



**DAMASCUS CITIZENS FOR SUSTAINABILITY**  
CLEAN WATER, AIR AND LAND ARE BASIC HUMAN RIGHTS

July 5, 2017

Sandra Hinkel  
NYS Department of Environmental Conservation  
Division of Environmental Remediation  
625 Broadway, Albany NY 12233-7255

Sent via email to  
Regs.Radiation@dec.ny.gov

Dear Ms. Hinkel:

Re: Comments by Damascus Citizens for Sustainability on Proposed Part 380

Damascus Citizens for Sustainability appreciates this opportunity to provide comments and suggestions on the proposed revisions to 6 NYCRR Part 380. Many of our comments are the same as those submitted by the Citizens' Environmental Coalition. For this reason we are signing on to support those comments. In addition to signing on to the CEC comments, DCS is submitting this additional comment letter to address a key issue not included in the CEC comment letter. This issue is the protection of public health from radioactive radon and its radioactive progeny in natural gas.

### **BACKGROUND**

Of all the proposed updates to New York's radiation protection regulations, the huge issue the proposed regulations fail entirely to address is the human health hazard from exposure to radon. In fact, the proposed rules go entirely in the wrong direction by declaring that radon is NORM (naturally occurring radioactive material). As the authors of the revisions to Part 380 noted, radioactive material that is correctly classified as NORM would not be subject to permitting or regulation under Part 380.

Geologic layers that contain the primordial radioactive elements (such as uranium, thorium and radium) will also contain radon as a radioactive decay product of the primordial elements. Radon and its radioactive decay elements (such as polonium, bismuth and lead) are components of the shale deposits beneath New York such as the Marcellus Shale and the Utica Shale.

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Of all these radioactive elements, the most dangerous to health is radon 222, one of the decay products of radium. Rn 222 is a noble gas. This means that it does not react with any other elements and it does not burn. The only way radon is created is by radioactive decay and the only way it is destroyed is also by radioactive decay.

Just as the natural gas released by hydraulic fracturing is brought to the surface, so too the radon gas that is liberated by the fracturing comes to the surface as part of the produced natural gas. The radon gas entrained in the produced natural gas is carried through each step in the production and delivery of the natural gas all the way through the distribution system to the kitchen stoves, furnaces, water heaters and other natural gas powered appliances in our homes. Other members of the public will be exposed to radon and its decay products because they live near natural gas well pads, compressor stations, metering and regulating stations, and other processing facilities that emit natural gas containing radon and its radioactive decay products. Attached to these comments are other informational background materials related to radon and its radioactive progeny.

Some of the radon we inhale will radioactively decay either in our lungs or in our homes to produce radioactive elements of polonium, bismuth and lead. Radon is a carcinogen and is the leading cause of lung cancer among non-smokers. **DEC should revise its proposed amendments to Part 380 by classifying radon and its radioactive progeny (including polonium 210 and lead 210) as TENORM and developing a program to reduce radon and its radioactive progeny levels to “as low as reasonably achievable (ALARA).”** Further revisions to the proposed Part 380 radioactivity controls should be developed and implemented so that health risks to the public from radon and its radioactive progeny are reduced to a level that is consistent with ALARA.

### **NORM and TENORM Definitions**

The “Summary of Express Terms” document to accompany the proposed Part 380 regulations adds TENORM to clarify that technologically enhanced naturally occurring radioactive material (TENORM) is the same as processed concentrated naturally occurring radioactive material, which is regulated radioactive material. The actual text of the proposed amendments states that constraints on airborne emissions must be established by the permittee such that the member of the public that is likely to receive the highest dose will not receive a dose equivalent greater than 10 mrem in any given year. If this annual dose equivalent is exceeded, the permit holder must take corrective action. **However, the proposal excludes radon 222 and its decay products from the radioactive material that is included in the dose calculation. This attempt to eliminate DEC’s regulatory authority over radon and its radioactive decay products stands the whole regulatory structure of Part 380 on its head.** Classifying all radon and radioactive progeny as NORM would take away DEC’s authority and responsibility to

regulate these radioactive materials to protect public health for all New Yorkers and should be rejected.

The description in the existing and proposed versions Part 380 of NORM appears in Section 380-2.1(i)(3), as “naturally occurring radioactive material with atomic numbers less than 92, in any form and in natural isotopic abundance” The proposed Part 380 amendments mistakenly label all radon as NORM. Once man alters the rock at depth by drilling into the shale rock to extract natural gas, the classification of the radon released by human activity changes from NORM to TENORM. While the undisturbed condition classifies the radon as NORM, as soon as man steps in to alter the geologic structure of the shale to release the trapped natural gas and radon, the now altered and disturbed conditions change the classification of the radon to TENORM. As TENORM, the radon and its radioactive decay products brought to the surface by human activity are now subject to regulation under Part 380.

What follows is an analysis of the definitions of TENORM and NORM by both the State of New York and by EPA. The conclusion of this review is that the radon and its radioactive progeny (such as polonium 210 and lead 210) that is entrained with the natural gas is subject to regulation as TENORM.

### **Part 380 Definition of NORM**

The proposed revisions to Part 380 declare that radon and its radioactive decay products are NORM. This is an erroneous and sweeping conclusion that is inconsistent with other statements in the proposed amendments to Part 380, and more importantly, is not consistent with the federal definitions of NORM and TENORM.

To evaluate the application of these terms to a real world situation, we looked to a technology and industry that involves application of the NORM and TENORM classifications. Natural gas exploration, development, production, transmission and consumption is an industrial activity that involves application of both NORM and TENORM.

### **Part 380 Definition of TENORM**

The Part 380 proposal defines TENORM as “naturally occurring radioactive material whose radionuclide concentrations are increased by or as a result of past or present human practices.” See, Subpart 2.1 (a)(66) of the proposed regulations.\* The proposal doesn’t expressly define NORM except as, “naturally occurring radioactive material with atomic numbers less than 92, in any form and in natural isotopic abundance.” See, proposed amendment to Part 380, Section 380-2.1(i)(66).

### **EPA and ATSDR Definitions of NORM and TENORM**

The Environmental Protection Agency defines NORM as, “materials which may contain any of the primordial radionuclides or **radioactive elements as they occur in nature,**

such as radium, uranium, thorium, potassium, and their radioactive decay products that are undisturbed as a result of human activities such as manufacturing, mineral extraction or water processing." See, <https://www.epa.gov/radiation/technologically-enhanced-naturally-occurring-radioactive-materials-tenorm>. Background radiation, which is present in terrestrial, cosmic, man-made or cosmogenic sources, is around us at all times.

Further, EPA defines TENORM as: Technologically Enhanced Naturally Occurring Radioactive Material (TENORM) is defined as, "**materials that have been concentrated or exposed to the accessible environment as a result of human activities** such as manufacturing, mineral extraction, or water processing." See, <https://www.epa.gov/radiation/technologically-enhanced-naturally-occurring-radioactive-materials-tenorm>.

"Technologically enhanced" means that the radiological, physical, and chemical properties of the radioactive material have been concentrated or further altered by having been processed, or beneficiated, or disturbed in a way that increases the potential for human and/or environmental exposures.

EPA's definition of NORM is alternatively stated as: "[Naturally occurring radioactive materials found in nature that emit ionizing radiation that have not been moved or concentrated by human activity.](#)" Radioactive materials that have been concentrated, moved or exposed to the accessible environment as a result of human activities such as manufacturing, mineral extraction, or water processing" would be TENORM.

### **Application of NORM and TENORM Definitions**

The plain truth is that some radon can be classified as NORM while other radon must be classified as TENORM. The factor which determines which category applies is the involvement of human activity. EPA's NORM definition applies to "the primordial radionuclides ... as they occur in nature ... undisturbed as a result of human activities." The TENORM federal definition refers to, "materials that have been concentrated or exposed to the accessible environment as a result of human activities."

Radon that exists in the geologic layers where uranium, thorium and radium exist undisturbed by man is NORM radon. However, as soon as we start drilling to release and recover the natural gas and oil from those geologic layers, we are changing the relative abundance of the various radionuclides. This is particularly the case for radon. Radon is a noble gas that is created only by radioactive decay of the primordial elements, uranium, thorium, and radium. When we drill into the host rock, we release the radon as well as the natural gas we are extracting. The radon is brought to the surface and concentrated in the host natural gas, including in the cuttings that are brought to the surface as the well is drilled.

The only radon that is NORM is the radon that is undisturbed by human activity in the host rock at depth. As soon as we drill into the host rock, we disturb the host environment and alter the conditions affecting the radon. We convert the radon from NORM to TENORM.

The radon and its radioactive progeny (including polonium and lead) are part of the natural gas stream as it travels through the processing, storage, transmission, distribution, and consumption stages of natural gas. Through each of these stages, radon continues to decay by radioactive emission. At the same time, any uranium, thorium or radium that remains in the natural gas as it moves through the stages after extraction will continue to produce more radon. All of this radon and its radioactive progeny will adversely impact the health of those members of the public that are customers consuming the gas and those members of the public that are exposed by emissions at compressor stations, metering and regulating stations and other facilities from the well head to the stoves, furnaces, water heaters, and other gas-powered equipment.

Throughout this process, the radon is continuously emitting energized alpha particles and creating respiratory diseases including lung cancer. The federal government estimates that radon is responsible for over 21,000 cancer deaths per year, making it the number one cause of lung cancer among non-smokers. See, <https://www.epa.gov/radon/health-risk-radon>. DEC has the authority and the responsibility to protect the public health from exposure to radioactive radon and its radioactive decay progeny from the extraction and consumption of natural gas.

## **CONCLUSIONS**

The proposed revisions to Part 380 distort the definitions controlling the regulation of radioactive material and of radon associated with natural gas production and use; and by doing so, almost entirely ignores the environmental and public health impacts of those materials including the radon. This must be corrected.

Radioactive materials moved with cuttings and waste water are TENORM as is the radon entrained with the gas extracted and transported away from the wells for eventual residential and business use.

Radon entrained with natural gas from shale is radioactive material that Part 380 was put in place to reduce and mitigate the environmental and public health impacts of such radioactive materials.

We urge DEC to develop further amendments to Part 380 to correct the NORM, TENORM definitions and to incorporate regulatory controls on radioactive radon and its

radioactive progeny through application of TENORM controls and implementation of ALARA principles.

Respectfully submitted,

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#### Attachments

1. Zimmerman, J., "Radon in Natural Gas in New York City" (2012)  
(sent as separate email)
2. ATSDR, "Draft Toxicological Profile for Radon" (2008), available at:  
<https://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=407&tid=71>