October 24, 2020

Catherine R. McCabe, Commissioner Submitted by email: release_prevention@dep.nj.gov
New Jersey Department of Environmental Protection
Trenton, New Jersey

Re. **Underground Storage Caverns, Proposed New Rule: N.J.A.C. 7:1F** under Authority: N.J.S.A. 13:1D-1 et seq., 13:1K-1 et seq., 26:2C-1 et seq., 58:10-35.1 through 35.4, 58:10A-1 et seq.
Comments of Delaware Riverkeeper Network

Delaware Riverkeeper Network submits these comments on behalf of our 25,000 members and in service of our mission to defend, protect and restore the Delaware River Watershed, its habitats, environment, and communities. Delaware Riverkeeper Network supports the regulation of underground storage caverns. The fact that six underground storage caverns exist in New Jersey without regulations is unacceptable. The lack of regulation deprives the public and the environment of needed protection from releases of pollution, contamination of the environment, including water supplies, and the health, safety, and wellbeing of human and nonhuman communities and their habitats. Of great importance is the need to prevent catastrophe and the loss of life that could occur without adequate regulation. We support DEP's stated intention to "protect public safety, health and welfare" with these proposed regulations.

Delaware Riverkeeper Network supports DEP's proposed prohibition of the storage of liquefied natural gas (LNG) in underground caverns. We agree that this "extraordinarily hazardous substance", as defined under the Toxic Catastrophe Prevention Act (TCPA) program rule, would not be approved under the TCPA regulations (NJAC 7:31). We agree with the findings presented in the Proposed Rule (the rule) by the New Jersey Geological and Water Survey that there is a "lack of safe and feasible underground storage method" for LNG. Based on the evidence presented in the rule, the risk of catastrophe is too great to allow the underground storage, under any circumstances, of LNG.

Delaware Riverkeeper Network does not support the allowance of underground storage caverns for the substances that are proposed in the rule: "gasses, petroleum products, and the derivatives of petroleum products". Despite the three-part review proposed, the storage of these substances is too dangerous to allow because of the risk of the release of pollutants and resulting contamination, and the threats posed to public health and safety. These substances are hazardous substances that, under existing regulations and laws, cannot be released to the environment because of their toxicity, volatility, flammability, and other properties. The caverns will be within the same underground environment as groundwater and aquifers that

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supply drinking water. Additionally, groundwater can express to surface water, and if contaminated can adversely impact water supplies from surface water sources and the water quality of our streams, lakes, and rivers. The release of these substances to the air contributes hazardous pollution and threatens public health, especially for communities that are already disproportionately enduring the brunt of air and water pollution, imposing environmental injustice.

The construction and operation of underground caverns for the storage of these hazardous materials can result in their release by accident, technological failure, human error, and terroristic attack. In the most densely populated state in the nation with the highest number of Superfund sites and a legacy of pollution from industrial and commercial activities, as well as the ongoing pollution releases to our air and water by current human activities, New Jersey is already carrying a great burden of pollution that has damaged and continues to compromise our health and the environment. The risks of further ruining water quality, degrading natural assets, and releasing toxic pollutants into the air that jeopardize the health and safety of the public is too great and the costs vastly outweigh any benefit for the public.

Regarding the specifics of the proposed rule, Delaware Riverkeeper Network provides these comments on some of the major deficiencies in the rule:

Natural Gas Liquids

The dangers of handling and storing natural gas liquids underground are not mentioned in the rule and must be considered. Natural Gas Liquids, also classified as Liquefied Hazardous Gas (LHG) by the federal Pipeline and Hazardous Materials Safety Administration (PHMSA), have extremely dangerous properties. These volatile hydrocarbons including ethane, propane and butanes and other natural and synthetic hydrocarbons (as listed in the rule: methane, ethane, propane, butane, gasoline, kerosene, fuel oil, synthetic oil, crude oil, and LPG) present significant public safety threats. When released to the air these substances form gaseous clouds that, once ignited, can interact with obstacles such as trees and other vegetation, walls, tunnels, buildings and embankments to create turbulent conditions that can lead to detonations[1] that can be deadly to humans and highly destructive to building materials including metals and reinforced concrete.

In 1978, a small leak occurred in underground caverns in Marcus Hook, PA that were storing butane. Five houses burned down and 30 families were temporarily displaced.[2]

On April 7, 1992, an explosion occurred at an underground cavern storing NGL near Brenham, Texas. A combination of accidental overfilling of the cavern and a failure of a safety valve led to NGLs escaping into the air. Although the accident occurred in a rural area, the resulting explosion killed 3 people and 75 cattle grazing nearby, injured 24 people, and caused $9 million in damage to homes and farms.[3]

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[1] E.S. Oran, et al, "Mechanisms and occurrence of detonations in vapor cloud explosions", Progress in Energy and Combustion Science, 77 (2020) 100804 https://www.sciencedirect.com/science/article/pii/S0360128519300243

[2] Dragon Pipe Diary (2017). Is it safe to store massive quantities of NGLs underground in Marcus Hook? Retrieved from https://dragonpipediary.com/2017/08/01/is-it-safe-to-store-massive-quantities-of-ngls-underground-in-marcus-hook/

[3] Fehling, D. (2015). On Edge of Houston, Underground Caverns Store Huge Quantities Of Natural Gas Liquids. Houston Public Media. Retrieved from

Leak Detection and Emergency Response and Shutdown

The NJDEP proposed rulemaking contains no requirements for leak detectors and emergency shutoff valves. In densely populated New Jersey, the death and damage toll from a release of the proposed list of substances could be much higher than the examples of the incidents in Texas or Marcus Hook, PA. Marcus Hook, for instance, has a population density of 2,150 people per square mile. In Linden, NJ, where five of New Jersey's existing underground storage caverns are located, the population density is 4,001 people per square mile.

At the time of the Texas explosion, there were no industry or government standards for emergency shutoff valves. A year later, Texas adopted regulations requiring leak detectors and emergency shutoff valves for underground caverns storing NGL.[4]

The underground storage cavern leak at Aliso Canyon, California, located close to the neighborhood of Porter Ranch near Los Angeles, was discovered on October 23, 2015 and persisted uncontrolled into 2016. It is considered the worst natural gas leak in U.S. History[5], causing massive environmental destruction and the enormous release of methane and ethane into the air, increasing the emissions of greenhouse gases and exacerbating atmospheric warming and climate change.[6] According to the New York Times: "For more than 100 days in 2015 and 2016, gas leaked out of the Aliso Canyon Natural Gas Storage Facility near Los Angeles — the largest known leak of methane in United States history. More than 8,300 households were evacuated, and people exposed to the gas reported nosebleeds, dizziness and respiratory problems."[7] The rule's lack of a leak detection requirement that would trigger immediate response is irresponsible.

The Aliso Canyon 2015-2016 leak illustrates the need for technological advancements to stop the emission of gases once an incident occurs. Obviously, the 100-day lack of control points to a glaring weakness in the storage of these gases in caverns. If it cannot be contained, it should not be allowed. If a release occurs that cannot be controlled without risking substantial adverse impacts, it should not be allowed in the first place.

The rule states that, "with regard to suspected releases, owners and operators are required to investigate the suspected release within seven calendar days." Seven days is too long to wait to investigate a suspected release and puts the health and safety of people and the environment at risk. Suspected releases should be investigated immediately and corrected as soon as possible after the initial report.

Buffer and Exclusion Zones

The rule contains no buffer zone requirements from environmental features. Development of a cavern, like other earth disturbance, should never occur within the 500-year floodplain or the flood hazard zone as

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https://www.houstonpublicmedia.org/articles/news/2015/10/19/124674/on-edge-of-houston-underground-caverns-store-huge-quantities-of-natural-gas-liquids/

[4] Texas Administrative Code. Retrieved from https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=16&pt=1&ch=3&rl=95

[5] https://laist.com/projects/2019/after-aliso/

[6] https://en.wikipedia.org/wiki/Aliso_Canyon_gas_leak

[7] https://www.nytimes.com/2019/05/17/business/porter-ranch-gas-leak.html

defined by DEP floodplain regulations. This disturbance should not occur within 300 feet of waterways protected under Category 1 or other protective New Jersey stream classifications or those included in the Delaware River Basin Commission Special Protection Waters program, which covers the entire nontidal Delaware River and its watershed. The rule also does not provide information on soils, porosity, permeability, wetlands, floodplains, or inappropriate geology for storing NGL. Exclusion zones based on environmental and physical properties are not mentioned.

It is important to define a buffer zone that reflects the geologic uncertainty of the particular field and associated risks. Additionally, exclusion zones for rock formations or physical features such as slope, erodability, existing vegetative cover, and other aspects of a site should be included in the rule to protect vulnerable and unsuitable areas or regions from disturbance. Regions that are managed under special regulations and plans due to vulnerable and unique resources, such as the Highlands or Pinelands, should also be named as excluded from cavern development.

The porosity and permeability of the geologic formation should also be considered.[8] Studies have shown that lithology is particularly important for underground caverns. The host unit must be relatively homogeneous and at least 40 feet thick to accommodate NGL. In addition, rock units with high clay mineral content should be avoided, due to the likelihood of gas adsorption onto the clay particles, thereby hindering extraction of NGLs.[9]

The New York State Department of Environmental Conservation has buffer zone requirements and language regarding maximum storage capacity when modifying a permit.[10]

Expansion of Caverns/Modification of Permits

The modifications section in the rule does not include a cap limit for expanding capacity. For example, Delaware River Partners, the developers of the Gibbstown Logistics Center in Greenwich Township, Gloucester County wants to expand the cavern at the Gibbstown terminal from storing 186,000 barrels of NGL to three million barrels.[11] This is inappropriate but nothing in the rulemaking precludes DRP from doing this. It is known that some industrial and commercial projects begin out with certain specifications, only to be expanded down the road.

Developers often use this approach as a means of escaping rigorous environmental review that is comprehensive and accurately reflects the full development of a facility prior to the first phases of its construction. Assessing the footprint of a project without the full build out disclosed and considered can lead to faulty decisionmaking that causes harm to the environment and the public. This tactic has been used by Delaware River Partners at the Gibbstown Facility through its plans to substantially expand its

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[8] Ground Water Protection Council and Interstate Oil and Gas Compact Commission. *Underground Gas Storage Regulatory Considerations : A Guide for State and Federal Regulatory Agencies* . May 2017. 122 pages.
[9] Carter et al. (2017). A Geologic Study to Determine the Potential to Create and Appalachian Storage Hub for Natural Gas Liquids. Appalachian Oil & Natural Gas Research Consortium.
[10] NYSDEC Gas Storage. Retrieved from https://www.dec.ny.gov/energy/1612.html
[11] Nichols. D. (2019). Old Factory on Delaware River near Philadelphia Under Development for LNG & LPG Exports. Frack Check WV.

infrastructure and operations. The result has been piecemeal review of environmental, public health and safety impacts by agencies that did not anticipate the huge expansion, and has led to a lack of analysis of the cumulative impacts of the facility.[12]

Earthquakes

The NJDEP proposed rulemaking makes no mention of the risks associated with earthquakes.

A 2016 report prepared for the U.S. Department of Energy contends that earthquakes or other disasters could disable multiple underground storage facilities in an affected area, or they could take out combinations of underground storage facilities and other important gas supply infrastructure. A storage well at the Aliso Canyon underground facility was crushed during the 1994 Northridge Earthquake in Los Angeles, California.[13] How caverns will impact water wells, existing pollution plumes, utilities, and other infrastructure must be fully addressed through in-field investigations and assessment.

Carbon Capture in Underground Storage Caverns

There is also no mention of utilizing underground caverns for carbon storage. However, methane is listed as one of the substances included in the rule, although it is unclear why methane would be stored. There are many questions surrounding the efficiency and sustainability of the storage of carbon or other greenhouse gases for the purposes of capturing the emissions to prevent their release to the atmosphere. The practice of storing in underground caverns is not well studied and provides a false sense of security that misleads regulators, policy makers, and planners by masking the effects of greenhouse gas release on the earth's growing climate crisis. If it turns out that the leaking or fugitive emissions of greenhouse gas or associated environmental cost of the carbon stored outweighs the value of capturing the carbon, rationalizing activities that produce carbon by trying to capture it after-the-fact will end up increasing emissions and worsen global warming.

A report by the Intergovernmental Panel on Climate Change (IPPC) discusses some of the environmental impacts and energy consumption issues with carbon storage. "However, CO2 capture systems require significant amounts of energy for their operation. This reduces net plant efficiency, so power plants require more fuel to generate each kilowatt-hour of electricity produced. Based on a review of the literature, the increase in fuel consumption per kWh for plants capturing 90% CO2 using best current technology ranges from 24–40% for new supercritical PC plants, 11–22% for NGCC plants, and 14–25% for coal-based IGCC systems compared to similar plants without CCS. The increased fuel requirement results in an increase in most other environmental emissions per kWh generated relative to new state-of-the-art plants without CO2 capture and, in the case of coal, proportionally larger amounts of solid wastes. In addition, there is an

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[12] See DRP applications and permits to NJDEP, Delaware River Basin Commission, Army Corps of Engineers, and US Coast Guard sand Federal Energy Regulatory Commission. Examples of the attempts to avoid regulatory oversight and/or comprehensive environmental review: https://www.delawareriverkeeper.org/sites/default/files/DRN%20written%20comnt%20Air%20permit%20mod.combinedpdf.pdf and https://www.delawareriverkeeper.org/sites/default/files/DRN%20Protest%20to%20DRP%20Petition%20%282020-10-15%29.pdf

[13] Folga et al. (2016). U.S. Natural Gas Storage Risk-Based Ranking Methodology and Results.

increase in the consumption of chemicals such as ammonia and limestone used by PC plants for nitrogen oxide and sulphur dioxide emissions control."[14]

It is far better to prevent the initial release of carbon by eliminating the development of fossil fuels, for instance, than allowing the extraction and use of fossil fuels and other sources of greenhouse gases to continue; the precautionary principle is far more effective in reducing pollution. Natural carbon sequestration through the protection of forests and other natural vegetative systems, for instance, has known multiple benefits for the environment and public health and has long-term sustainability without the numerous environmental and public health costs of fossil fuel development. An IPCC 2019 report says limiting warming to 1.5C, which is necessary to avoid near-term disasters as well as long term warming, 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.[15] The most effective way to slow the rapid pace of climate change is to stop the initial release of greenhouse gases, including methane, which is the major component of natural gas, as opposed to trying to recapture and store them in caverns or other locations.

Carbon release from a storage site also has public safety hazards. According to the IPCC: "A sudden and large release of CO2 would pose immediate dangers to human life and health, if there were exposure to concentrations of CO2 greater than 7–10% by volume in air. Pipeline transport of CO2 through populated areas requires attention to route selection, overpressure protection, leak detection and other design factors."[16]

As New Jersey reforms its environmental regulations under the PACT initiative, it is essential that climate impacts of the underground cavern storage of these gases are required to be measured, weighed, and put through a rigorous test to prove the public benefit based on climate impacts from these activities. This analysis is not mentioned in the rule.

According to the National Energy Technology Laboratory, building carbon capture and storage (CCS) into a key component for managing anthropogenically-derived CO2 will likely require more than just technological feasibility; it also may require the development of regulatory policies. Although CO2 storage sites and underground natural gas storage facilities are characterized in similar fashion and utilize similar geologic formation types, they are regulated by entirely different governing bodies (the EPA's UIC Program for CO2 storage).[17]

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[14] "Special Report on Carbon Dioxide Capture and Storage", Prepared by Working Group III of the Intergovernmental Panel on Climate Change. Published by Cambridge University Press, 2005. Section 1, p. 27. https://www.ipcc.ch/site/assets/uploads/2018/03/srccs_wholereport-1.pdf

[15] *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/

[16] "Special Report on Carbon Dioxide Capture and Storage", Prepared by Working Group III of the Intergovernmental Panel on Climate Change. Published by Cambridge University Press, 2005. Section 1, p. 12. https://www.ipcc.ch/site/assets/uploads/2018/03/srccs_wholereport-1.pdf

[17] Vikara et al. (2019). Underground Natural Gas Storage – Analog Studies to Geologic Storage of CO2. National Energy Technology Laboratory.

The Entire Footprint of Underground Cavern Storage

There is no mention of the transportation or infrastructure needed to deliver these substances to the underground storage site. There needs to be companion regulation of the overland and pipeline transportation of these hazardous materials. The regulation of gas transport by PHMSA and other agencies by pipeline, rail, tank car or rail container, truck, barge, marine vessel or any other vessel is poorly regulated, as is evidenced by the numerous environmental impacts that these systems have had on New Jersey, Pennsylvania, another states. More underground storage caverns will require the expansion of the methods of transport to get the materials to the caverns. Some systems, such as many of New Jersey's highways, are failing to meet current traffic loads and many roads and bridges are in need of repair and upgrading. All of this infrastructure preparatory work must be done ahead of time to meet basic safety needs.

The upstream and downstream development impacts must be considered in any rule that will induce this development. This may require additional regulations or reform of current regulations and it could require the prohibition of transport by certain modes of transportation, particularly here, in New Jersey, where the population density is so great and traffic systems are already heavily used.

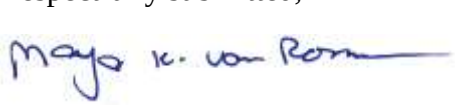
Ethical Standards for Personnel

The rule states that the third-party evaluation personnel "shall not accept future employment with the owner or operator of the cavern system for at least two years following the submission of the evaluation." First, two years is not long enough and only provides a flimsy separation of a person's potential for conflicting interests from different employers. The period of time must be much longer and in line with some federal requirements such as 5 years or never. This requirement should be applied in reverse as well. To eliminate bias, no third party personnel should have been employed by or performed consulting work for the owner or operator of the cavern system for at least two years prior to the submission of the evaluation. Without this requirement, operators will hire consultants that they have used in the past and who have given them favorable results. This will result in bias and would not constitute a true third party, independent evaluation.

In conclusion, Delaware Riverkeeper Network opposes the allowance of underground storage caverns for the substances that are proposed in the rule and supports a rule that prohibits LNG and other gases from being stored in underground caverns based on environmental, public health, public safety, and climate considerations.

Thank you for the opportunity to comment on this important proposed new rule.

Respectfully submitted,



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