of the air and water of the Commonwealth of Pennsylvania. DRN represents more than 20,000 members.

DRN objects to the issuance of a "Water Quality Mgmt. Part II, Industrial Wastewater Facility" permit for the Epiphany Allegheny LLC centralized wastewater treatment facility in Potter County, PA. On August 30, 2017, Epiphany Allegheny LLC filed a "Water Quality Mgmt. Part II, Industrial Wastewater Facility" permit application (Water Quality Management application # 5317201) to build a Centralized Wastewater Treatment Facility (CWT) in Eulalia Township, Potter County, PA and requests that the application be denied. The company's previous application was denied by Pennsylvania Department of Environmental Resources (PADEP) due to incomplete information including lack of public notification in the local area to be affected; lack of Act 537 Planning: and lack of notification by the Coudersport Area Municipal Authority (CAMA) - which would receive the processed effluent from the Epiphany facility for discharge into the Allegheny River - of the planned change in their waste stream.[1]

The project consists of receiving oil and gas wastewater (flowback and production brines) for processing in a multi-stage process. Following initial receipt and storage, chemical treatment would precipitate metals prior to processing via zero liquid discharge (ZLD) crystallizer separation of salts from distillate. Distillate will either be sold back to industry or discharged to the CAMA POTW for ultimate discharge to the Allegheny River. The proposed treatment facility would discharge up to 42,000 gallons of treated fracking water into the river each day. The plant is capable of processing between 20,000 – 80,000 gallons daily. In addition, up to 2.5 tons of "dewatered sludge cake" will be removed from the facility and taken to landfills.

[1] http://publicherald.org/fledgling-company-awaits-approval-for-fracking-wastewater-treatment-plant-on-pennsylvania-headwaters/

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The experimental facility would be the first of its kind, using a new technique of distillation that has been largely untested on that scale.

Hydraulic fracturing for oil and gas ("fracking") wastewater contains many dangerous chemicals. A 2017 scientific study systematically evaluated 1,021 chemicals identified in hydraulic fracturing fluids, wastewater, or both for potential reproductive and developmental toxicity in humans. A total of 157 chemicals were associated with at least one endpoint. Of these, 95 were constituents of fracturing fluids, 38 were detected in wastewater, and 24 were in both.[2] Many of these chemicals are not treated or even monitored for in the waste stream for this facility or the Coudersport Area Municipal Authority (CAMA) wastewater treatment facility. The parameters in the effluent that require monitoring, treatment and removal to clean water standards do not include all of the chemicals in the wastewater being produced by fracking in the Marcellus Shale in Pennsylvania. Testing done by New York Department of Environmental Conservation listed 154 parameters in frack wastewater they sampled from the Marcellus in Pennsylvania and West Virginia in 2011.[3] Many of the additives in the fluids used to frack wells and naturally occurring hazardous materials present in flowback or produced water are carried into the frack wastewater. Many of these hazardous constituents will migrate or concentrate in the residual solids that the facility proposes to dispose of in landfills. There is no analysis of how the sludge/solids/residuals will be monitored and treated. This is an omission that constitutes a fatal flaw since many of these constituents are toxic and/or have harmful health effects for humans or fish, wildlife and plant life.

When U.S. Environmental Protection Agency (EPA) officials attempted to accurately identify the constituents in frack wastewater that should be monitored and treated, they were not capable of doing so and that lack of specific information persists through to today's fracking chemicals. EPA officials could not be certain about the accuracy of their list of chemicals found in fracking fluid and wastewater in part because the list did not include confidential chemicals used by drilling companies for hydraulic fracturing. Drilling companies have withheld fracking chemical identities from the public as confidential thousands of times.[4]

Two Harvard researchers found that 92 percent of the well-by-well fracking chemical disclosures submitted to the non-governmental organization FracFocus between approximately March 2011 and April 2015 included at least one chemical identity withheld from the public as confidential business information (CBI). FracFocus is the nation's leading repository of fracking chemical disclosure information and currently contains disclosures from more than 127,000 wells. EPA commented that "when chemicals are claimed as CBI, there is no public means of accessing information on these chemicals. Furthermore, many of the chemicals and chemical mixtures disclosed, or those detected in produced water, lack information on properties affecting their movement, persistence, and toxicity in the environment should they be spilled."[5] It

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[2] Elliott, E.G., Ettinger, A.S., Leaderer. B.P., Bracken, M.B., & Deziel, N.C. (2017). A systematic evaluation of chemicals in hydraulic-fracturing fluids and wastewater for reproductive and developmental toxicity. *Journal of Exposure Science and Environmental Epidemiology* (27), 90–99.

[3] New York State Department of Environmental Conservation, Revised Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas, and Solution Mining Regulatory Program, Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and other Low-Permeability Gas Reservoirs, September 2011, Table 5.9.

[4] http://www.pfpi.net/toxic-secrets-companies-exploit-weak-us-chemical-rules-to-hide-fracking-risks

[5] Ibid.

also raises questions about how this wastewater treatment facility would be able to treat fracking wastewater if they don't know what's in it.

Examples of chemicals in frack wastewater linked to adverse reproductive or developmental effects with a water quality guideline or standard included: polycyclic aromatic hydrocarbons (e.g., benzo(a)pyrene); metals (e.g., cadmium, arsenic, mercury, and lead); volatile organic compounds (e.g., toluene and benzene); and other organics (e.g., di(2-ethylhexyl) phthalate and dibutyl phthalate).[6] The wastewater produced by fracking is also known to contain radioactive material such as Radium (Ra)-226. Sampling and data-gathering by New York State detected radiological parameters in Marcellus Shale flowback, including Ra-226. Gross Alpha, Gross Beta, Total Alpha Radium and Radium-228 were also found.[7] A Duke University study of a stream in Pennsylvania below a frack wastewater plant found Ra-226 levels in stream sediments at the point of discharge were ~200 times greater (544−8759 Bq/kg) than upstream sediments and background sediments (22−44 Bq/kg) and above radioactive waste disposal threshold regulations.[8]

Interstitial or formation water (the brine in the shale formation) can be highly radioactive (as concentrated as 15,000 pCi/L), so each time the water is reused, the radium is concentrated. This will result in TENORM, or Technically Enhanced Naturally Occurring Radioactive Materials.[9] The recycling or re-use of the fluids that the proposed Epiphany facility plans to produce will be subject to enhancement as it is re-used, and can result in highly toxic TENORM. Frack wastewater containing TENORM is not properly regulated due to lack of requirements for monitoring/testing for TENORM at crucial junctures in the waste stream where it should be targeted for detection and removal. For instance, the concentrated residuals that would be filtered from frack wastewater at the proposed Epiphany facility can occur at levels that are so dangerous they would need to be removed to a specially designed storage facility, such as those used for nuclear waste – and yet this is not discussed or explored by the application materials.

Ra-226 is very dangerous and cannot be disposed of safely unless segregated from the environment virtually indefinitely because of its known adverse health effects and because it has a half-life of 1,600 years.[10] Exposure to high levels of radium can cause a number of negative effects on human health such as cataracts,

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[6] New York State Department of Environmental Conservation, Revised Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas, and Solution Mining Regulatory Program, Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and other Low-Permeability Gas Reservoirs, September 2011, Table 5.9.

[7] New York State Department of Environmental Conservation, Revised Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas, and Solution Mining Regulatory Program, Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and other Low-Permeability Gas Reservoirs, September 2011, Table 5.24.

[8] Nathaniel R. Warner*, Cidney A. Christie, Robert B. Jackson, and Avner Vengosh, "Impacts of Shale Gas Wastewater Disposal on Water Quality in Western Pennsylvania", Division of Earth and Ocean Sciences, Nicholas School of the Environment, Duke University, Durham, North Carolina 27708, United States, Environ. Sci. Technol., 2013, 47 (20), pp 11849–11857, DOI: 10.1021/es402165b http://pubs.acs.org/doi/abs/10.1021/es402165b

[9] Marvin Resnikoff, Ph.D., Radioactive Waste Management Associates, "Comments on Marcellus Shale Development", October 2011.

[10] Thomas Jefferson National Accelerator Facility - Office of Science Education, *The Element Radium*, Jefferson Lab, April 2016.

anemia, cancer, and death.[11] This is very concerning because the proposed project is located one mile from the Coudersport Area Elementary School, putting the health of children at risk.

In addition to concerns about discharging this wastewater into the Alleghany River without adequate treatment and removal of hazardous materials from the discharged effluent, the location of the facility is precarious and prone to rapid release to surface water should there be spills or an accident. The proposed treatment facility would be located in a 100-year floodplain. In the event of a flood or spill, thousands of gallons of untreated hazardous and radioactive material stored on-site would be released directly into the Allegheny River. Also of concern is the transport of untreated frack wastewater to the facility. The lack of testing at the well site and related lack of truck signage ("placarding") that accurately reflects the level of radioactivity of the wastewater that is transported[12] adds great risk to the transport of the untreated, toxic wastewater. Wastewater effluent that contains levels of dangerous pollutants and untreated waste that may be spilled or released into the floodplain and river at the facility or *en route* will negatively impact the water quality of all downstream waters and the people in New York State as well as Pennsylvania that would be exposed to the untreated toxic mix directly, through their water supplies, contact with the river, and/or fish consumption. Communities downstream of the proposed facility at Coudersport involve millions of people, including Pittsburgh, Louisville, Cincinnati and New Orleans and the Allegheny Indian Reservation of the Seneca Nation, which includes the City of Salamanca.[13] The Seneca Nation objects to the proposed facility which will adversely impact their lands; DRN supports the Seneca Nation's concerns.

In addition to human health concerns, there are also ecological concerns about discharging this wastewater into the Alleghany River. The application notes that there are burbot (a PA state endangered fish) and bigmouth shiner (a PA state threatened fish) in the project area but there is no mention of the impacts from this project on these species. Wastewaters from the Marcellus Shale have been known to elevate total dissolved solids (TDS, up to 300 000 mg/L), variable concentrations of organic compounds, and naturally occurring radioactive material (NORM) in rivers and streams, all of which would be threats to fish and aquatic wildlife.[14] In such huge amounts, TDS is very difficult to keep under control. PADEP requires (by regulation, only measured at a downstream point, not at the point of discharge, which exposes entire portions of the receiving water to higher concentrations of TDS, which is known to have negative impacts) a limit of 500 mg/l of TDS for a discharge permit. However, 500 mg/l is not protective of aquatic life. For instance, 350 mg/l TDS reduced spawning of Striped bass (Morone saxatilis) in the San Francisco Bay-Delta region, and concentrations below 200 mg/l promoted even healthier spawning conditions for fish.[15] And in the Truckee River, the EPA found that juvenile Lahonton cutthroat trout were subject to higher

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[11] ATSDR, Public Health Statement for Radium, December 1990.
[12] Resnikoff, Marvin, ""Review of Pennsylvania Department of Environmental Protection Technologically Enhanced Naturally Occurring Radioactivity Materials (TENORM) Study Report", Dec. 2015.
[13] http://artvoice.com/2018/01/26/proposal-dump-pegula-frackwater-allegheny-river-upstream-nys-southern-tier-advances/#.WmxRzqinGUk
[14] Akob, D.M., Mumford, A.C., Orem, W., Engle, M.A., Klinges, J.G., Kent, D.B., & Cozzarelli I.M. (2016). Wastewater Disposal from Unconventional Oil and Gas Development Degrades Stream Quality at a West Virginia Injection Facility. *Environ. Sci. Technol.* 50, 5517−5525
[15] Kaiser Engineers, California, Final Report to the State of California, San Francisco Bay-Delta Water Quality Control Program, State of California, Sacramento, CA (1969).

mortality when exposed to thermal pollution stress combined with high total dissolved solids concentrations.[16]

A study in June 2014 sampled water in a tributary of Wolf Creek in West Virginia downstream from an injection disposal facility. The results showed elevated conductivity (416 µS/cm) compared to background waters upstream (74 µS/cm).[4] There were also elevated TDS, Ba, Br, Sr, Cl, Li and Na concentrations, while sediments downstream from the facility were enriched in Ra and had high bioavailable Fe (III) concentrations relative to upstream sediments.[4] The wastewater discharged from this facility would clearly compromise the ecological health of the Alleghany River.

There are also numerous flaws and missing information within the application itself. First, the project is located in a 100-year floodplain, but in the application checklist, "No" is checked next to whether or not the project is located in a floodplain.

The CWTF will be located within the 100-year flood plain of the Allegheny River (see Figure 4-2). CAMA has agreed as part of the land lease agreement that a leveled and compacted site will be provided to Epiphany before CWTF installation is initiated. The leveling and compaction will include sufficient fill to provide a base for the Storage Tank Secondary Containment Area that is above the 100-year flood plain with a minimum bearing design capacity of 1,500 lbs/sq. feet.

5.3	**Floodplain Projects by the commonwealth, a Political Subdivision of the commonwealth or a Public Utility – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a floodplain?**	☐	Yes	☒	No
6.0	**Will the project involve discharge of stormwater or wastewater from an industrial activity to a dry swale, surface water, ground water or an existing sanitary sewer system or separate storm water system?**	☐	Yes	☒	No
7.0	**Will the project involve the construction and operation of industrial waste treatment facilities?**	☒	Yes	☐	No

Secondly, the application states that the dewatered crystalized salt would be dried and transported for beneficial reuse, but there is no mention of what this beneficial reuse would be. Will it be spread on roads? Precipitation could wash the salt into nearby bodies of water. Salts are very dangerous to plant and animal life and can lower water quality in receiving streams and groundwater.

The dewatered crystallized salt is transferred to a lined and sealed roll-off box where it further dries and is stored until it is transported for beneficial reuse.

Third, according to Epiphany's application, the "influent" and "effluent" parameters, as well as the parameters for distilled water discharge into the sewer, do not include radiologicals. Is the testing of radiologicals not required?

[16] C.M. Hogan, Marc Papineau et al. Development of a dynamic water quality simulation model for the Truckee River, Earth Metrics Inc., Environmental Protection Agency Technology Series, Washington D.C. (1987).

3850-PM-B 1000 7/2016
Module 1

WASTE CHARACTERISTICS

OUTFALL: NONE

SAMPLING LOCATION * – TREATMENT FACILITY INFLUENT

PARAMETER	UNITS	MONTHLY AVERAGE	24 HR. MAX.	MIN.	MAX.
pH	pH	6.8			
Iron	mg/L	61.6			
TSS	mg/L	730			
Hardness	mg/L	630			
Barium	mg/L	2250			
Strontium	mg/L	4920			
Chloride	mg/L	140000			
Sodium	mg/L	71700			
Calcium	mg/L	15800			
Magnesium	mg/L	1100			
Sulfate	mg/L	5			
Methanol	mg/L	5			
TDS	mg/L	281000			

*Use Additional Sheets as Necessary

Comments/additional information

5. Sewage Flows

Volume of water discharged to the POTW: 42,000 gallons per day. There will be no domestic sewage discharge.

The Epiphany water treatment facility will discharge distilled water from the operation to the CAMA sewer system. The operation of the system will be operating 16 to 24 hours per day. The discharge from the distilled water system will occur from the hours of 8:00 AM to 4:00 PM and 8:00 PM to 5:00 AM on an as needed basis. The estimated distilled water quality is:

- Organics (ppm) 5
- Chloride (ppm) 70
- Sodium (as NA^{+}) (ppm) 33
- Calcium (as Ca^{2+}) 7
- Magnesium (as Mg^{2+}) (ppm) 1
- Sulfate (ppm) 2
- Methanol (ppm) 3

- pH Range 6 to 9

How will this material be monitored to assure it is safe and does not have dangerous concentrations of radiologicals? How will radiologicals be disposed? Will it be taken to landfills in the solids/residual wastes? The cumulative buildup of radioactive materials is not adequately controlled at landfills, even if tested by the truck as it enters the landfill site, because there is no testing for the accumulation of

radiologicals at the landfill site. For instance, the leachate from Pennsylvania landfills is not routinely monitored and treated for radioactive materials. This constitutes a threat to the health and safety of those in the landfill's region, particularly from highly toxic and persistent Ra-226. Wind could blow toxic radioactive dust into the environment and leachate with radioactivity levels above human health guidelines could occur as the residual waste is accumulated in landfills.

Fourth, Epiphany also indicated in its application to PADEP that the facility would produce air emissions. How will this be monitored throughout the region? How is this safe considering how close the project would be to residences and an elementary school?

You must enter potential emissions below. If also reporting actual emissions, provide the actual emission amounts and calculations as attachment(s) in Section F. of this RFD.

Pollutant(s) (from Instructions)	Emissions (lbs/hr)*	Emissions (tons/year)*	Calculation Method Code Appendix B
PM	-	0.10	
PM-10	-		
PM-2.5	-		
SO_x	--	0.01	
CO	-	1.51	
NO_x	-	1.20	
VOC		0.43	
Total HAPs**			

Will the construction or modification of this source increase emissions from other sources at the facility?

☐ **Yes (Describe and quantify emissions on separate sheet)**

☒ **No**

Finally, DRN is gravely concerned about the ability of this company to carry out operations safely and according to regulations and permits. JKLM Energy, the company behind the proposal of this facility, has a history of environmental contamination, which does not bode well for a project of this magnitude that is the first of its kind. JKLM has amassed 44 violations in Potter County since 2015 which includes spilling hundreds of gallons of acid, "failure to properly store, transport, process or dispose of waste," and contamination of "waters of the Commonwealth."[17] JKLM also accumulated 877 violations when it was formerly known as East Resources, founded by Terry Pegula in 1983 and operated by staff who now work with JKLM Energy.[5] Additionally, the company had six outstanding violations just in the past months, in December 2017, at its Reese Hollow pad. The violations were for "failure to notify the Department of an accident or other activity or incident", "a toxic substance or another substance which would endanger downstream users of the waters", "failure to design and construct well site to prevent spills", and "failure to control waste."[5] It is clear this company is basically a scofflaw operator and cannot be trusted to operate this highly risky facility that has not ever been proven safe and manageable at this enormous scale.

In conclusion, it is clear that this project cannot be approved because it is dangerous to the community and the environment, including the Allegheny River, and its application is riddled with deficiencies and inaccuracies. DRN requests and advocates that the application be denied.

[17] Troutman, M.A. (2018). The Road Paved in Waste: Fracking waste facility proposed for Allegheny River. *Public Herald*, January 14, 2018.

Thank you for the opportunity to comment.

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Tracy Carluccio
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Attachment B

June 16, 2020

Policy Office
Department of Environmental Protection
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Harrisburg, PA 17105-2063

RE: Residual Waste General Permit WMGR123; Proposed Modifications and Renewal

These comments are submitted by Delaware Riverkeeper Network on behalf of our organization's 25,000 members, many of whom live and work in Pennsylvania. Delaware Riverkeeper Network is opposed to some provisions of the proposed modifications to the Residual Waste General Permit WMGR123, under the Solid Waste Management Act (35 P.S. §§ 6018.101—6018.1003); the Municipal Waste Planning, Recycling and Waste Reduction Act (53 P.S. §§ 4000.101—4000.1904). Delaware Riverkeeper Network's concerns arise from the substantial adverse impacts that can result from the processing, transfer and "beneficial use" of oil and gas liquid waste to develop or hydraulically fracture an oil or gas well.

Delaware Riverkeeper Network is commenting solely on the proposed modifications to the General Permit and not on the current regulatory language. There are important definitions in the proposed modifications that have the potential to result in the release of pollution from the liquid waste produced by hydraulic fracturing (fracking) being handled at the reuse facility, adversely impacting the environment, public health, and site worker health. The newly defined terms are integrated into the provisions of the General Permit, expanding the permitted activity. Delaware Riverkeeper Network objects to the definitions provided for processing, transfer, and storage because the expanded activities weaken the regulations' ability to prevent pollution and degradation and do not provide adequate oversight. Delaware Riverkeeper Network is focusing on "Storage", a new definition in the General Permit.

STORAGE DEFINITION

The newly added definition reads:

> **Storage** - The containment of waste on a temporary basis in a manner that does not constitute disposal of the waste. It shall be presumed that containment of waste in

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excess of 1 year constitutes disposal. This presumption can be overcome by clear and convincing evidence to the contrary.

Delaware Riverkeeper Network objects to this definition. There are several problems with the use of this term:

- The allowance of storage of fluid waste up to a year is excessive considering its dangerous constituents.
- The added allowance of an extension of the length of time for storage of waste constitutes a potentially perpetual or never-ending retention of wastewater under the permit, particularly considering that there is no end date or maximum period specified. This adds unnecessary risk because the "units" or impoundments are not designed as long-term storage facilities.
- The dictionary definition of storage is "the action or method of storing something for future use". However, it is not clear that the waste will definitely be reused. The proposed definition sets up a loophole that would allow the wastewater to be stored for up to a year or longer and then simply disposed of as waste. Let's look at these issues one at a time.

<u>1. The allowance of storage of fluid waste up to a year is excessive considering its dangerous constituents.</u>

The General Permit requires in Appendix A that certain maximum concentrations of constituents be met by the fluids that are stored. However, there are many components of wastewater produced by fracking that are not included in Appendix A that pose significant danger if released to the environment through a leak, spill, volatilization/venting to the air or if released through other manner.

The storage and processing of fluids on site allows and prolongs the handling of dangerous materials at the well site. Due to the current exemption of oil and gas activities from the U.S. Resource Conservation and Recovery Act Subtitle C standards, these materials are not classified as hazardous and are not required to be handled as hazardous substances despite the many wastewater constituents that do have hazardous properties. This reality must be reflected in strict regulation of these fluids, not the extension of time for potentially toxic materials to be stored on site.

Some of the materials in wastewater that is to be stored for reuse under the General Permit is not even accounted for by the well operator or perhaps even by PA Department of Environmental Protection (DEP). A 2018 report "Keystone Secrets" documents that drilling companies have extensively used exemptions in Pennsylvania rules that allow companies to withhold chemical identities as trade secrets. Regulations at the federal and state level allow for the information about the chemicals injected into drilled wells to be kept from the public and, in some cases, even from emergency responders and regulatory agencies. ("Keystone Secrets: Records Show Widespread Use of Secret Fracking Chemicals Is a Looming Risk for

Delaware River Basin, Pennsylvania Communities", Dusty Horwitt, Partnership for Policy Integrity (PFPI), September 11, 2018)

Drilling companies injected secret fracking chemicals 13,632 times into 2,515 "unconventional" wells in Pennsylvania between 2013 and 2017, primarily in Marcellus and Utica shale formations. The companies injected at least one hydraulic fracturing ("fracking") chemical with an identity kept hidden from the public into each of the 2,515 unconventional natural gas wells drilled in Pennsylvania, amounting to 55 percent of the more than 4,500 unconventional gas wells drilled in the state during the five-year period. Each well received an average of more than five secret chemical injections. ("Keystone Secrets: Records Show Widespread Use of Secret Fracking Chemicals Is a Looming Risk for Delaware River Basin, Pennsylvania Communities", Dusty Horwitt, Partnership for Policy Integrity (PFPI), September 11, 2018)

Under Pennsylvania law, well operators must report the chemicals they use to fracture unconventional gas wells to FracFocus, a publicly-accessible database operated by non-governmental organizations. However, well operators are allowed to withhold the identities of fracking chemicals as trade secrets. When they do, they must indicate in the FracFocus database that the chemical is a trade secret. Keystone Secrets is based on these public disclosures.

The amount of secret chemical use in oil and gas wells is likely much greater than publicly disclosed because of regulatory exemptions that don't require reports or readily accessible records of all chemicals used in drilling and fracking. For instance, no drilling chemicals (drilling precedes fracking in the oil and gas extraction process) used in either conventional or unconventional wells are required by Pennsylvania to be disclosed at all, so these occurrences could not be included in the report, even though, according to US Environmental Protection Agency (EPA) records, it is known that some drilling chemicals have been kept secret from the public at the federal level, and some are known to be linked to adverse health effects. ("Keystone Secrets: Records Show Widespread Use of Secret Fracking Chemicals Is a Looming Risk for Delaware River Basin, Pennsylvania Communities", Dusty Horwitt, Partnership for Policy Integrity (PFPI), September 11, 2018)

If chemical manufacturers, as opposed to other companies involved in fracking, assert trade secret claims, Pennsylvania law appears to allow no one to learn the chemicals' identities, even in the case of a leak or spill. The exemption relieves chemical manufacturers of the duty to report the chemicals in their fracking fluid products to the public, regulators such as DEP, emergency personnel and first responders, health professionals, and even well operators using the products. ("Keystone Secrets: Records Show Widespread Use of Secret Fracking Chemicals Is a Looming Risk for Delaware River Basin, Pennsylvania Communities", Dusty Horwitt, Partnership for Policy Integrity (PFPI), September 11, 2018)

Another source of information about the dangers of chemicals used in fracking is the EPA. EPA has found that some chemicals used in drilling and fracking have serious health risks. In response to a Freedom of Information Act request filed by PFPI in 2014, EPA disclosed health assessments and regulatory determinations for dozens of new chemicals proposed for use in

drilling and fracking fluid. PFPI has reviewed records for 126 of the chemicals reviewed under EPA's New Chemicals program between 2003 and 2014. Of the 126, EPA expressed health concerns about 109 of the chemicals proposed for use in oil and gas drilling and fracking. Regardless, EPA approved most of the 109 chemicals for use, and 62 of them were most likely used in oil and gas wells. The health effects noted by EPA include "irritation to the eye, skin, and mucous membranes," kidney toxicity, liver toxicity, neurotoxicity, and developmental toxicity. ("Keystone Secrets: Records Show Widespread Use of Secret Fracking Chemicals Is a Looming Risk for Delaware River Basin, Pennsylvania Communities", Dusty Horwitt, Partnership for Policy Integrity (PFPI), September 11, 2018)

Yet these chemicals are not captured in Appendix A; many because there is no way to know if these chemicals were used in the fluids that are to be reused in fracking under this General Permit. Of the 62 chemicals likely used in oil and gas wells despite EPA's health concerns, manufacturers concealed the identities of 41 with trade secret claims. ("Keystone Secrets: Records Show Widespread Use of Secret Fracking Chemicals Is a Looming Risk for Delaware River Basin, Pennsylvania Communities", Dusty Horwitt, Partnership for Policy Integrity (PFPI), September 11, 2018)

It has been well established that there are constituents in wastewater produced by fracking that are not required to be tested for. Some have been included in Appendix A but many toxic ingredients have not. New York's 2009 DSGEIS contained a list of constituents in gas drilling Marcellus shale wastewater from Pennsylvania and West Virginia (NYSDEC Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas, and Solution Mining Regulatory Program (DSGEIS), 2009, Tables 5-8 and 5-9, p. 5-109). Many are hazardous, some have known harmful health impacts, and some are carcinogenic. New York tested flowback from these shale gas extraction operations in Pennsylvania and West Virginia and found 154 parameters.

A 2017 scientific study systematically evaluated 1,021 chemicals identified in hydraulic fracturing fluids, wastewater, or both for potential reproductive and developmental toxicity in humans. A total of 157 chemicals were associated with at least one endpoint. Of these, 95 were constituents of fracturing fluids, 38 were detected in wastewater, and 24 were in both. ("A systematic evaluation of chemicals in hydraulic-fracturing fluids and wastewater for reproductive and developmental toxicity", Elliott, E.G., Ettinger, A.S., Leaderer. B.P., Bracken, M.B., & Deziel, N.C. (2017). *Journal of Exposure Science and Environmental Epidemiology* (27), 90–99.)

Some constituents in flowback and produced waters from gas development are not regulated under the Safe Drinking Water Act or other regulations even though they have human health risks and ecosystem/environmental impacts; these are also not included in Appendix A. Many of these are known as "emerging contaminants" and have known harmful human health effects but standards and use guidelines are still in the process of being developed. Some of these are endocrine disruptors (EDC) or pharmaceuticals that may occur in gas drilling wastewater. (2010 NWRI Final Project Report on "Source, Fate, and Transport of Endocrine Disruptors, Pharmaceuticals, and Personal Care Products in Drinking Water Sources in California", May

19, 2010. http://www.nwri-usa.org/pdfs/cecresearchprofile.pdf). Another example is the family of perfluoroalkyl and polyfluoroalkyl substances (PFAS) that have been discovered in Pennsylvania and are known to be correlated with serious adverse health effects, including cancer. (https://www.dep.pa.gov/Citizens/MyWater/drinking_water/PFAS/Pages/default.aspx) Some PFAS may be used in fracking fluids.

Adding to pollution dangers posed by the reuse or recycling of frack fluids, Marcellus Shale contains radionuclides including uranium-238, thorium-232, and their decay products. Radioactive concentrations in the Marcellus Shale formation are at concentrations 20 to 25 times background, making shale gas wastewater extremely radioactive. The produced water from Marcellus Shale has higher levels of radionuclides than water from Barnett Shale wells, according to the GAO. (US General Accountability Office, ***Information on the Quantity, Quality, and Management of Water Produced During Oil and Gas Production***, GAO-12-56, January 2012.)

The General Permit condition C.11 states: "A copy of the DEP approved Radiation Protection Action Plan (RPAP), for the facility must be maintained by the permittee and be available at the facility at all times. The RPAP must address the management of oil and gas liquid waste and solids generated that contain technologically enhanced naturally occurring radioactive material (TENORM) and be implemented during all phases of operations at the facility."

A review of the Radiation Protection Action Plan requirements shows that the specific plan for a site can have varying requirements and facilities that process and store radioactive materials can be required to monitor doses of workers. TENORM materials could be required to be immediately removed or handled in a special manner. But it is even possible that the Plan will allow the facility to receive from DEP a blanket waiver of TENORM. As stated by DEP: "A facility may submit, in their proposed Action Plan, to obtain a blanket approval for disposal of such small quantities of waste with TENORM." (DEP, p. 9 at: http://www.depgreenport.state.pa.us/elibrary/GetDocument?docId=1419619&DocName=FINAL%20GUIDANCE%20DOCUMENT%20ON%20RADIOACTIVITY%20MONITORING%20AT%20SOLID%20WASTE%20PROCESSING%20AND%20DISPOSAL%20FACILITIES.PDF%20%20%20%3cspan%20style%3D%22color:blue%3b%22%3e%3c/span%3e)

Delaware Riverkeeper Network considers these uncertainties as to what is required in the Radiation Protection Action Plan to be too great to provide the protection needed from TENORM and that the General Permit requirements must be strengthened to prevent release.

"It has been known since the 1960's that the Marcellus shale formation is radioactive. Drilling logs by gas companies and reports by USGS show that underground/subsurface radium concentrations in the Marcellus shale are up to 32 times surface background concentrations. Measurements by New York State DEC show radium in rock cuttings over 200 times background concentrations. (NYSDEC, Division of Environmental Remediation, August 2012, re. Allied Landfill, Niagara County) Drilling and natural gas production brings this radioactivity to the surface in the form of solids (rock cuttings), liquids (drilling fluids, flowback water and brine), and gas (radon)." (Review of Pennsylvania Department of Environmental Protection

Technologically Enhanced Naturally Occurring Radioactivity Materials (TENORM) Study Report, Marvin Resnikoff, Ph.D. December 2015)

Interstitial or formation water (the brine in the shale formation) can be highly radioactive (as concentrated as 15,000 pCi/L), so each time the water is reused, the radium is concentrated. This will result in TENORM, or Technically Enhanced Naturally Occurring Radioactive Materials. (Radioactive Waste Management Associates, "Comments on Marcellus Shale Development", Marvin Resnikoff, Ph.D., October 2011) TENORM is highly toxic and can be even more dangerous than Radium 226. The liquid waste stored on site under the General Permit is required under Appendix A to meet a standard for Radium 226 and 228 of 5 pCi/L (combined). However, the problem of TENORM complicates the storage of wastewater produced by fracking over a period of time. As radioactive elements are stored, radioactive properties can build up in tanks, liners, piping and residual material in the storage vessel. There is no requirement for sampling of these tanks, units or other infrastructure over time and the sampling of the fluids may not accurately represent the level of radioactivity embodied in the units, impoundment liners, or other related components of the storage system.

For these reasons, Delaware Riverkeeper Network also points out that the removal of decommissioned tanks, units, and other related storage and processing infrastructure must require sampling for radioactivity before reuse, recycling, or disposal, applying this comment to condition C.8 in the General Permit to prevent human health and environmental damage. Also under C.8, components of storage or processing units or systems that will continue to be used on the site must be sampled for radioactivity before being used for other purposes.

<u>2. The added allowance of an extension of the length of time for storage of waste constitutes a potentially perpetual or never-ending retention of wastewater under the permit, particularly considering that there is no end date or maximum period specified. This adds unnecessary risk because the "units" or impoundments are not designed or regulated as long-term storage facilities.</u>

In the 2013 review of Pennsylvania's Oil and Gas Regulations it was noted that General Permit WMGR123 serves DEP's goals of encouraging the "beneficial use" of wastewater produced by hydraulic fracturing but that long term facilities increase the potential for adverse environmental impacts. "At the same time, long term facility [sic] present potential for environmental impacts that warrants closer regulation, such as bonding, siting and oversight." (Pennsylvania Follow-up State Review, State Review of Oil and Natural Gas Environmental Regulations, Inc. (STRONGER), September 2013, p. 62.)

One problem caused by reuse of the wastewater is the resulting concentration of certain contaminants. The wastewater produced by fracking that is regulated under the General Permit will be held in "temporary" storage units that may not be designed to hold the potentially corrosive and/or concentrated materials found in this waste stream. Impoundments that hold the stored fluids use plastic liners that may not have the required strength to hold these potent fluids for a year or more, as allowed in the General Permit.

There is no requirement limiting the size of these units, which are being built in enormous sizes today, increasing the potential adverse impacts should a unit break. There, likewise, is no size or capacity limit on impoundments.

There is no requirement to prevent all vapors and emissions from the storage vessels to be treated and filtered to remove all contaminants, including methane, except to reference current DEP air regulations that address fugitive emissions of a select group if certain volume thresholds are met. As stated in the General Permit at Condition C.13, the capture of emissions in the state regulations is: "(relating to prohibition of certain fugitive emissions and fugitive particulate matter)".

Construction specifications that prevent leaks and subsequent water and soil contamination must be required with adequate inspection and maintenance routines but these are not prescribed in the General Permit.

<u>3. The dictionary definition of storage is "the action or method of storing something for future use". However, it is not clear that the waste will definitely be reused. The proposed definition sets up a loophole that would allow the wastewater to be stored for up to a year or longer and then simply disposed of as waste.</u>

The problem of long term storage is compounded by the lack of strict regulation of the stored waste's ultimate fate, which is allowed to remain on the site in what is considered a "temporary storage" unit or impoundment even if the fluids are too toxic to reuse in fracking. Under Condition C.3.d., "If the results of any future sampling taken to satisfy this condition fail to meet the concentration limits in Appendix A, the permittee must immediately notify the DEP and manage the processed oil and gas liquid waste as a residual waste."

Remarkably, the operator does not have to remove the waste if the fluids do not meet Appendix A requirements but apparently may allow them to stay on site for a year or for the life of the General Permit. It is entirely possible that processing does not accomplish the reduction of regulated constituents to DEP's requirements and a "bad batch" can stay on site for a year and may be extended even longer if permitted by DEP. This provision in the General Permit can be used as a loophole where waste is kept on site because it is a convenient storage location until disposal is economic or available. The storage of fluids for reuse at a well site for fracking was never meant to be a *de facto* wastewater storage location yet there is nothing in the General Permit to preclude this.

It is not farfetched to imagine that the sites where fluids to be reused may become waste storage sites. There is tremendous pressure today for locations to dispose of wastewater produced by fracking because of the downturn in the drilling and fracking of new production wells. The demand for reused wastewater for fracking has plummeted with the lack of new well starts, creating a glut of wastewater that is more expensive to dispose when it must be transported to injection wells or industrial treatment plants.

As stated in a peer-reviewed report:

> "The vast majority of reuse is for hydraulic fracturing of new wells, thus reuse is only a viable waste handling practice while new development stays apace. Evidence has already been found in Pennsylvania that lower ratios of reused water by operators occur when there are pauses in new drilling.
>
> [In 2016] The cost of oil and gas dropped to a point where new well development was no longer economically feasible for some operators, and their market for wastewater dropped."
> (Excerpted from: Science of the Total Environment, "Temporal and spatial trends of conventional and unconventional oil and gas waste management in Pennsylvania, 1991–2017", Lee Ann L. Hill, Eliza D. Czolowski, Dominic DiGiulioa, Seth B.C. Shonkoff, https://doi.org/10.1016/j.scitotenv.2019.03.475 , p.630)

The supersized gas wells being drilled today in the Marcellus and Utica shale formations use 10-20 million gallons of water per well. According to FracFocus data, the average well in Pennsylvania's Marcellus Shale used 11.4 million gallons in 2017, up from 4.3 million gallons reported by agencies in 2011. This means not only more water is needed to fracture the extended horizontal well bores but also means there are greater volumes of wastewater produced by these wells - between 1-1.5 million gallons of wastewater (for 10 M gallons of water used in fracking a well), increasing the volumes many times over the amount typically produced previously in Pennsylvania. (See: FracTracker Alliance Issue Paper, "Potential Impacts of Unconventional Oil and Gas on the Delaware River Basin", March 20, 2018. Main Author: Matt Kelso.
https://www.delawareriverkeeper.org/sites/default/files/FT-WhitePaper-DRB-2018%20%28003%29.pdf)

Coupled with this is the fact that fracked wells today are using more water and, as a result, more wastewater is being produced by these "super wells". Drilling and gas development companies are looking for locations they can take or keep their wastewater and, if available and not prohibited by regulation, well sites could easily become like today's nuclear power plants where waste is allowed to be stored on site indefinitely, despite the tremendous risks.

SAMPLING by Processors

Delaware Riverkeeper Network objects to the allowance in Condition C.4 and C.5 for reduction of frequency of sampling and analysis, and a reduction in the number of parameters to be sampled for the reasons outlined above in this comment. One of the key characteristics of wastewater produced by fracking is that it is variable depending on local geology, construction materials of the well (steel, cement, etc.); the formula of stimulation fluids used to frack the well, drilling fluids used to drill the well, and other variable environmental factors. It is not reasonable to allow for less frequent and fewer parameters to be tested for when the waste stream cannot be reliably consistent. This provision makes it more likely that pollutants will go undetected, unprocessed, and travel through to the environment and needs to be removed from consideration.

LOCATION

Delaware Riverkeeper Network objects to the addition of the emphasized language under C.7.f.: "Within 150 feet of high quality or exceptional value waters, as defined in 25 Pa. Code § 93.1., ***unless the storage and processing will not occur within that distance and no adverse hydrologic or water quality impacts will result."*** This provision to allow a waiver of the 150-foot buffer for High Quality and Exceptional Value streams would be a heavy blow to the clean waters of Pennsylvania, providing a pathway for degradation for streams and waterways that are supposed to be the most highly valued in the Commonwealth.

DEP states in their explanation of the Special Protection Waters program:

> The Pennsylvania Department of Environmental Protection (DEP) classifies streams based on their water quality. Among the classifications are Exceptional Value (EV), High Quality (HQ) and Warm Water Fisheries (WWF). EV is the highest or top tier classification/level of protection and HQ is the next step down. The Clean Water Act requires states to have protective uses for their surface waters. Once a protective use is established for a surface water, that use must be maintained and the surface water is not permitted to degrade. This DEP policy of anti-degradation, which originated from the U.S Department of the Interior and the Clean Water Act, promotes the maintenance and protection of existing water quality in the State. (https://waynecountypa.gov/265/Special-Protection-Waters)

As concluded in a study of gas well development patterns, "Gas wells are often sited close to streams, increasing the probability of harm to surface waters, and preliminary data suggest the potential for detectable effects from sedimentation." ("Rapid expansion of natural gas development poses a threat to surface waters", Sally Entrekin, Michelle Evans-White, Brent Johnson, and Elisabeth Hagenbuch, *Front Ecol Environ* 2011; 9(9): 503–511, doi:10.1890/110053 (published online 6 Oct 2011) p. 9)

Why would DEP consider jeopardizing the most valued of these protected streams by allowing a potential source of pollution to be located within its designated protective buffer? This allowance is not only reckless, it is likely a violation of the federal Clean Water Act and the state Clean Streams Law, in spirit as well as in the letter of the law. This proposed modification must be removed to save these irreplaceable exceptional value and high quality waters and to support the efficacy of Pennsylvania's Special Protection Waters anti-degradation program.

STORMWATER DISCHARGES

Pertaining to Condition C.20, Delaware Riverkeeper Network objects to the language added regarding stormwater discharges, which reads (emphasis added):

> "The permittee shall not cause or allow a point or non-point source discharge of any of the following: residual wastes; liquid waste; combined stormwater runoff and leachate, if

> generated; or runoff from the staging, processing, and storage areas where solid waste management activities are conducted; to the surface waters of the Commonwealth, unless permitted by DEP. ***This does not include rainwater or stormwater that is collected in a containment area that has not been mixed with a residual waste.*** "

Under the General Permit for stormwater for a gas well site, monitoring is not required. If a discharge is to occur from a stormwater system, an individual stormwater NPDES permit must be obtained but typically, gas well sites operate under DEP's General Permit. Due to the activity at a gas well site undergoing drilling, stimulation, fracking, and the processing of wastewater, there is an enormous amount of activity and traffic. For sites located well off a paved road, thousands of trucks are required to carry various chemicals, water, machinery, equipment, etc., traveling typically on a gravel road installed from the well to the nearest roadway. These trucks cause sediment pollution and BTEX-laden particulates to be washed off in a storm event, often not captured in the on-site stormwater system. The trucks also emit diesel air pollution that is deposited on the surfaces, soil, and vegetation to be washed into the nearest waterway with precipitation. These emissions and airborne pollutants also deposit directly on surface water. This runoff is unmitigated, negatively impacting water quality, human health, and habitats.

There is no requirement to prevent air emissions that could deposit on the surface and be carried with stormwater as polluted runoff. DEP recognizes in this General Permit that fugitive and vented air emissions occur on gas well sites. It is not possible to control where land-deposited air pollutants, including heavy metals, priority pollutants, and volatile organic compounds, will fall to the surface.

Studies have shown that air pollution accompanies gas well development as discussed in a report that examined the Marcellus Shale among other gas fields:

> Air pollutants are released during at least 15 different parts of the oil and gas development process. (Tanja Srebrotnjak and Miriam Rotkin-Ellman, Natural Resources Defense Council, *Fracking Fumes: Air Pollution from Hydraulic Fracturing Threatens Public Health and Communities*, December 2014) Many of the chemicals used in fracking are known air pollutants, and wastewater produced from fracking operations includes volatile compounds that can evaporate into the air, and have been linked to human health problems. (U.S. House of Representatives, Committee on Energy and Commerce, *Chemicals Used in Hydraulic Fracturing*, April 2011)
>
> Leaking or vented natural gas can also contain toxic chemicals such as toluene and xylenes, which can cause breathing difficulty, and benzene, which can cause leukemia – even at low levels of exposure. (Gabe Rivin, "Fracking Regulators Won't Create Rules for Air Pollution," *North Carolina Health News*, 29 July 2014)

> A 2010 study by the Pennsylvania Department of Environmental Protection found elevated levels of ethane, propane and benzene – all toxics associated with fracking – "in the air near Marcellus Shale drilling operations." (Pennsylvania Department of Environmental Protection, *Southwestern Pennsylvania Marcellus Shale Short-Term Ambient Air Sampling Report*, 1 November 2010)
> (Excerpted from: "Fracking Failures; Oil and Gas Industry Environmental Violations in Pennsylvania and What They Mean for the U.S.", Jeff Inglis, John Rumpler, Environment America Research & Policy Center, 2015. P. 10)

The mixing of runoff, particularly during a severe storm event, is common on this type of an industrial site and has led to degradation of receiving waterways that are proximate to a site. Without monitoring and tracing stormwater runoff to its source, it is not reasonable to expect that pollution will not be mixed into the portions of the site that are supposed to be segregated as the capture area for a stormwater control. Pollutants are deposited from both land activities (including spills, leaks, accidents, etc.) and air emissions that are deposited on the land surface.

As explained in a paper regarding the impacts of gas development on the environment, explaining why stormwater is one of the "key" aspects of gas site development that requires better control (emphasis added):

> Stormwater discharges are regulated by state and local governments. The National Pollution Discharge Elimination System (NPDES) program regulates stormwater runoff at the federal level, although states can receive primacy to administer their own permitting program. At the federal level, oil and gas operations have been afforded special protections and are exempt from provisions in the Clean Water Act. Consequently, oil and gas operators are not required to obtain a stormwater permit, unless over the course of operation, the facility generates stormwater discharge containing a reportable quantity of oil or hazardous substances or if the facility violates a water quality standard (40 CFR 122.26(c)(1)(iii)).10 In 2005, the definition of oil and gas exploration and production was broadened to include construction and related activities, although regulations still require well pads larger than one acre to apply for an NPDES stormwater permit (Wiseman 2012).11 ***A 2005 study on the surface water impacts of natural gas drilling noted the difficulty of monitoring and suggested that few facilities were monitoring in a way that would allow them to determine whether they even required an NPDES permit (U.S. EPA 2007b)***.
> ("Hydraulic Fracturing and Water Resources: Separating the Frack from the Fiction", Heather Cooley, Kristina Donnelly. June 2012, p. 28. https://pacinst.org/wp-content/uploads/2013/02/full_report5.pdf)

An extensive examination of sediment runoff contained in stormwater from oil and gas well sites found that gas well sites with disturbance produce greater amounts of sediment pollution than undisturbed land on the site. From the report:

> The main goals of this research was to determine the extent of sediment movement off of gas well sites, identify conditions that might contribute to sediment movement, and characterize the types of materials that are moving as sediment. The results show that sediments are eroding from the gas well sites examined in this study. Observations made during the study include: the amount of runoff and erosion from the gas well sites appears to be greater than that from non-disturbed areas around the sites; the slope of the land where a gas well is built affects erosion; the total rain per event and rain intensity affects erosion in most cases; eroded materials may enter local stream channels from gas well site construction; and vegetation (including revegetation of disturbed areas) appears to effectively slow storm water runoff and decrease the potential for erosion.
> ("Assessment of sediment runoff from natural gas well development sites", Havens, David Loran, M.S. thesis May 2007, available at http://digital.library.unt.edu/ark:/67531/metadc3665/m1/1/high_res_d/thesis.pdf)

An analysis of the land to be disturbed and forest to be changed by Marcellus Shale gas development in Pennsylvania concluded:

> Well development – We estimated that 47,600 additional wells could be developed on 5,950 well pads over the next 30 years if the Interior Marcellus's technically recoverable resources were fully developed.
> Land use change – The construction of natural gas infrastructure (well pads, gathering pipelines, and access roads) to support projected well development would result in about 94,000 acres of land disturbance. Over half (about 51,000 acres) of the land disturbance would impact agricultural land, while about 28,000 acres would constitute the clearing of forest cover.
> Forest change – Of the 28,000 acres of forest that would be cleared, we found that 12,700 acres were core forest areas (over 100 meters from the nearest forest edge). Additionally, over 88, 000 acres of core forest would be fragmented by road and pipeline development and converted to edge forest. Thus, over 100,000 acres of core forest would be lost due to the combined effect of clearing and fragmentation.
> (Excerpted from: "Potential Environmental Impacts of Full-development of the Marcellus Shale in Pennsylvania", Lars Hanson, Steven Habicht, and Paul Faeth, CNA, September 2016. Document Number: IRM-2016-U-01369)

These land use changes cause increases in rate and volume of stormwater and add pollutants to the runoff, despite the regulations that are currently in place. It is essential that strict regulatory controls be included in the General Permit with no loophole left open for a case-by-case exemption from the rule available. This proposed modification should be removed.

INSPECTIONS

Delaware Riverkeeper Network opposes the monthly-only inspections of the area where the General Permit activities occur if the operations are not currently active in processing and transfer – in other words where wastewater produced by fracking is stored.
Condition C.24 states (emphasis added):

> At a minimum, weekly inspections of all processing and storage areas are to be conducted to determine compliance with the terms and conditions of this general permit, and for evidence of failure. This includes the processing and storage areas for operations permitted under WMGR123 that are located on a well pad that is actively engaged in drilling, casing, cementing, hydraulic fracturing, or flowback operations. ***For operations permitted under WMGR123 that are located on a well pad and are not actively engaged in drilling, casing, cementing, hydraulic fracturing or flowback operations, or WMGR123 operations that are not actively engaged in processing or transfer, a monthly inspection of all processing and storage areas is adequate.***

It makes no sense to not require "at a minimum, weekly inspections" of the area where wastewater produced by fracking is stored. For the reasons detailed above in this comment regarding the potential toxicity and public safety issues of wastewater produced by fracking and the fact that polluted fluids that do not meet the standards set by DEP in Appendix A could be stored for a year or more on the site, it is essential that these areas are <u>at a minimum</u> inspected weekly.

As discussed in a 2019 paper that assessed the impacts of fracking in Pennsylvania on the environment, leaks and spills are often the pathways of pollution from well sites into the environment. As stated in the report regarding violation data for Pennsylvania (emphasis added):

> In 2017, there were 821 violations at unconventional wells and 3,273 violations at conventional wells. Almost all (92 percent) of the unconventional well violations were environmental health and safety-related, including ***"failure to properly store, transport, process or dispose of a residual waste"***, "conducting an activity...without a permit or contrary to a permit issued by DEP", "failure to prevent gas flow in the well annulus", "failure to plug a well upon abandoning it", "conducting casing and cementing activities that failed to prevent pollution or diminution of fresh groundwater", and other violations.
> The number of unconventional well violations for all wells (821) exceed the number of unconventional wells drilled in Pennsylvania in 2017 (810) (Figure 11). Well violations occur for wells at all stages of its lifespan.

Further discussed in the 2019 Report, spills were plentiful and there are not enough inspections to keep on top of violations in Pennsylvania. The impacts can be high-consequence if the material spilled is toxic:

In Pennsylvania from 2008 to 2013 violations occurred for 3.4 percent of wells. (Vidic, R. D., Brantley, S. L., Vandenbossche, J. M., Yoxtheimer, D., & Abad, J. D. (2013). Impact of shale gas development on regional water quality. *Science*, 340(6134), 1235009)
Based on the limited data, the median volume of the spills is 120 gallons. The total volume of the reported spills from 2005 to 2014 is 0.26 million gallons in Pennsylvania. (Patterson, L. A., Konschnik, K. E., Wiseman, H., Fargione, J., Maloney, K. O., Kiesecker, J., ... & Saiers, J. E. (2017). Unconventional oil and gas spills: Risks, mitigation priorities, and state reporting requirements. *Environmental Science & Technology*, 51(5), 2563-2573.
The spatial distribution of violations corresponds to areas with high well density. The number of inspectors is also very low relative to the number of wells, which leads to poorly regulated wells. (Bosquez IV, T., Carmeli, D., Esterkin, J., Hau, M. K., Komoroski, K., Madigan, C., & Sepp, M. (2015). Fracking debate: the importance of pre-drill water-quality testing. *In American Bar Association Section of Litigation.)*
The effect of violations, spills, and explosions endanger habitat. Untreated releases of fracking fluid have caused 100 percent mortality of some species in the area. (Adams, M. B., Edwards, P. J., Ford, W. M., Johnson, J. B., Schuler, T. M., Thomas-Van Gundy, M., & Wood, F. (2011). Effects of development of a natural gas well and associated pipeline on the natural and scientific resources of the Fernow Experimental Forest. *US Department of Agriculture Forest Service, Northern Research Station. General Technical Report NRS-76. Newtown Square, Pennsylvania.* And: Auchmoody, L. R., & Walters, R. S. (1988). Revegetation of a brine-killed forest site. *Soil Science Society of America Journal*, 52(1), 277-280.)
(Excerpted from: "The Economic Costs of Fracking in Pennsylvania" May 2019, ECONorthwest, KOIN Center, 222 SW Columbia Street, Suite 1600, Portland, OR 97201, 503-222-6060. P. 14, 15)

DEP must employ a rigorous inspection program to catch potential leaks and spills before they occur. Prevention of pollution is the best management practice and an important part of that pro-active practice is to require and carry out inspection consistently and regularly. This proposed modification should be removed.

In closing, Delaware Riverkeeper Network is opposed to the proposed modifications to and provisions of the Residual Waste General Permit WMGR123, under the Solid Waste Management Act (35 P.S. §§ 6018.101—6018.1003); the Municipal Waste Planning, Recycling and Waste Reduction Act (53 P.S. §§ 4000.101—4000.1904) that we herein reviewed. Delaware Riverkeeper Network respectfully requests that DEP not allow those proposed modifications.

Delaware Riverkeeper Network's concerns arise from the substantial adverse impacts that can result from the processing, transfer and "beneficial use" of oil and gas liquid waste to develop or hydraulically fracture an oil or gas well under General Permit WMGR123.

Thank you for the opportunity to comment.

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