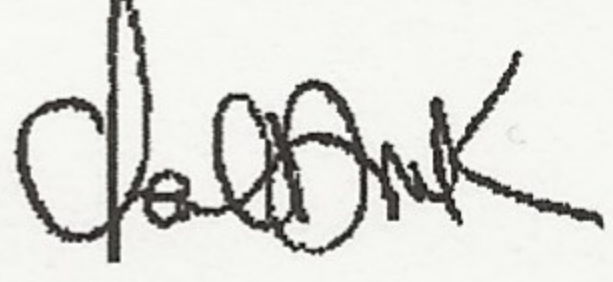




Division of Oil and Gas Resources Management
Radiation Safety Section



Interoffice Memorandum

TO: Richard J. Simmers, Chief
THROUGH: Scott Kell, Assistant Chief
FROM: Chuck McCracken, Manager, Radiation Safety Section 
DATE: July 26, 2017
RE: ASSESSMENT OF RA226 & RA228 RADIOACTIVITY IN AQUASALINA

As requested, an analytical assessment of the radioactive content of Nature's Own Source / AquaSalina and the vertical well brine associated with its production was initiated on May 24, 2017. During the month of June 2017, Radiation Safety Section (RSS) staff partnered with Environmental Safety Section staff to collect 14 samples from 6 locations in Ohio. All samples were sent to PACE Radiological Analytical Laboratory with the last of the analytical results being received back from PACE on July 5, 2017.

The attached radiological survey report no. 2017-044 details the RSS radiological assessment process and the results achieved. Based on the findings in this assessment, the following recommendations are being made for your consideration:

1. Advise Nature's Own Source/AquaSalina that our assessment finds that they are producing TENORM however, we require additional details about their production process to be absolutely certain. *(NOTE: We may need to collect additional pre and post samples)*
2. Advise Nature's Own Source/AquaSalina that the average radioactivity in AquaSalina exceeds the 40 CFR 141.66 Drinking Water limits for combined Ra-226 and Ra-228 by a factor of 300, thus human consumption of any amount of AquaSalina is highly discouraged.
3. Advise Nature's Own Source/AquaSalina that the radioactivity in AquaSalina exceeds State of Ohio discharge to the environment limits for Ra-226 and Ra-228 as delineated in Ohio Administrative Code 3701:1-38-12, Appendix C, Table II, Effluent Concentrations.
4. DOGRM should continue to analyze the radioactive concentrations in vertical formation brine to create an Ohio specific data set that can be used to further assess impacts to humans and the environment from the use of vertical brine from the oil and gas industry for dust suppression and road stability.

cf: Eric Vendel, Legal Counsel



**DIVISION OF OIL & GAS
RESOURCES MANAGEMENT,
RADIATION SAFETY SECTION**



**RADIOLOGICAL ASSESSMENT
SPECIAL REPORT**

Report No: 2017-044

Permit No(s): Chief's Order 2004-82

Location(s): Nature's Own Source/AquaSalina
246 North Cleveland Avenue Mogadore,
OH 44260

Nature's Own Source/AquaSalina
2850 W. 3rd Street
Cleveland, OH 44113

Counties: Guernsey, Summit, Tuscarawas, Cuyahoga

Date(s): June 2, 2017, June 5, 2017, June 12, 2017,
June 15, 2017 and June 21, 2017

Inspector: *Robert Leidy* Date: 07/20/2017

Robert Leidy
Senior Health Physicist

Inspector: *Paul Carder* Date: 07/26/2017

Paul Carder
Senior Health Physicist

Supervisor: *Chuck McCracken* Date: 07/26/2017

Chuck McCracken
Section Manager

1.0 Purpose

At the request of the Chief, Division of Oil & Gas, an analytical assessment of the radioactive content of Nature's Own Source / AquaSalina and the vertical well brine associated with its production was conducted.

2.0 Scope of Action / Sampling Methodology

May 24, 2017

Two Ohio Department of Natural Resources, Division of Oil & Gas Resources Management (DOGRM) staffs were assigned to go to Nature's Own Source / AquaSalina facility located at 246 North Cleveland Avenue, Mogadore, OH 44260 to collect pre and post-production samples of their liquid deicer, AquaSalina. Upon arrival staff was met by Stephanie Moore. The property owner, Jeff Moore, spoke to staff by phone and requested that they communicate directly with Mr. Dave Mansbery, the owner of Nature's Own Source/AquaSalina. Staff spoke with Mr. Mansbery, who was attending an Ohio DOT trade show. Mr. Mansbery said that AquaSalina is out of season and not currently in production but there is product on site. Mr. Mansbery offered to make arrangements for a qualified individual to be onsite to assist DOGRM staff by providing access and collecting split samples of AquaSalina. Staff suggested to Mr. Mansbery that he coordinate a return visit to the Mogadore facility with DOGRM Management. No samples were collected this day.

June 2, 2017

A DOGRM Columbus office staff member collected two 1-liter samples from a container of AquaSalina that was in storage at the DOGRM Environmental Analytical Laboratory located at 325 N. 7th St., Cambridge, Ohio 43725. Each sample was preserved with HNO₃. A chain of custody was created and the samples were delivered to the Pace Analytical Laboratories Service Center located at 4860 Blazer Pkwy, Dublin, OH 43017.

June 2, 2017

A DOGRM Uniontown office staff member was assigned to go to Hartville Hardware located at 1315 Edison St., NW, Hartville, OH 44632. Staff purchased a 1.74 gallon container of AquaSalina at this location. Staff then went to Lowe's Home Center located at 940 Interstate Parkway, Akron, OH 44312 and at 12:20 pm, purchased a 2.11 gallon container of AquaSalina. Two 1-liter samples were collected from each of the 2 containers of AquaSalina. Each sample was preserved with HNO₃. A chain of custody was created and the samples were delivered to the Pace Analytical Laboratories Service Center located at 4860 Blazer Pkwy, Dublin, OH 43017.

June 12, 2017

Two DOGRM staff members were assigned to go to the ODOT Tuscarawas County Garage located at 384 Stonecreek Road SE, New Philadelphia, 44663 to collect samples of brine that was made by adding halite salt to tap water. Two 1-liter samples were collected and each sample was preserved with HNO₃. A chain of custody was created and the samples were delivered to the Pace Analytical Laboratories Service Center located at 4860 Blazer Pkwy, Dublin, OH 43017.

June 12, 2017

Two DOGRM staff members were met in Mogadore by representatives for Nature's Own

Source/AquaSalina, Larry Gibler, Jim Hogue and Precision Analytical staffer, Jeremy Bratnick. Samples were collected by DOGRM and Precision Analytical of pre and post-production liquid. Each DOGRM sample was preserved with HNO₃ and tamperproof seals were placed on the sample containers. A chain of custody was created and the DOGRM samples were delivered to the Pace Analytical Laboratories Service Center located at 4860 Blazer Pkwy, Dublin, OH 43017.

DOGRM staffs were then directed to the Nature's Own Source/AquaSalina's Cuyahoga County facility located at 7033 Mill Road, Brecksville, OH 44141 to collect additional samples. Upon arrival staff was told that the location was a corporate office only and AquaSalina was not produced there. Staff was told that the Cuyahoga County production facility is located on the Arcelormittal Steel Mill property located at 2850 W. 3rd St., Cleveland OH. Staff was then informed that DOGRM's legal department needed to contact Nature's Own Source/AquaSalina's lawyer, Scott Doran, to discuss obtaining samples. No samples were collected.

June 15, 2017

Two DOGRM staff members were met at the Nature's Own Source/AquaSalina production facility on the Arcelormittal Steel Mill property by company representatives, Larry Gibler, Jim Hogue and Precision Analytical staffer, Jeremy Bratnick. Samples were collected by DOGRM and Precision Analytical of pre and post-production liquid. Each DOGRM sample was preserved with HNO₃ and tamperproof seals were placed on the sample containers. A chain of custody was created and the DOGRM samples were delivered to the Pace Analytical Laboratories Service Center located at 4860 Blazer Pkwy, Dublin, OH 43017.

June 21, 2017

DOGRM staff returned to the ODOT Tuscarawas County Garage to collect samples of the raw water used to create the brine mixture sampled on June 12, 2017. Each sample was preserved with HNO₃. A chain of custody was created and the samples were delivered to the Pace Analytical Laboratories Service Center located at 4860 Blazer Pkwy, Dublin, OH 43017.

3.0 Observations / Analytical Results

Sample Collection Location	Collection Date	Ra226 Results (pCi/l)*	Ra228 Results (pCi/l)*	Combined Results (pCi/l)*
Lowes – Canton [purchase]	6/2/17	1,059 ± 136	604 ± 111	1,663 ± 247
Hartville Hardware [purchase]	6/2/17	1,158 ± 144	1,333 ± 241	2,491 ± 384
ODNR Cambridge Lab	6/2/17	791 ± 41.8	604 ± 25.7	1,395 ± 67.5
AquaS Mogadore - PRE	6/12/17	925 ± 116	373 ± 69.8	1,298 ± 185.8
- POST	6/12/17	1,010 ± 126	432 ± 80.1	1,442 ± 206.1
AquaS Cleve - PRE (1)	6/15/17	595 ± 772	568 ± 127	1,163 ± 899
- POST (1)	6/15/17	949 ± 478	734 ± 129	1,683 ± 607
- PRE (2)	6/15/17	501 ± 462	387 ± 75	888 ± 537
- POST (2)	6/15/17	997 ± 545	713 ± 102	1,710 ± 647
ODOT tap water - PRE	6/21/17	1.90 ± 0.8	0.922 ± 0.4	2.8 ± 1.2
ODOT mixture - POST	6/12/17	2.77 ± 1.58	5.78 ± 7.67	8.55 ± 9.27

* Analytical laboratory results reports are attached.

4.1 Findings, Discussions & Conclusions

Findings

- All post-samples collected in this study were found to be increased in radioactivity activity from their respective pre-samples.
- There was an 11% increase in combined radium Ra226/Ra228 concentration between the pre and post-samples collected from the Nature's Own Source/AquaSalina Mogadore production facility.
- There was a 45% increase in combined radium Ra226/Ra228 concentration between the pre (1) and post (1) samples collected from the Nature's Own Source/AquaSalina Cleveland production facility.
- There was a 92% increase in combined radium Ra226/Ra228 concentration between the pre (2) and post (2) samples collected from the Nature's Own Source/AquaSalina Cleveland production facility.
- The combined radium Ra226/Ra228 concentration in the Nature's Own Source/AquaSalina container purchased from Hartville Hardware was the highest identified in this study at 2,491 pCi/l.
- The combined radium Ra226/Ra228 concentration in all samples of post-production AquaSalina (except the Hartville Hardware container sample) averaged within 10% of each other at 1,578.6 pCi/l.
- There are no production dates, lot numbers or other unique identifiers on the purchased containers of Nature's Own Source/AquaSalina.

Discussions

- Formation brine is Naturally Occurring Radioactive Material (NORM). Technologically Enhanced NORM (TENORM) is NORM that has been increased in radioactivity by or as a result of human activity¹. It would appear that Nature's Own Source/AquaSalina is producing TENORM however, without additional batch processing information from them, it cannot be determined with 100% certainty that the sampled pre-production brine has been increased in radioactivity due to the AquaSalina production processes.
- The USEPA National Primary Drinking Water Regulation, 40 CFR 141.66 limits combined Ra-226 and Ra-228 in drinking water to 5.0 pCi/l.
- The State of Ohio discharge to the environment limits for Ra-226 and Ra-228, as delineated in Ohio Administrative Code 3701:1-38-12, Appendix C, Table II, Effluent Concentrations, are 60 pCi/l for each (120 pCi/l for combined Ra226 & Ra228 and the unity rule applies).

¹ Abbreviated TENORM definition. Full definition found in ORC 3748.01 as stated in ORC 1509.074 (C)(1)

- The Pennsylvania Department of Environmental Protection (PADEP) TENORM Study Report, Revision 1, dated May 2016 assessed radiation exposure to humans from road spreading of conventional (vertical) well brine.
 - The assessment was based on surface soil samples taken from roads where brine spreading is known to have occurred. The specific radioactive concentration of the brine that was spread on these roads was not considered in the assessment.
 - The estimated total dose to a recreationist was modeled to be 0.441 mrem/yr, which is well below PADEP's 100 mrem/yr public exposure regulatory limit.
 - The report concluded that while limited potential was found for radiation exposure to recreationist using roads treated with brine from conventional (*vertical*) gas wells, further study of radiological environmental impacts from the use of brine from the oil and gas industry for dust suppression and road stabilization should be conducted.
- Other states in our region of the U.S. that allow road spreading of vertical oil and gas well brine include Michigan, Illinois, Pennsylvania and West Virginia.

Conclusions

- Analytical results suggests that Nature's Own Source/AquaSalina is producing TENORM however, without additional batch processing information, it cannot be determined with 100% certainty that the sampled pre-production brine has been increased in radioactivity due to the AquaSalina production processes.
- All sample results (except the DOT tap water) **exceed** the USEPA 40 CFR 141.66 Drinking Water limits of combined Ra-226 and Ra-228 at less than or equal to 5.0 pCi/l.
 - None of the sampled liquids (except DOT tap water) in this assessment are meant for human consumption.
- All sample results (except the DOT samples) **exceed** State of Ohio discharge to the environment limits for Ra-226 and Ra-228 as delineated in Ohio Administrative Code 3701:1-38-12, Appendix C, Table II, Effluent Concentrations.

These liquid effluent concentration limits were originally codified by the U.S. Nuclear Regulatory Commission to limit public radiation exposure to 50 millirem per year from ingestion of radioactive material discharged into rivers, streams and other bodies of water by companies and facilities licensed to possess and handle radioactive materials.

 - None of the sampled liquids (except DOT tap water) in this assessment are meant for human consumption.
- Using the assumptions and findings in the PADEP study, RSS evaluated the post-processing sample results from this assessment and determined that it is unlikely that radiation exposure to Ohioans from road spreading of vertical brine would exceed the 100 mrem/yr public dose limit.

5.1 Recommendations

1. Advise Nature's Own Source/AquaSalina that our assessment finds that they are producing TENORM however, we require additional details about their production process to be absolutely certain. (NOTE: We may need to collect additional pre and post samples)
2. Advise Nature's Own Source/AquaSalina that the average radioactivity in AquaSalina exceeds the 40 CFR 141.66 Safe Drinking Water limits for combined Ra-226 and Ra-228 by a factor of 300, thus human consumption of any amount of AquaSalina is highly discouraged.
3. Advise Nature's Own Source/AquaSalina that the radioactivity in AquaSalina exceeds State of Ohio discharge to the environment limits for Ra-226 and Ra-228 as delineated in Ohio Administrative Code 3701:1-38-12, Appendix C, Table II, Effluent Concentrations.
4. DOGRM should continue to analyze the radioactive concentrations in vertical formation brine to create an Ohio specific data set that can be used to further assess impacts to humans and the environment from the use of brine from the oil and gas industry for dust suppression and road stabilization.