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TESTIMONY OF GARY A. ABRAHAM, ESQ. BEFORE
THE NEW YORK STATE SENATE DEMOCRATIC CONFERENCE
Public Forum on the health and environmental risks posed by hydraulic
fracturing by-products and the acceptance thereof by New York State publicly
owned treatment works and landfills

ALBANY

Tuesday, May 13th, 2014

11:30 A.M.

Hearing Room A

Legislative Office Building, 2nd Floor
Albany, New York

Good day Leader Stewart-Cousins and Conferees, and thank you for the opportunity to contribute to this important Forum.

I have a limited contribution to make to your discussion, involving the landfilling of Marcellus Shale wastes in New York landfills, the risk posed by this practice of releases of radioactive contaminants, and the state of current regulation of this practice in New York.

I am an environmental attorney and I have been practicing before the New York State Department of Environmental Conservation (NYSDEC) in landfill permitting matters for the last fifteen years. In 2010 I represented a community-based environmental group called Residents for the Protection of Lowman and Chemung (RFPLC), challenging the legality of disposal of large volumes of drill cuttings and other Marcellus Shale wastes generated in Pennsylvania at the Chemung County Landfill. This landfill is operated under a lease by a subsidiary of Casella Waste Systems of Vermont. Casella owns and operates two other landfills in the Southern Tier, the Hyland Landfill in Angelica (Allegany Co.) and the Hakes Construction and Demolition Landfill in in Painted Post (Steuben Co.), both of which also accept substantial volumes of Marcellus Shale industry wastes. Casella's attorney Thomas West also represents several gas exploration companies operating in the Pennsylvania shale play, including Cabot and Chesapeake. In addition to Hyland, Chemung, and Hakes, Allied Waste Landfill in Niagara Falls (Niagara Co.) and Seneca Meadows Landfill in Waterloo (Ontario Co.) accept such wastes for disposal.

Soon after the notice of a proposal to increase the rate of waste acceptance at the landfill was published in April 2010, RFPLC learned that NYSDEC had approved by email the disposal of Marcellus Shale wastes in the fall of 2009. We also learned that the purpose of the proposal was specifically to increase Marcellus Shale wastes. At that time Marcellus Shale wastes "comprised about half of the incoming waste on a tonnage basis."¹ Ultimately the proposal to increase waste

1 Rulings of the ALJ on Issues and Party Status, In re Chemung County, DEC Application No. 8-0728-

acceptance was approved, and Casella began hauling Chemung County waste to other landfills it operates (such as the Ontario County Landfill) in order to maximize the use of space for drilling wastes.

In April 2013, representing Concerned Citizens of Allegany County, I submitted detailed comments challenging the disposal of Pennsylvania Marcellus Shale wastes in the Hyland Landfill. It has been over a year since then and no response to comments has been prepared and issued by NYSDEC. Both Hyland and Chemung landfills are currently seeking approval to expand in order to take more such such wastes.²

The only written decisions by NYSDEC stating the agency's position on the legality of this practice have been issued in the Chemung County Landfill proceeding, which concluded with an August 4, 2011 Decision of the Commissioner. That decision adopted the recommendations of an Administrative Law Judge, dismissing our challenge on procedural grounds, but remanded the matter to regional NYSDEC Staff to determine whether waste received by Chemung County Landfill would be adequately monitored to ensure releases of radioactivity commonly found in Marcellus Shale wastes will not occur. As a result, some unconventional permit conditions were imposed on the landfill. As discussed below, the results of enhanced monitoring provided under these permit conditions now shows that the landfill is becoming progressively more radioactive.

Low-level radioactive waste may not be disposed in a New York landfill under current regulations if it is also "processed and concentrated." In that case, the waste must be transported to a licensed low-level radioactive waste landfill.³ There are no such landfills in New York, and waste loads with detected excessive radioactivity have been redirected away from landfills in Pennsylvania to one of the few licensed low-level radioactive waste landfills in the nation, in Utah. In fact, between 2009 and 2012 radiation portal alarms were triggered at Pennsylvania landfills over 1,000 times due to Marcellus Shale wastes in the waste loads passing through the radiation portals.⁴

In the 2010 Chemung County Landfill proceeding, RFPLC offered the testimony of three experts and the results of a handful of reports on the concentration of radioactivity in Marcellus Shale wastes. Dr. Anthony Ingraffea, a rock fracture scientist at Cornell University who was involved in the development of high-volume horizontal fracturing over two decades ago, testified regarding the processes involved in generating drill cuttings during the initial development of a Marcellus Shale drill site. Dr. Conrad Volz, at that time a health physicist at the University of Pittsburgh, testified regarding the health risks of Marcellus Shale wastes, principally the risk of bone cancer and leukemia resulting from ingestion of airborne or water-borne radium. Radioactive radium acts chemically in the body like calcium, concentrating in the bones. Finally, Dr. Marvin

00004/00013, 2010 N.Y. ENV LEXIS 60, *69 (September 3, 2010), available at <http://www.dec.ny.gov/docs/legal_protection_pdf/chemung.pdf>, affirmed by Final Decision of the Commissioner (Aug. 4, 2011), available at <http://www.dec.ny.gov/docs/legal_protection_pdf/chemungd.pdf>.

2 I have attached comments submitted to Chemung County Legislature on behalf of RFPLC, dated March 4, 2014, which augment the present statement to the Conference.

3 6 N.Y.C.R.R. §§ 380-1.2(e), 382.1(c)(5), 360-1.1(a).

4 Timothy Puko, "Radioactive fracking debris triggers worries at dump sites," Pittsburgh Tribune-Review (May 12, 2013), available at <<http://triblive.com/business/headlines/3945499-74/gas-radiation-radioactivity>>.

Resnikoff, a nuclear physicist with experience assessing drilling wastes generated from the Barnett Shale in Texas, testified regarding the relatively high levels of radiation expected in Marcellus Shale wastes, as well as the processes that concentrate radiation in waste waters that accompany Marcellus Shale solid wastes. It is generally accepted that the Marcellus formation is a “highly radioactive shale.”⁵

It is important to understand the basis for the concern with high levels of radioactivity in these wastes. Radium-226 and Radium-228 are regulated as “combined radium,” and for reference the limit allowable in drinking water is 5 picocuries per liter (pCi/L), and the limit allowable in treated wastewater is 60 pCi/L. Radium is particularly problematic because it is soluble in water. While Casella and NYSDEC insisted that no liquid wastes would be landfilled at Chemung, RFPLC observed trucks said to be hauling “drill cuttings” leaking at the landfill gate. Drill cuttings generally arrive at landfills wet. Specifically, drill cuttings are coated with either briny liquid that is part of the shale formation, or drilling fluid which was injected into the wellbore to help bring the cuttings to the surface, or both.

In addition, Casella and other New York landfills solidified wastewater, sludges, filtrates and other residuals from recycling or treatment of produced water and “frac fluid” generated at Marcellus Shale drilling sites. Hyland and Chemung also accept soils contaminated by spills at oil and gas drilling sites. Hyland also accepts “pad liners and deconstruction wastes from the well sites.”⁶ Hyland acknowledges that these waste streams “[m]ay have higher levels of NORM [naturally occurring radioactive materials]” than other approved waste streams.⁷ In fact Casella operates liquid solidification facilities at the Hyland Landfill in Allegany County, New York, and the McKean County Landfill in Pennsylvania. These solidification facilities process waste waters generated during the drilling, production and completion phases of Marcellus Shale drill sites. The residues from these processes are allowed to be landfilled in New York if they are at least 20% solids. Thus, up to 80% of the volume of these wastes can be liquid, so long as they do not contain free-flowing liquids. The common practice to ready these wastes for off site disposal is to add bulking materials such as sawdust or wood chips to eliminate free flowing liquid. However, this process does not diminish the volume of liquid in the waste.

Because of its solubility, radium is leached from the Marcellus Shale into formation brine. Formation brine (also called extant brine, or brine water) is the remains of seawater in which sediments were deposited millions of years ago, when the Marcellus Shale region was closed off to the sea by shifting landforms, forming an inland salt sea. This brine has leached radium from the shale to its saturation point, and thus is much more radioactive than the shale itself. No one has assessed the volume of liquid accompanying so-called solid wastes from Pennsylvania drill sites being disposed in New York landfills.

5 K. R. Bruner, R. A. Smosna, *Comparative study of the Mississippian Barnett Shale, Fort Worth Basin, and Devonian Marcellus Shale, Appalachian Basin*, DOE/NETL- 2011/1478 (Department of Energy, National Energy Technology Laboratory, 2011), 2. *Cf. also id.*, 92, Table 9.

6 See NYSDEC, Part 360 Permits for Chemung County Landfill, Hyland Landfill. The Author will be pleased to provide these and all other documents referenced herein to the Conference upon request.

7 Mark P. Millspaugh (Sterling Environmental Engineering, P.C.) and Larry Shilling (Casella Waste Systems), *Hydrofracking and Engineering Issues* (November 12, 2012), 27, available at <http://www.cscos.com/wp-content/uploads/Keynote_Hydrofracking-and-Engineering-Issues.pdf>.

Radium is also leached from the shale by drilling fluids and fracking fluids. In fact, wastewater is generated at all stages of gas well development, and is generally mixed with extant brine to various degrees at each stage. This is important because Pennsylvania's Department of Environmental Protection (PADEP) now insists that drillers reuse drilling and fracking fluids to a greater extent than was done just two years ago due to its concern with excessive radioactivity and salinity in wastewater discharged to surface water bodies. As a result, the radium concentration in waste water generated at these sites can approach saturation, just like extant brine.

In the Chemung County Landfill proceeding, RFPLC offered as proof of its concern that Marcellus Shale wastes would be excessively radioactive, Appendix 13 from NYSDEC's draft Supplemental Generic Impact Statement on the Oil, Gas and Solution Mining Regulatory Program (dSGEIS).⁸ NYSDEC has prepared this document in support of new regulations that would allow high-volume horizontal hydrofracking in New York. Appendix 13 reports on the results of NYSDEC's analysis of samples of brine water returned at 13 natural gas wells in New York drilled into the Marcellus Shale and found combined radium levels averaged 4,924 pCi/L with much variation, with the highest result 16,942 pCi/L and the highest eleven averaging 8,423 pCi/L.⁹

In 2011, USGS found radium concentrations in waters co-produced with oil and gas in New York and Pennsylvania in the range of less than detection uP to 18,000 pCi/L.¹⁰

Finally, radium is problematic not only because it is soluble in water. Landfill leachate is generally transported from the landfill to a municipal wastewater treatment plant for treatment and discharge to a local water body. Chemung County Landfill transports millions of gallons of leachate to the county wastewater treatment plant in Elmira, which discharges the treated wastewater to the Chemung River.¹¹ Hyland Landfill transports comparable volumes of leachate to wastewater treatment plants in the villages of Wellsville or Painted Post, which discharge the treated wastewater to the Genesee River or the Cohocton River, respectively. However, these plants, and indeed no municipal wastewater treatment plant in New York, has the ability or is licensed to remove radioactivity from landfill leachate.¹²

8 NYSDEC, *Supplemental Generic Environmental Impact Statement On The Oil, Gas and Solution Mining Regulatory Program*, September 2009, Appx. 13. This Appendix appears unchanged as NYSDEC, *Preliminary Revised Draft Supplemental Generic Environmental Impact Statement On The Oil, Gas and Solution Mining Regulatory Program*, July 1, 2011, Appx. 13.

9 An annotated copy of Appendix 13 is appended to this statement.

10 E.L. Rowan, et al., *Radium Content of Oil- and Gas-Field Produced Waters in the Northern Appalachian Basin (USA): Summary and Discussion of Data*, U.S. Department of the Interior and U.S. Geological Survey Scientific Investigations Report 2011-5135 (2011).

11 See Chemung County Landfill, 2009 Annual Report (to NYSDEC), p.4 (reporting that 2.0 million gallons were transported off site for treatment); 2010 Annual Report, p. 6 (reporting 5.6 million gallons treated); 2011 Annual Report, p. 6 (reporting 9.7 million gallons treated); 2012 Annual Report, p. 6 (reporting 2.99 million gallons treated). These reports are available at <<http://www.garyabraham.com/ChemungLF.html>>.

12 Centralized waste treatment plants, including pretreatment plants, are not designed to remove radionuclides, and discharge of "NORM associated with oil and gas extraction . . . that requires a change of disposal practice (e.g., radioactivity, etc.) is considered to be interference under the pretreatment program." Memorandum from James Hanlon, Director of EPA's Office of Wastewater Management to the EPA Regions, *Natural Gas Drilling in the Marcellus Shale under the NPDES Program*, Attachment, 16,

Once released to these rivers, radium bioaccumulates in the food chain so that fish in the river, and those who eat fish from the river are at risk of a highly magnified dose. Since the half-life of Radium-226, which comprises most of the combined radium, is over 1,600 years, the radionuclide is a persistent bioaccumulative toxin.¹³ RFPLC's concern is therefore that the landfill will become more radioactive over time, as will the landfill's leachate. The prevention of releases of harmful radionuclides is also the concern underlying NYSDEC's regulation of naturally occurring radioactive materials, or NORM.

However, in the Chemung County Landfill proceeding NYSDEC took the position that the Marcellus Shale wastes Casella accepts are not processed and concentrated because they are more like gravel mining spoils, and therefore these waste are not subject to regulation as NORM, regardless of their level of radioactivity. In addition, NYSDEC took the position that these wastes are not much more radioactive than surface soils, so they would not even need to be landfilled, they could be "left on the ground":

The CoPhysics report [offered by Casella] further supports the previous assertion of Department staff that the proposed modification is not expected to result in any regulatory violations because the naturally occurring radioactive material ("NORM") in Marcellus shale drill cuttings is not processed and concentrated, and, as such, these drill cuttings are not required to be disposed at a facility authorized under 6 NYCRR 380, 382 or 383.

The data presented in the CoPhysics report are not required to show regulatory compliance. However, the results do show that concentrations of the primary radionuclide of concern, radium-226, fall near the low end of potential concentrations in the Marcellus shale. The concentrations reported (4.3 pCi/g or less) would not pose a public health or environmental threat even if left on the ground surface. Also, even at the higher concentrations that have been reported for some Marcellus shale drill cuttings samples, they would not be inappropriate for disposal in a properly managed 6 NYCRR 360 regulated facility such as the Landfill.

available at <<http://cfpub.epa.gov/npdes/hydrofracturing.cfm>> (citing 40 C.F.R. §§ 403.3(k)(2), 403.5(a) (1)). Discharge of "radioactive wastes" is prohibited under 40 C.F.R. § 403.5(b). Cf. EPA, *Guidance Manual for the Identification of Hazardous Wastes Delivered to Publicly Owned Treatment Works by Truck, Rail, or Dedicated Pipe*, No. 833B87100 (June, 1987), C-3, available at <<http://www.epa.gov/npdes/pubs/owm0190.pdf>>.

- 13 See E.L. Rowan, et al., *Radium Content of Oil- and Gas-Field Produced Waters in the Northern Appalachian Basin (USA)*, at 1 ("In surface and shallow subsurface environments, radium can be relatively soluble and, therefore, mobile in groundwater over a range of pH and Eh (redox) conditions. Radium also may be adsorbed onto clay particles or onto oxide grain coatings. As a radioactive element, radium may represent a potential health hazard if released into the environment. The half-lives of the two principal isotopes of radium, Ra-226 and Ra-228, are 1,600 and 5.75 years, respectively, and approximately 10 half-lives are required for a radioactive element to decay to negligible quantities. Chemically, radium behaves in a manner similar to calcium and is capable of bioaccumulation in plants. There is a significant body of research aimed at quantification of radium uptake in crops and livestock that make up the human food chain.") (supporting citations omitted). See also NYSDEC, *An Investigation of Naturally Occurring Radioactive Materials (NORM) in Oil and Gas Wells in New York State* (April, 1999), 16. Note that NYSDEC's investigation did not include any wells drilled into the Marcellus Shale. See *id.*, 11-12, Table 3 and Fig. 2 (locations of samples).

RFPLC objected to the CoPhysics report on which NYSDEC relied for these conclusions because the laboratory report accompanying the report shows that the lab first washed the samples of drill cuttings in water before analyzing their radium concentration, with the likely result that radium was washed out of the samples before analysis. In addition, only three samples were analyzed, and Casella refused to disclose the locations where the samples were taken. It was therefore not clear that these were samples of Marcellus Shale, or that these were representative of the potential concentrations of radium in the wastes the landfill is accepting. As noted above, there is a wide variation in radium concentrations in Marcellus Shale brine water. Finally, although Casella insisted it accepted only “drill cuttings,” and insisted it does not accept any liquid waste, as noted above this is not the only waste stream from Pennsylvania drill sites NYSDEC allows, and each of the accepted waste streams is wet.

The outcome of the proceeding was that the presiding administrative law judge (ALJ) recommended that RFPLC’s concerns be dismissed because the proceeding was held to consider Casella’s request that it be allowed to accept a higher volume of waste, but RFPLC’s concerns address the quality of the waste. It would therefore be inappropriate to allow RFPLC to request the landfill’s permit be modified to avoid the risk of releases of radioactivity by limiting the kind of waste it accepts. All that was at issue in the proceeding, according to the ALJ, was whether to allow an increase in the landfill’s waste acceptance rate.¹⁴

RFPLC appealed the recommendation to the NYSDEC Commissioner who rejected the appeal and adopted the recommendation. However, to his credit, the Commissioner stated in his decision that serious questions about the risk of releases of radioactivity were raised, and therefore he remanded the matter back to NYSDEC regional Staff to determine the adequacy of monitoring to ensure that levels of radioactivity in waste disposed at the landfill would, as Staff insisted, would be close to background levels and thus pose no elevated risk. As a result, Staff added radiation portal monitors and a requirement to test the landfill’s leachate for radioactivity twice annually.

The results of four rounds of sampling and analysis of leachate at the Chemung Landfill are now available and these results show that combined radium concentrations in the leachate are progressively increasing. Combined radium in the Chemung County Landfill’s leachate now exceeds 4 pCi/L and is trending upward. In addition, Concerned Citizens of Allegany County has begun collecting samples of off-site runoff from the Hyland Landfill. The results of analysis of samples of the runoff taken from a stream exiting the site have exceeded 9 pCi/L. In addition, at least one load of Marcellus shale drill cuttings was turned away from the Allied Waste Landfill in Niagara County after it set off the radiation portal alarm and direct measurements of radioactivity in the haul truck showed

These results disconfirm conclusively NYSDEC’s assertion that wastes accepted for disposal at these landfills are no more radioactive than background.¹⁵ The results confirm RFLPC’s and

14 Rulings of the ALJ on Issues and Party Status, *In re Chemung County*, 2010 N.Y. ENV LEXIS 60, *58.

15 Strontium, Barium and Bromine “are highly specific signatures of flowback and produced waters [from Marcellus Shale sites in Pennsylvania, and] . . . the ratio of ⁸⁷Sr/⁸⁶Sr may be an isotopic fingerprint of Marcellus Shale waters.” R.D. Vidic et al., *Impact of Shale Gas Development on Regional Water Quality*,

CCAC's concern that releases of radioactive radium into local water bodies is occurring, and supports their concern that ingestion of fish caught downstream from these releases could expose people to carcinogens.

As the Hyland and Chemung landfill cases show, currently there is no regulation of the disposal of radioactive Marcellus Shale wastes in New York. At the Chemung County Landfill alone, over 300,000 tons of such wastes are now contained in the landfill.

The reluctance of NYSDEC to regulate these wastes as NORM stands in contrast to Pennsylvania and USEPA. In 1999, the National Research Council established a committee to evaluate EPA's guidelines for assessing exposure to NORM and TENORM.¹⁶ The Committee found the materials of concern in EPA's guidelines are TENORM, defined as: "Technologically enhanced naturally occurring radioactive materials are any naturally occurring radioactive materials not subject to regulation under the Atomic Energy Act whose radionuclide concentrations or potential for human exposure have been increased above levels encountered in the natural state by human activities."¹⁷

Regarding exposure pathways, the Committee found that the conditions under which a radionuclide becomes soluble in water, for purposes of determining the water-borne pathway, is among the "issues [that] are particularly important with respect to TENORM":

Soluble radionuclides are more available for biologic uptake than those sorbed on soils or sediments, so the partitioning of radionuclides among these phases— between groundwater and aquifer materials; between river water and suspended or bottom sediments—is important in pathway modeling. A laboratory-derived distribution coefficient, K_d , is typically used, where

$K_d = \frac{\text{concentration of radionuclide sorbed on sediment}}{\text{concentration of radionuclide in remaining solution}}$

For a given element, the coefficient can be expected to vary with the chemical speciation of the element, the solute chemistry of the water, the mineralogy and surface area of the solids, redox conditions, and pH. For example, the presence of competing ions in solution can decrease the sorption of a radionuclide. *That effect was seen in the sorption of 226Ra from a sodium chloride oil-production brine by soils and marsh sediments where the percentage of radium sorbed increased with brine dilution (Landa and Reid 1983). . . .* Laboratory-derived K_d values should attempt to

340 SCIENCE 826 (May 2013). However, Strontium is not on the list of expanded parameters for which Chemung, Hyland or other New York landfills accepting wet drilling wastes must test leachate. See 6 N.Y.C.R.R. § 2.11(d)(6); Hyland's Part 360 Permit (mod 5), Special Cond. 70. Nor are most of the dozens of chemicals the Department has identified as potentially contained in flowback and produced waters from Marcellus Shale sites in Pennsylvania. See NYSDEC, dSGEIS, Ch. 5. This despite NYSDEC acknowledgement that "little information is available to document whether and at what concentrations most fracturing chemicals occur in flowback water." *Id.*, 5-100.

16 Committee on Evaluation of EPA Guidelines for Exposure to Naturally Occurring Radioactive Materials, National Research Council of the National Academy of Sciences and National Academy of Engineering, *Evaluation of Guidelines for Exposures to Technologically Enhanced Naturally Occurring Radioactive Materials*, 1999, available at <http://www.nap.edu/openbook.php?record_id=6360>.

17 *Id.*, at 1-2.

simulate field conditions at the TENORM site, and generic, literature-derived Kd values should be used with caution.¹⁸

As detailed above, New York landfills accepting large volumes of Pennsylvania drilling wastes have become TENORM sites. However, no pathway modeling such as EPA recommends has been required or performed.

Pennsylvania DEP has recently found that “[t]he drilling industry production and flowback water, as well as drill cuttings and sources of off gassing (e.g. drill cuttings), are potentially impacted with naturally occurring radioactive material (NORM) and/or technologically enhanced naturally occurring radioactive material (TENORM).”¹⁹ Accordingly, on January 24, 2013, PADEP announced a comprehensive study of radioactivity in materials associated with oil and gas development, including radioactivity in materials disposed in landfills and the effect of such materials on the radioactivity of landfill leachate and the effluent from treatment plants receiving landfill leachate.²⁰ The study “is expected to take 12 to 14 months.”²¹

The scope of PADEP’s proposed TENORM study includes the quantification of potential radioactivity of several waste streams that are disposed at New York landfills.²² Sludge from the treatment of Marcellus shale industry wastewater “will be analyzed for gross alpha and beta and by gamma spectroscopy to identify TENORM radionuclides.”²³ “Approximately 10% of the samples, based on the gross alpha and beta, and gamma spectroscopy results, will also be analyzed by alpha spectroscopy for uranium (U- 238, U-235 and U-234), thorium-232, radium (Ra-226 and Ra-228) and for any unsupported decay chain radionuclides; and for radon (Rn-220 + Rn-222).”²⁴ “Based on the results of the first round of waste water treatment plant sampling, loads of sludge from selected facilities will be followed to the landfill disposal sites and resampled to evaluate the effects of the transportation of that material as part of the second round of sampling of these facilities.”²⁵ “Landfill leachate will be sampled at each of the 54 active landfills and analyzed for gross alpha/beta and Ra-226/Ra-228 by gamma spectroscopy to evaluate the effects of NORM/TENORM disposal on

18 *Id.*, at 84 (italics added).

19 PADEP, *TENORM Study Scope of Work* (April 3, 2013), 1, available at <http://www.portal.state.pa.us/portal/server.pt/community/oil_gas_related_topics/20349/radiation_protection/986697>. PADEP has defined TENORM as materials “whose radionuclide concentrations or potential for human exposure have been increased above levels encountered in the undisturbed natural environment by human activities.” *Final Guidance Document on Radioactivity Monitoring at Solid Waste Processing and Disposal Facilities*, PADEP Doc. No. 50-3100-001 (January 2, 2004), 4.

20 PADEP, *DEP Announces Comprehensive Oil and Gas Development Radiation Study* (January 24, 2013), available at <<http://files.dep.state.pa.us/OilGas/BOGM/BOGMPortalFiles/RadiationProtection/rls-DEP-TENORMStudy-012413.pdf>>.

21 *Id.*

22 Specifically, the study will provide: “An assessment of the current landfill conceptual model used to determine the DEP blanket authorization activity and quantity for disposal of TENORM in the Commonwealth municipal landfills. The RESRAD software code will be used to model the standard landfill future exposure through environmental pathways.” PADEP, *TENORM Study Scope of Work*, 5.

23 *Id.*, 6

24 *Id.*

25 *Id.*

leachate quality. . . . field sampling at nine (9) landfills [will] include ambient measurements, solid samples and sweeps of facilities and equipment at entry points to the facilities, the working faces and other areas potentially affected during disposal activities . . . [and the study will evaluate] all byproducts of the oil and gas production industry including crystalline salts from the evaporation of brine water and the sludge associated with the flocking of process and flowback waters impacted with solids, in regards to worker exposure, public exposure and future exposure from the disposal of the products.”²⁶

The PADEP TENORM study will also evaluate the “rapid buildup of radon and progeny in samples/waste streams impacted with radium,” based on the following consideration: “The evaluation of waste containing Ra-226 is subject to the buildup of radon gas and the other short-lived progeny of Ra-226, complicating any decision made to transport or dispose of such materials based on an exposure rate survey of the container. The exposure rate is directly proportional to the degree of secular equilibrium and NOT proportional to the activity concentration of Ra-226 (remains the same as radon and other progeny buildup).”²⁷

New York State has implemented a *de facto* moratorium on fracking until health and environmental agencies adequately understand its most serious potential impacts, including the impacts of mismanagement of fracking wastes. NYSDEC’s 2011 dSGEIS has been unable to provide the agency with a basis for determining whether, and under what conditions, fracking might be permitted. Despite this, with little or no additional study DEC has approved opening the doors of the State’s landfills to liquid and solid fracking wastes.

Respectfully submitted,

Gary A. Abraham



gaa/encs.

²⁶ *Id.*, 6-7.

²⁷ *Id.*, 9.

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Alexander B. Grannis
Commissioner

May 18, 2010

Edward Buhrmaster, Esq.
NYS Department of Environmental Conservation
Office of Hearings and Mediation Services
625 Broadway – 1st floor
Albany, New York 12233-1550

Dear Judge Buhrmaster:

Re: Chemung County Landfill Permit Modification
DEC Project No. 8-0728-00004/00013

This letter presents the Department staff response to the April 2010 sound level monitoring summary report prepared by Barton and Loguidice and the April 2010 radiological survey report on Marcellus shale drill cuttings prepared by CoPhysics Corp. ("CoPhysics"), which were provided at the issues conference on April 28, 2010, in support of the County's application for permit modification, and in response to claims made in the petition for party status filed by Residents for the Preservation of Lowman and Chemung ("RFPLC"). As directed by the ALJ's memorandum of May 6, 2010, this letter also explains the Department staff position as to how use of newly installed radiation detectors at the Chemung County Municipal Solid Waste Landfill ("Landfill") may address RFPLC's concern about the disposal of potentially high radioactive Marcellus shale gas drilling wastes.

I. Barton and Loguidice April 2010 sound level monitoring report

The sound level monitoring report further supports the previous assertion of Department staff that the proposed modification is not expected to result in violation of the rural community noise standard at 6 NYCRR 360-1.14(p) under the conditions of the draft permit.

Department staff reviewed the applicant's "Sound Level Monitoring Summary Report, April 2010" using NYSDEC Program Policy DEP-00-01 "Assessing and Mitigating Noise Impacts" as guidance. DEP-00-01 indicates a simple distance attenuation calculation (inverse square rule) should be used for first level noise impact evaluations. The policy states that if a first level investigation demonstrates a potential impact a second level evaluation should be performed. The applicant's study concludes and Department staff agrees that a simple distance attenuation calculation indicates the 84.7dB (A) sound level (as measured 50 ft from the source) would be reduced to about 62 to 63 dB (A) at the Roberts Hollow property line.

Part 360-1.14(p) establishes a 57 dB (A) Leq sound limit at the solid waste facility property line in a rural setting (7:00 am to 10:00pm). The first level evaluation concludes a 5 to 6 dB (A) exceedance would be

expected at the Roberts Hollow property line. This result requires that a second level evaluation be performed. DEP-00-01 indicates second level evaluations can consist of calculation that takes into consideration mitigating and adverse factors affecting noise transmission, or it can rely on data gathered by actual on-site measurements. The conclusions of the "Sound Level Monitoring Summary Report, April 2010" are based on onsite measurements conducted as part of the April 2010 study.

Department staff finds no reason to dispute the methodologies or finding of the applicant's April 2010 noise study. Because the number and potential interaction of factors affecting noise transmission to the west of the Chemung landfill present a complex issue, staff believes it would be difficult to accurately model using simple calculations. Some of the factors which should be considered in any such calculation include vegetative cover between the source and receptor, natural and manmade landforms, and landfill geometry. As a result, Department staff believes a series of onsite measurements, such as those which are required by special condition number 72 of the draft permit, is a more accurate and therefore preferable method to insure regulatory compliance with the 6 NYCRR 360 noise requirements.

Additionally, yesterday Department staff received from RFPLC a noise report by The Noise Consultancy concerning the permit modification application. Due to the timing of the submission, Department staff has not yet reviewed this report. If Department staff determines that it wishes to respond to this report, I will make an appropriate request to the Administrative Law Judge at that time.

II. CoPhysics Corp. April 2010 radiological survey report on Marcellus shale drill cuttings ("CoPhysics report")

The CoPhysics report further supports the previous assertion of Department staff that the proposed modification is not expected to result in any regulatory violations because the naturally occurring radioactive material ("NORM") in Marcellus shale drill cuttings is not processed and concentrated, and, as such, these drill cuttings are not required to be disposed at a facility authorized under 6 NYCRR 380, 382 or 383.

The data presented in the CoPhysics report are not required to show regulatory compliance. However, the results do show that concentrations of the primary radionuclide of concern, radium-226, fall near the low end of potential concentrations in the Marcellus shale. The concentrations reported (4.3 pCi/g or less) would not pose a public health or environmental threat even if left on the ground surface. Also, even at the higher concentrations that have been reported for some Marcellus shale drill cuttings samples, they would not be inappropriate for disposal in a properly managed 6 NYCRR 360 regulated facility such as the Landfill.

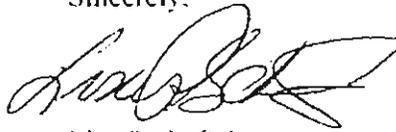
III. The radiation detectors newly installed at the Landfill

While there is no regulatory requirement to install them, the use of portal type radiation detectors at solid waste transfer stations and disposal sites is a well established practice. Their main purpose is to preclude the inadvertent disposal of regulated radioactive materials or waste in solid waste landfills. The primary materials they detect are unregulated medical isotopes from patients or – less frequently – improperly disposed radioactive materials. Portal monitors need to be sensitive enough to detect these sources when shielded by the rest of a waste load. The Ludlum system installed at the Landfill is sensitive enough to detect these materials and is in fact designed specifically for this purpose. Once appropriately prepared and tested, this system is also capable of differentiating between Marcellus shale drill cuttings (no alarm) and the potentially higher radioactive content in non-cuttings drilling waste streams (alarming due to the higher radioactivity content.)

Proposed Section 4.4.1 of the applicant's Operations and Maintenance Manual dealing with use of the portal monitor and handling of a truck with a load that sets off the system alarm is generally adequate. However, Department staff has not yet seen information describing operator training, system calibration, or differentiation between how different types of waste loads (municipal waste vs. drill cuttings) will be handled in the event of a system alarm. While there are no regulatory requirements specifically addressing these issues, there is information available in the general scientific and industry literature which can be used to support these efforts. Department staff understands that the applicant is working with CoPhysics to address these needs.

The radiation monitoring system installed at the Landfill is capable of addressing the concerns expressed by RFPLC for exclusion of drilling waste streams that potentially contain higher levels of NORM. However, until it is verified that the necessary procedures are in place, the applicant's capacity to use the recently installed radiation monitors to properly discriminate between loads of cuttings and the non-cuttings wastes with potentially higher radioactive content cannot be confirmed. Department staff is willing to work with the applicant as the necessary procedures are established.

Sincerely,



Lisa Perla Schwartz
Assistant Regional Attorney

cc: Ronald G. Hull, Esq.
Thomas S. West, Esq.
Gary A. Abraham, Esq.

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March 4, 2014

Ms. Linda Palmer, Clerk of the Chemung County Legislature
John H. Hazlett Building
203 Lake Street, 5th Floor
Elmira, New York 14902-0588
via email to: lpalmer@co.chemung.ny.us

Re: Proposed Chemung County Landfill Expansion

Dear Ms. Palmer:

Please accept the following comments regarding the above-referenced proposal on behalf of Residents for the Protection of Lowman and Chemung ("RFPLC"). As you know, the County's Draft Environmental Impact Statement ("DEIS") for this project proposal, on which together with public comments it will rely to decide whether to approve the proposal, is posted on line on the County's website. In addition, several landfill-related documents referred to below have been posted on my website (see letterhead above).

The County's decision not to consider Marcellus Shale waste issues

The County announced in the scoping statement prepared for this proposal last June that because such issues were considered in a 2010 state Department of Environmental Conservation (DEC) review of an earlier proposal to increase the tonnage rate at the landfill, it would not consider any comments related to potential exposure of workers and residents to radioactivity:

[Certain] comments were not incorporated into this RFSD [Revised Final Scoping Document] because they were not relevant, not environmentally significant, and/or adequately addressed in a prior environmental review. Such issues include impacts relating to radiation, radon and/or acceptance of materials from the Marcellus [Shale] as those impacts were examined in a prior environmental review before the NYSDEC, and/or are not environmentally significant based on the composition of Marcellus shale waste materials that are currently being deposited at the landfill.¹

However, the premise of the County's decision to exclude the potential impact of radioactive wastes from its consideration of the current landfill expansion proposal is not borne out by the record. In fact, in 2010 DEC clearly ruled it would not adjudicate issues relating to radiation,

¹ Chemung Landfill, LLC, REVISED FINAL SCOPING DOCUMENT [RFSD] FOR A DRAFT ENVIRONMENTAL IMPACT STATEMENT (June 2013), p. 12.

radon and/or acceptance of materials from the Marcellus Shale :

No issue exists for adjudication. The permit modification proposed by RFPLC, to disposal of Marcellus Shale gas waste streams, is unrelated to and involves issues distinct from those bearing on the permit modification proposed by the County, to increase the tonnage of undifferentiated concerns about the radioactivity of particular Marcellus Shale waste streams should have been -- and may still be -- raised before DEC Staff in a request for modification of the landfill permit under 6 NYCRR 621.13(b).²

Thus, there is no basis for the County's assertion that radioactivity exposure issues are "not relevant, not environmentally significant, and/or adequately addressed in a prior environmental review." Since offers of proof brought by RFPLC that these issues deserve a hearing were turned away by DEC, no meaningful record exists on which the County could rely for its conclusion that these issues are irrelevant and/or not significant.

However, there is a record of volumes of Marcellus Shale industry wastes disposed in the landfill, and the radioactivity in landfill leachate, which is trending upward, in the time since the 2010 DEC proceeding.

What's in the County landfill?

As acknowledged in the County's scoping document, it is important to understand "the composition of Marcellus shale waste materials that are currently being deposited at the landfill."³

In 2010 Chemung County Landfill disposed 48,225 tons of Marcellus Shale drilling waste from Pennsylvania, almost half the total tonnage disposed; in 2011 the number was 58,741 tons, about one-third of the total tonnage disposed; in 2012 the number was 68,903 tons, also almost one-third of the total tonnage disposed. These amounts do not include tens of thousands of tons of "daily cover" imported from Pennsylvania.

² *Rulings of the Administrative Law Judge on Issues and Party Status, In the Matter of the Application of Chemung County for modification of the Part 360 permit for its municipal solid waste landfill on County Route 60 in Elmira [sic], Town of Chemung, Application No. 8-0728-00004/00013, SEPTEMBER 3, 2010, p. 33, available at <http://www.dec.ny.gov/docs/legal_protection_pdf/chemungr.pdf>. The Rulings of the ALJ were affirmed upon appeal by DEC Commissioner Martens in DECISION OF THE COMMISSIONER, *In the Matter of the Application for Modification of the Part 360 Permit for a Municipal Solid Waste Landfill on County Route 60 in Lowman, Town of Chemung, New York, by Chemung County, Applicant*, August 4, 2011, available at <http://www.dec.ny.gov/docs/legal_protection_pdf/chemungd.pdf>.*

³ *Cf. above*, note 1.

The DEIS specifies that the landfill disposes “Marcellus Shale drill cuttings” and other wastes from the Marcellus Shale industry, but not other drill cuttings or gas and oil wastes.⁴ Presumably, non-Marcellus Shale oil and gas wastes, such as drill cuttings from the vertical section of a wellbore, do not need to be disposed in a landfill.

Drill cuttings arrive at the landfill wet, raising issues about what is in the liquid that accompanies the cuttings. Specifically, drill cuttings are coated with either briny liquid that is part of the shale formation, or drilling fluid which was injected into the wellbore to help bring the cuttings to the surface, or both.

Much of the concern with wastewater and wet wastes from the Marcellus Shale industry is addressed to radium, which is soluble in water and is known to cause bone cancer and leukemia when ingested. In its 2011 draft environmental impact statement addressing high-volume hydro-fracking, DEC found that brine returned from Marcellus Shale drilling sites had concentrations of Ra-226 ranging from 7,885 (\pm 1,568) to 16,030 (\pm 2,995) picocuries per liter (pCi/L).⁵ DEC has also acknowledged that “concentrated radiation” is found in the waste residue left after closure of a Marcellus Shale drill site’s waste water holding pond, including the sediments, liner and any remaining liquid.⁶ EPA measured values of radioactivity for Marcellus Shale flowback water (brine) of 9,000 pCi/L, or about 9,000 times the natural radiation in normal well water.⁷ For reference, the legal limit for discharges of liquid (including landfill leachate) to a treatment plant is 60 pCi/L, the drinking water limit for combined radium (Ra-226 + Ra-228) is 5 pCi/L.

Thus, Marcellus Shale drill cuttings accepted at the landfill are coated with return water from drilling operations that can be expected to exhibit high concentrations of radioactive

⁴ See DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR CHEMUNG COUNTY LANDFILL (“DEIS”), 151 (specifying waste streams accepted at the landfill, including “Marcellus Shale drill cuttings”), available at <<http://www.chemungcounty.com/index.asp?pageId=574>>.

⁵ DEC, REVISED DRAFT SUPPLEMENTAL GENERIC ENVIRONMENTAL IMPACT STATEMENT ON THE OIL, GAS, AND SOLUTION MINING REGULATORY PROGRAM (Sept. 7, 2011) (hereafter, “2011 dSGEIS”), Appendix 13, available at <<http://www.dec.ny.gov/data/dmn/rdsgeisfull0911.pdf>>.

⁶ Senate Standing Committee on Energy Conservation, *Public Hearing to examine waste water produced by hydraulic fracturing, sponsored by New York State Senators Mark Grisanti and Patrick Gallivan*, testimony of Eugene Leff, Deputy Commissioner, Remediation and Materials Management, NYS Department of Environmental Conservation (January 12, 2011, Canandaigua, NY), available at <<http://www.shaleshockmedia.org/2011/12/14/2-eugene-leff-dec-deputy-commissioner/>> (go to time 1:01:36-1:02:52).

⁷ DEC, 2011 dSGEIS, section 5.2.4.2.

radium. Considering that DEC permits the landfill to accept wastes solidified to 20% solids (thus, 80% liquids), substantial volumes of liquid saturated with radium could be disposed in the landfill.

As RFPLC told DEC in 2010, the concentration of radioactivity in leachate transported from the landfill for treatment at the County Sewer District treatment plants in Elmira can be expected to increase as increasing volumes of Pennsylvania oil and gas wastes are disposed in the County landfill. The County Sewer District prohibits “[a]ny wastewater containing any radioactive wastes” unless approved by the district’s Executive Director.⁸ To our knowledge, the Executive Director has not approved the acceptance of any radioactive components in the landfill’s leachate.

Casella sends roughly 2 to 10 million gallons of leachate per year to Elmira.⁹ It should be stressed that no publicly owned wastewater treatment plant in New York is licensed to, or is capable of removing radioactivity from wastewater.¹⁰ However, there is no indication the County has considered the impact of approving the landfill’s expansion on the radiological character of the County sewer district’s discharges to the Chemung River.

Despite dismissal of RFPLC’s effort to have this issue adjudicated before DEC in 2010, the DEC Commissioner directed regional DEC staff to modify the landfill’s permit to enhance monitoring for radioactivity. As a result, the landfill’s permit was modified to require radiation portal detectors at the landfill gate, and to require analysis twice each year of leachate from the landfill, once each year from the leachate lagoon (an open air pond) to which all leachate is

⁸ Chemung County Sewer Use Law, Rules & Regulations § 602(11).

⁹ See Chemung County Landfill, 2009 Annual Report (to NYSDEC), p.4 (reporting that 2.0 million gallons were transported off site for treatment); 2010 Annual Report, p. 6 (reporting 5.6 million gallons treated); 2011 Annual Report, p. 6 (reporting 9.7 million gallons treated); 2012 Annual Report, p. 6 (reporting 2.99 million gallons treated). These reports are available at <<http://www.garyabraham.com/ChemungLF.html>>.

¹⁰ Waste treatment plants, including pretreatment plants, are not designed to remove radionuclides, and discharge of “NORM associated with oil and gas extraction . . . that requires a change of disposal practice (e.g., radioactivity, etc.) is considered to be interference under the pretreatment program.” Memorandum from James Hanlon, Director of EPA’s Office of Wastewater Management to the EPA Regions, “Natural Gas Drilling in the Marcellus Shale under the NPDES Program, Attachment, 16, available at <<http://cfpub.epa.gov/npdes/hydrofracturing.cfm>> (citing 40 C.F.R. §§ 403.3(k)(2), 403.5(a)(1)). Discharge of “radioactive wastes” is prohibited under 40 C.F.R. § 403.5(b). Cf. EPA, *Guidance Manual for the Identification of Hazardous Wastes Delivered to Publicly Owned Treatment Works by Truck, Rail, or Dedicated Pipe*, No. 833B87100 (June 1987), C-3, available at <<http://www.epa.gov/npdes/pubs/owm0190.pdf>>.

stored before pumping and transport to Elmira, and from lagoon sediments. These leachate analysis requirements are scheduled for three years, ending in June 2014, after which the landfill is required to sample and analyze leachate once annually, only from the lagoon. After 2014, no further analysis of sediment or leachate collected directly from landfill cells would be required.¹¹

In addition, at the time of the 2010 DEC proceeding, in May 2010, leachate was collected directly from landfill cells and analyzed. Although the landfill has not fully complied with the three-year sampling and analysis requirements, the results of sampling up to June 2013 are available and displayed in the following tables:¹²

TOTAL RADIUM IN LANDFILL LEACHATE SAMPLES - CELLS I/II/III

sampling date	lab results (Ra-226 + Ra-228, pCi/L)
May 2010	15.60
January 2012	3.12
June 2012	---
January 2013*	7.00
June 2013	---

* Ra-226 = 7.0, but Ra-228 = -0.388. Since negative concentration is impossible, and since the uncertainty (2.16) exceeds the reported negative value, it assumed to be zero.

TOTAL RADIUM IN LANDFILL LEACHATE SAMPLES - CELLS I/II/III (FILTERED)

sampling date	lab results (Ra-226 + Ra-228, pCi/L)
May 2010	---
January 2012	3.35
June 2012	---
January 2013	3.34
June 2013	---

¹¹ Chemung County Landfill, LLC, *Environmental Monitoring Plan*, Appx. E. This plan is incorporated as conditions in the landfill's DEC permit.

¹² The analytical reports from which these numbers are taken are available in full at <<http://www.garyabraham.com/ChemungLF.html>>. Dashes indicate a failure to sample as scheduled.

TOTAL RADIUM IN LANDFILL LEACHATE SAMPLES - CELL IV

sampling date	lab results (Ra-226 + Ra-228, pCi/L)
May 2010	1.44
January 2012	3.71
June 2012	8.05
January 2013	6.94
June 2013	14.18

TOTAL RADIUM IN LANDFILL LEACHATE SAMPLES - CELL IV (FILTERED)

sampling date	lab results (Ra-226 + Ra-228, pCi/L)
May 2010	---
January 2012	---
June 2012	5.72
January 2013	1.27
June 2013*	3.70

* Ra-226 = 7.0, but Ra-228 = -6.51. Since negative concentration is impossible, and since the uncertainty (7.3) exceeds the reported negative value, it assumed to be zero.

TOTAL RADIUM IN LANDFILL LEACHATE SAMPLES - LEACHATE LAGOON

sampling date	lab results (Ra-226 + Ra-228, pCi/L)
January 2012*	1.23
January 2013	4.91

* Average of primary sample and duplicate results

TOTAL RADIUM IN LANDFILL LEACHATE SAMPLES - LEACHATE LAGOON FILTERED

sampling date	lab results (Ra-226 + Ra-228, pCi/L)
May 2010	---
January 2012	1.16
January 2013	5.40

TOTAL RADIUM IN LANDFILL LEACHATE SAMPLES - LAGOON SEDIMENT

sampling date	lab results (Ra-226 + Ra-228, pCi/L)
May 2010	---
June 2012*	5.10
June 2013**	4.91

* Using EPA Method 901.1. A second analysis was completed using Method 903.1 for Ra-226, and Method 904.0 for Ra-228 (total = 4.29).

**Only Ra-226 was analyzed, no Ra-228 results are reported. According to the lab report, the sample "was accidentally dried upon receipt."

These results show that the radium concentration in landfill leachate was high after wet Marcellus Shale wastes were first accepted in 2009-2010 (this included loads of "soil contaminated with brine from produced water").¹³ There is no baseline analysis of radium or other radionuclides prior to this period, so it is difficult to evaluate the May 2010 results as a spike.¹⁴ However, there is a discernible upward trend in the concentration of radium in leachate from the January 2012 sampling event forward, especially for Cell IV, the most active landfill

¹³ *In the Matter of the Application of Chemung County for modification of the Part 360 permit for its municipal solid waste landfill on County Route 60 in Elmira [sic], Town of Chemung*, Application No. 8-0728-00004/00013, Issues Conference Transcript, April 28, 2010, 83-84 (unsworn testimony of Casella's attorney Thomas West).

¹⁴ Letter from Lisa P. Schwartz, Assistant Regional Attorney, NYSDEC Region 8, to G. Abraham, October 31, 2011 ("Department staff does not have any records of any testing to establish baseline (i.e., prior to the acceptance of Marcellus Shale drill cuttings) leachate radiological conditions.").

cell in the period since 2010. Concentrations in the leachate lagoon would be expected to be lower because the lagoon receives precipitation run off from the working face of the landfill, and is otherwise diluted by rainfall. Although only two samples of wastewater in the lagoon have been taken, the second sample is about three times more concentrated in radium than the first.

Radioactive radium (Ra-226 and Ra-228) is a persistent bioaccumulative carcinogen. It is bioaccumulative because its concentration in the environment progressively increases as it moves up the food chain. Radium released into water will be ingested by micro-organisms, and these micro-organisms will be eaten by other micro-organisms. The concentration of radium will be greater in larger organisms, and concentrations increase roughly geometrically as the radium moves up the food chain. The fish people catch and eat from the Chemung River, where Casella's leachate goes after treatment, will have the highest concentrations.

Finally, Ra-226 is persistent because its half-life is 1,620 years. Thus, in 3,240 years half the Ra-226 discharged into rivers will still be in the environment. It is important to stress that none of the radium would naturally be in the environment without fracking; it would remain deep underground for many millions of years. Radium binds to sediments in streams and rivers and will build up there over time even after the river washes much of it downstream. Thus, radium is dangerous because it is a persistent bioaccumulative carcinogen.

No one has estimated the volume of waste liquid being dumped into the Chemung County Landfill along with Marcellus Shale drill cuttings. In addition to the liquid accompanying drill cuttings, the landfill accepts spill contaminated soil, filtration solids, and waste sludges from the treatment of Marcellus Shale waste water. These wastes can be even more wet than drill cuttings.

Pennsylvania recently imposed more stringent rules on the management of gas and oil drilling wastewater, requiring that it be treated and reused as much as possible. Indeed, Casella has taken advantage of this change in policy by installing "liquid solidification" facilities at the McKean County Landfill in Pennsylvania and the Hyland Landfill in Angelica, NY. The processing of wastewater results in substantial volumes of wet waste solids taken out of the water that are landfilled in the Chemung County Landfill, the Hyland Landfill in Angelica and the Hakes Landfill in Painted Post, all operated by Casella.

Such wastes are considered "solid waste" so long as they contain a minimum of 20% solids. It should not have any free-flowing liquids. But a relatively uniformly consistent sludge can approach 80% liquid. Wet waste can be made uniform, and free liquids can be reduced, by mixing the waste with sawdust or oak bark chips. One observer has described a load of sludge from a Marcellus Shale drilling site being dumped at a landfill looked like chocolate pudding as it fell out of the truck.

It is clear that substantial volumes of Marcellus Shale waste water are being dumped in the Chemung County Landfill, mixed with the other liquids in the landfill, and collected from the bottom of the landfill as leachate.

The need to evaluate risks of releases of radioactive waste

Treated leachate discharged to Chemung River

The concentration of radium in landfill leachate discharged to a treatment plant in Elmira is clearly associated with a risk of release of radioactive wastewater to the Chemung River because, as previously noted, the treatment plant is unable to remove radium from the leachate.

Leachate discharged to groundwater

In addition, the risk of a release of radioactive leachate to groundwater beneath the landfill should be considered. Landfills have plastic bottom liners above and below a layer several feet thick of gravel into which piping is installed to allow the leachate to escape. Landfills are allowed to leak 20 gallons of leachate per acre per day from the gravel layer. The currently active area where drilling wastes are disposed is 29 acres, so the allowable leakage rate for that area is 580 gallons per day, or about one-quarter of a million gallons per year. The proposed expansion would add about 45 more acres.¹⁵

Drill cuttings are approximately four times more dense than conventional waste accepted at the landfill. This means that the landfill must support substantially more weight over time than it may have been designed to do. This puts unanticipated pressure on the liner system, may substantially increase the liquid content of the landfill, and may as a result increase the risk of the release through the liner system to groundwater.

As part of its presentation to DEC in 2010, Casella provided a study modeling the consequences of a landfill liner leak of radioactive leachate. However, that model assumes that drill cuttings alone are being dumped, and no waste water accompanies the cuttings. The model also assumes the maximum Ra-226 concentration in the waste is 50 pCi/g. However, in 2012, a load of drill cuttings from Pennsylvania was measured at the Allied Waste Systems landfill in Erie County and Ra-226 concentrations were found to be as high as 205 pCi/g. These measurements were taken at eight transects across the open top of the waste load, from the top down into the load. The Casella model is therefore unreliable.

At the Chemung County Landfill no measurements of the waste load in the truck are taken. Instead, a radiation alarm is installed at the gate. The radiation alarm at the landfill has not been triggered once by Marcellus Shale wastes, despite the fact that radiation alarms were triggered at PA landfills by loads of Marcellus Shale drill cuttings over 1,000 times between 2009 and 2012. Why? We think there are several reasons. First, the radiation alarms measure gamma radiation, but only three percent of the radiation emitted by radium is gamma radiation. The rest is alpha rays, and these do not pass through the skin, and certainly not through the walls of a truck. Second, the radiation detector is located at the weigh scale at the landfill gate, on

¹⁵ Cf. DEIS, vol. 1, page preceding Table of Contents.

either side of an incoming truck. Radioactive waste can be buried in the middle of a waste load and avoid detection.

Third, the radiation alarm level at Chemung County Landfill has been set by DEC at five times the local background radiation level, and the maximum radiation concentration allowed in waste is 50 pCi/g, about 50 times background.¹⁶ By contrast, at New York's only hazardous waste landfill, the radiation investigation level for waste has been set at 1.5 times local background, and the maximum concentration allowed in waste is designated in the landfill's permit as "slightly above background."¹⁷ Under those permit conditions, waste loads measuring much less than what is permitted at Chemung County Landfill have been turned away.¹⁸

Finally, we believe the radiation alarms are not always operated properly, for example a truck will be allowed to coast through the weigh scale without coming to a full stop, and avoid detection.

The risk of a release of radioactive leachate to groundwater should also be evaluated in

¹⁶ Letter from Lisa Schwartz, Regional Attorney, NYSDEC Region 8, to NYSDEC Commissioner Joseph Martens, dated October 19, 2011, p. 4, available at <http://www.garyabraham.com/files/Chemung_Co/Staff_response_10-19-11_OCR.pdf>.

¹⁷ Hazardous Waste Management Permit for CWM Chemical Services L.L.C., Model City Facility, Niagara County, DEC Permit No. 9-2934-00022/00097 Attachment C, C-2 (November 2013), available at <<http://www.dec.ny.gov/chemical/30726.html>> ("Any wastes containing trace levels of radioactive material that reads slightly above background may not be land disposed without NYSDEC approval. Wastes with higher levels of radioactivity are prohibited from land disposal.").

¹⁸ Letter from Barbara Youngberg, Chief, Radiation Section, NYSDEC Bureau of Hazardous Waste and Remediation, to Jill Knickerbocker, CWM Chemical Services, LLC, July 26, 2002 (citing the permit condition quoted in footnote 7, above, and stating: "The results from our analysis indicated the presence of Thorium-232 at approximately 10 pCi/gram and Radium-226 at approximately 6 pCi/g. This would indicate that this container of material is not suitable for disposal at your facility."); Letter from B. Youngberg, NYSDEC, to J. Knickerbocker, CWM, January 14, 2004 (the same, and stating: "radium-226 and its decay products in concentrations ranging from 19 pCi/g to 66 pCi/g . . . are not considered trace concentrations. Therefore, based on these results, this waste cannot be accepted for disposal at CWM."); Letter from B. Youngberg, NYSDEC, to J. Knickerbocker, CWM, January 14, 2005 (the same, and stating: ". . . this waste contains thorium-232 and radium-228 in concentrations of about 16 picocuries per gram. This does not meet the criterion of being a trace concentration reading slightly above background. Therefore, this waste is not acceptable for disposal at your facility."). These letters are on file with the Author.

light of the proximity of the landfill to the Chemung River Valley Aquifer. The landfill site was originally approved by DEC in the 1980s, but only after “a protracted period of correspondence” between the agency and the County and a notice canceling the permit, ordering the landfill to close, and recommending four alternative landfills the County could use, including Seneca Meadows and the Broome County Landfill.¹⁹ The Seneca Meadows and Broome County landfills are still in operation with sufficient permitted disposal capacity to constitute reasonable alternatives for the County’s disposal needs.

The principal issue on which NYSDEC balked when considering whether to approve expansion of the County landfill in the 1980s was the proximity of the landfill to the Chemung River Valley principal aquifer, an underground water source capable of serving area municipalities, and the potential interference with publicly owned water treatment plants that would result from treating the expanded landfill’s leachate.²⁰ The County subsequently completed a hydrogeological report that confirmed DEC’s position, that the landfill is either located directly over the primary aquifer or its tributary to the aquifer, either circumstance requiring closure.²¹ Further internal DEC review of the County’s and other information resulted in a determination that the landfill expansion site “is adjacent to and upgradient from a Principal aquifer,” and that the risk to groundwater affects “numerous residents in the area” who rely on well water.²² A subsequent DEC staff evaluation concluded that the expansion landfill does not lie directly over a principal aquifer, defined as a groundwater resource sufficient to serve a municipality.²³ The initial expansion of the old landfill was therefore allowed to go forward, since the expansion at that time was to the north of old landfill.²⁴

The current expansion proposal would extend the landfill laterally to the south. By diminishing the lateral distance to the Chemung River Valley Aquifer, therefore, the proposal increases the risk of groundwater contamination for those residents who rely on well water drawn from this aquifer. However, the DEIS lacks any discussion of this potentially significant issue.

¹⁹ Letter from Albert W. Butkas, Regional Permit Administrator, DEC Region 8, to Robert H. Roller, Chemung County Solid Waste Disposal District, August 5, 1985.

²⁰ Letter from Albert W. Butkas, DEC, to Dennis A. Fagan, P.E., Chemung County Solid Waste Disposal District, November 13, 1985.

²¹ Letter from Dennis A. Fagan to Albert W. Butkas, January 15, 1986; Letter from Frank E. Shattuck, P.E., DEC, to Dennis A. Fagan, February 18, 1986.

²² DEC Memo from Barolo to Nosenchuck, “Chemung Co. SLF Expansion - Aquifer Determination,” December 2, 1986.

²³ DEC Memo from Barolo to Nosenchuck, “Aquifer Determination - Chemung Co. - Area 3,” January 30, 1989.

²⁴ Letter from Dennis A. Fagan to Albert W. Butkas, January 15, 1986.

Releases of radioactive radon gas

Another concern that is inadequately understood is the risk of releases of radon, a radioactive gas and the second leading cause of lung cancer in the U.S., after cigarette smoking. Radon results from the decay of Ra-226. Radon-222 has a half-life of eight days and decays to other radioactive element such as polonium, bismuth, and lead, which are emitted as fallout concentrated in the local area. These radon decay products are solid fine radioactive particles that can reside in the lung, yielding a radiation dose to the lung, and they can be taken up by plants grown in local gardens.

Will the landfill emit radon gas into the air as the radium decays? If so, how much? And will residential property in the area around the landfill be exposed at harmful levels? Radon has a very fast half-life, eight days, so the concern about exposure is focused on landfill workers and residents who live close the landfill.

Landfills generate hundreds of thousands tons of gas each year, most of which is carbon dioxide and methane. Less than one percent of the gas is highly toxic and has resulted in regulations requiring landfills to capture the gas with gas wells installed into the landfill and interconnected with horizontal pipes and blowers and directed to a combustion device that will burn off the toxics. However, much like radiation in waste water, radon will pass through the gas collection and control system into the ambient air. That effect, and the potential impact of this pathway for radiation exposure has not been considered.

Radon is also a potential issue for those concerned with area groundwater quality. In 2008, the U.S. Geological Service sampled well water in the Chemung River Valley, finding groundwater in the area is contaminated by elevated levels of inert radioactive radon gas.²⁵ Specifically, USGS found Radon-222 in every sample collected with activity levels from 153 to 1,740 pCi/L.²⁶ “Radon currently is not regulated in drinking water,” but U.S. EPA has proposed a maximum contaminant level for radon in drinking water of 300 pCi/L.²⁷

Conclusions regarding radioactivity exposure issues

In the absence of baseline water quality data for the leachate generated by the landfill,

²⁵ Amy J. Risen and James E. Reddy, *Groundwater Quality in the Chemung River Basin*, New York, 2008, USGS Open-File Report 2011-1112, available at <http://pubs.usgs.gov/of/2011/1112/>.

²⁶ *Id.*, at 6.

²⁷ USGS, *Groundwater Quality in the Upper Susquehanna River Basin*, New York, 2009, at 7, available at <http://pubs.usgs.gov/of/2012/1045/>. See also USGS, *305(b) Ambient Groundwater Quality Monitoring*, at <http://ny.water.usgs.gov/projects/305b/>.

prior to commencing disposal of Marcellus Shale industry wastes in 2009, it should be assumed that the increasing radium concentrations in the landfill's leachate is the result of Marcellus Shale industry waste disposed at the landfill. It is certain that releases of radium to groundwater will further increase the amount of radioactive radon gas in area groundwater. This is clearly a concern because groundwater is the source of drinking water for both urban and rural residents of the area. Increasing concentrations of radium in landfill leachate can also be expected to increase the release of radon from the landfill's leachate lagoon.

There was no prior environmental review by DEC of these issues, and the composition of Marcellus Shale waste materials that are currently being deposited at the landfill have never been adequately studied. For example, waste loads are not sampled and tested at the landfill. A limited number of samples of drill cuttings (but not other Marcellus Shale wastes accepted at the landfill) were analyzed for radioactivity by a Casella contractor in connection with the 2010 DEC permit review, but that study was never fully considered because DEC dismissed the issue of the safety of disposing such materials.²⁸ And as previously noted, the volume of highly radioactive waste water disposed in the landfill has never been evaluated. Thus although we know quite a lot about the harmfulness of Marcellus Shale wastes in general, this information has never been applied to this specific landfill.

In short, we know based on independent research that relatively high-activity radioactive materials are generated at Marcellus Shale drilling sites. We also know that radium is not removed from leachate before being treated and discharged into area waterways. Nor is radon removed from gas generated by the landfill and emitted into the local air. But no one has done any study of the pathways of exposure to radiation that result from increasing volumes Marcellus shale industry wastes landfilled by the County.

The Pennsylvania Department of Environmental Protection (PADEP) has begun a series of studies of the pathways to radiation exposure from trucking, landfilling and treating and discharging landfill leachate, but the results are not expected until later this summer.²⁹ These

²⁸ Cf. CoPhysics Corporation, *Radiological Survey Report, Marcellus Shale Drilling Cuttings from Tioga and Bradford Counties, Pa.*, April 2010, available at <http://www.garyabraham.com/files/gas_drilling/NEWSNY_in_Chemung/CoPhysics_Apr10.pdf>.

²⁹ PADEP, "DEP Announces Comprehensive Oil and Gas Development Radiation Study" (January 24, 2013), available at <<http://files.dep.state.pa.us/OilGas/BOGM/BOGMPortalFiles/RadiationProtection/rls-DEP-TENORMStudy-012413.pdf>>; PADEP, TENORM Study Scope of Work (April 3, 2013), 1, available at <http://www.portal.state.pa.us/portal/server.pt/community/oil_gas_related_topics/20349/radiation_protection/986697>. PADEP defines TENORM as materials "whose radionuclide concentrations or potential for human exposure have been increased above levels encountered in the undisturbed natural environment by human activities." *Final Guidance Document on Radioactivity Monitoring at*

studies will also evaluate the “rapid buildup of radon and progeny in samples/waste streams impacted with radium,” based on the following consideration: “The evaluation of waste containing Ra-226 is subject to the buildup of radon gas and the other short-lived progeny of Ra-226, complicating any decision made to transport or dispose of such materials based on an exposure rate survey of the container.”³⁰ Without adequate information about radiation exposure, the assertion in the County’s DEIS that portal radiation detectors alone “will mitigate any potential significant adverse environmental impacts to the maximum extent practicable”³¹ is not credible.

Finally, there is clear evidence that radium has leached from within the landfill to the leachate collected from the landfill. Sampling and analysis for radioactivity in landfill leachate should not be diminished. Indeed, the County should insist that the radioactivity testing measures be augmented and extended in time until there is no longer any reason for concern. The County should, therefore, at a minimum, withdraw its proposal to expand the landfill until this information becomes available.

The County’s role as “lead agency” under SEQRA

The County is considering the landfill expansion proposal pursuant to the State Environmental Quality Review Act (SEQRA). SEQRA requires that an EIS discuss mitigation measures with sufficient detail to ensure that environmental consequences have been fairly evaluated. The mitigation discussion is also needed to evaluate whether anticipated environmental impacts can be avoided. An essential component of a reasonably complete mitigation discussion is an assessment of whether the proposed mitigation measures can be effective. A mitigation discussion without at least some evaluation of effectiveness is useless in making that determination.

In this matter, disposal of long-lived radioactive contaminants clearly should be avoided. The landfill gate portal’s radioactivity detectors are the principal (perhaps the sole) mitigation measure designed to avoid that outcome. However, there has never been any direct measurements of typical or worst-case loads as they arrive at the landfill gate, including measurements of portions of the waste located in the center of the load, where radioactivity would be the most difficult to detect. In addition, the concentration of radioactivity in the landfill, as detected in the landfill’s leachate, appears to be increasing, indicating that the portal detectors by themselves do not provide effective mitigation. The County cannot therefore reasonably issue findings that the portal detectors are effective in keeping relatively high levels of radioactivity (e.g., several times higher than the background environment) from contaminating the landfill, its leachate and the

Solid Waste Processing and Disposal Facilities, PADEP Doc. No. 50-3100-001 (January 2, 2004), 4.

³⁰ PADEP, TENORM Study Scope of Work, 8.

³¹ DEIS, 152.

gas emissions from the landfill.

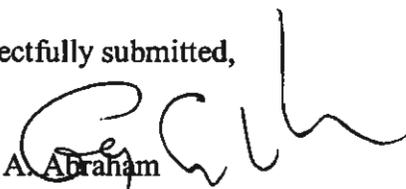
If the effectiveness of the portal detectors is unsupported by any evidence in the record, the County cannot rely on the portal detectors alone to find that the portal detection system is adequate. If the County's ultimate SEQRA findings lack an adequate discussion of effectiveness of the system as a mitigation measure, the public will be unable to rely on the County's findings.

The potential for adverse impacts of an ineffective radiation portal detection system cannot be eliminated from County consideration on the basis that this system may be evaluated later, by the DEC, in the context of an application for a modification of the County's state landfill operating permit. In the first instance, no such application has been submitted to DEC. But more importantly, DEC is not required to consider the effectiveness of the system. Whether DEC will in the context of a subsequent state permit modification consider the effectiveness of the system, by measuring waste loads to confirm or deny the system's effectiveness, is not certain because it did not do so when initially adding the requirement to operate the system as a special condition at the time of the last permit modification. Moreover, SEQRA obligates the County to take a look at all impacts, not just impacts that may be remedied by state landfill regulations. Stated differently, an agency may not excuse itself from its SEQRA hard look duty where a facility operates pursuant to a state permit.

Thus a lead agency may not rely on compliance with another agency's substantive standards as a proxy for the lead agency's more expansive hard look duty. Instead, the County has an independent duty to analyze the effects of radiation in the waste it accepts at the landfill regardless of whether the landfill operates in compliance with a state permit. Without fully exercising that duty, the County can not reach a fully-informed and well-considered decision.

We contend that the County is obligated to consider whether the landfill has in place measures that can be relied upon to adequately monitor radioactivity in the waste it disposes and, until it has done so, the County should not approve the expansion proposal.

Respectfully submitted,


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