



TOMPKINS COUNTY
 ENVIRONMENTAL MANAGEMENT COUNCIL



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New York State Department of Environmental Conservation Region 7
 615 Erie Boulevard West, Syracuse, NY 13204-2400

1 May 2017

Re: *Continued Concerns Surrounding DEC Application ID#0-9999-00075/00001 (Cargill Mine Shaft #4)*

Dear Mr. Marko, Mr. Sluzar and Ms. Powell:

Thank you for taking the time to meet with us today, Monday May 1st, 2017. We appreciate the DEC's receptivity to hear our well-documented concerns, and we hope that today's discussion points you toward ways of resolving them. These various concerns haven't received the oversight and attention they need, partly because of Cargill's unwillingness to release relevant information, and partly because the Shaft #4 issues and mine expansion issues are being improperly segmented.

Resolving these various issues would be consistent with DEC's mission:

"To conserve, improve and protect New York's natural resources and environment and to prevent, abate and control water, land and air pollution, in order to enhance the health, safety and welfare of the people of the state and their overall economic and social well-being."

As a first step, we ask the DEC to require detailed technical answers with rigorous support data from the businesses using our natural resources. As you review and act on this information, we ask that you work with the public, subject matter experts and concerned citizens to address critical issues of environmental protection, public health and safety, and economic and social well-being – and to do so within an unsegmented State Environmental Quality Review (SEQR) process. In this case, these steps are needed to ensure the protection of a multi-billion-dollar resource, Cayuga Lake, and the

multi-billion-dollar ecotourism economy centered on this lake. These steps are also needed to prevent the depletion of bedrock groundwater resources in the area.

Technical Issues

Leakage waters – Amount and Rate

1. Hydrogeology in the vicinity of Corehole 18/Shaft #4 is not adequately characterized and cannot support an informed decision on the safety, stability, and dewatering impacts of Shaft #4. In Western New York and the Finger Lakes Region, there are various known instances of groundwater flow along the unconformable contact at the base of the Onondaga or through the Oriskany Formation (e.g., Fairchild, *Science* **79**, 340-41 (1934)). Such flow is evident at the base of the Onondaga in Corehole 18/Shaft #4. Specifically, there is an apparent hydraulic connection through the Onondaga/Oriskany aquifer to a huge water reservoir in the valley fill aquifers and Cayuga Lake. The meteoric (indicated by the presence of tritium) water that migrates along this Onondaga/Oriskany pathway presents a serious risk of flooding of the proposed Shaft #4.

Please note that the flooding risk is linked to the faulty assumption that groundwater inflow rates measured in the pilot hole (Corehole 18) can be extrapolated to the enlarged hole (Shaft #4). While such an assumption is reasonable in unfractured media, it cannot be realistically applied to the type of fractured bedrock encountered here. As described below, the risk continually increases in bedrock affected by subsidence as existing fracture apertures tend to enlarge over time. Also, Shaft #4 is much closer to the subcrop of the Onondaga/Oriskany contact with the buried valley than the existing shafts used as analogs in inflow prediction to Shaft #4. As a partial safeguard, reaming of Shaft #4 from the surface downward would reduce the likelihood of mine flooding because unreamed rock would remain in place at the foot of the shaft until the very end of the reaming process. No such safeguard would remain in place if the shaft is reamed upward from the mine as is currently being proposed by Cargill.

2. An initial (“stabilized”) water level reported for this inflow in Corehole 18 was 502 ft below grade (RESPEC 2013 report, page 38), which corresponds to an elevation of 282 ft msl based on the top of test hole elevation of 784 ft msl. This measured water level elevation is approximately 100 ft lower than the elevation of Cayuga Lake, the regional discharge level, and is therefore indicative of a “sink” that is lower than the lake. This anomalously low water level is explained by draining of valley fill aquifer water along the Onondaga/Oriskany flow pathway to the mine, the only known sink lower than the Lake. The existing mine shafts are known to attract inflows as high as 40 gpm throughout their 100-year

period of operation. The addition of Shaft #4 would at least double the inflows and exacerbate and widen their draining impact on bedrock groundwater resources in the area. Given the serious implications of Shaft #4 on potential mine flooding and the depletion of groundwater resources over a large area, Cargill should be required to conduct additional characterization of the local hydrogeology. The suggestion by RESPEC (2013) that the tritium-bearing inflow in Corehole 18 came from “fluid losses during decades of solution-mining at Ludlowville ... 3 miles to the south” is entirely speculative, has no supporting data, and cannot be easily reconciled with a stabilized water level 100 ft lower than the elevation of Cayuga Lake. RESPEC’s speculative suggestion cannot serve as the basis for an informed decision on Shaft #4. Additional hydrogeologic characterization is needed.

3. The RESPEC inflow estimate of 5.5MM gallons of shaft leakage in the first seven months of construction does not include any water inflows from the upper 590 ft of the hole that was completed using air-rotary drilling and then cased-off without collection of any hydrogeologic data. While RESPEC apparently observed no substantial flow in this upper interval, it is important to note the importance of fracture flow in bedrock intervals of this type. Fracture flow is notoriously difficult to characterize and requires specialized testing. Fracture statistics from wells in the Newark Basin of New Jersey,¹ for example, show that only 10% to 20% of all fractures mapped/observed in cores or on borehole wall images are transmissive. Even within the transmissive fracture subset, relatively few fractures are truly productive, and these are commonly associated with bedding fractures. The statistics thus suggest that visual assessments of fractures (rose diagrams, polar plots, etc.), all of which are important for structural geologists, do not work well for hydro assessments. Hydrogeologists need to rely on methods geared toward the flow, such as flowmeters, packer tests, and short-term pumping tests, to identify and characterize such transmissive fractures.

Such testing should have been done by RESPEC, but we have seen no evidence that their testing included continuous geophysical logs of high-resolution fluid temperature, fluid conductivity/resistivity, and vertical flow (flowmeter) which are commonly considered groundwater industry standards for identification of water bearing/aquifer units.

Nevertheless, available data from nearby supply wells provide strong indirect evidence for the presence of water-bearing units within the interval penetrated by the uppermost 590 ft of Corehole 18/Shaft #4. A yield of 60 gpm is reported for the Koplinka-Loehr bedrock supply well located approximately 1,700 ft to the west-southwest of the proposed Shaft #4 location. Additional hydrogeologic

¹ Personal communication, Dr. Andrew Michalski, 30 March 2017.

characterization is needed to fill these gaps in RESPEC's testing. Such characterization needs to include water yield and depth to water table for Cargill's own domestic water well located about 675 ft due east of the Corehole 18 location.

4. Subsidence is an ongoing process that continually increases the transmissivity of groundwater flow pathways in bedrock above a mine. A water inflow estimate of 4 to 6 gpm, for example, can be expected to increase over time due to room closure and mine subsidence. This process causes sagging of the overlying bedrock strata and increases the apertures of bedding plane separations above the mined-out salt bed. In accordance with the cubic law, such aperture increases will result in disproportionately high increases of potential flowrates, by orders of magnitude, within a bedrock portion that was originally quite tight. When this area of subsidence-enhanced permeability connects with the virtually unlimited water source in the buried valley and the Lake, the resulting water inflow rates may become uncontrollable.

Leakage waters – Handling

1. The groundwater inflows into the shafts are undersaturated with salt. Disposal of this water to the Level 4 mine working in the old mine portion has caused dissolution and undercutting of the pillars near the injecting points. RESPEC expressed a concern that this practice can possibly result in mine collapse, which would have a significant effect on Cayuga Lake's shoreline and the mine shafts.² Water from Shaft #4 would be disposed of into the new mine portion beneath the Lake. If untreated, the disposal will undercut the pillars there. And, in any case, increased humidity will increase closure rates.
2. What requirements will DEC ask Cargill to meet to ensure that Shaft 4 leakage waters would be fully-saturated before being piped into the mine? A sump water monitoring system using real-time data loggers measuring both specific conductance and chloride levels would enable an automatic shutoff of pumping whenever less than fully-saturated waters were detected. Without such an automated real-time system required to be put in place, we fear that the malpractice regarding leakage waters from Shafts 1 & 2 documented by RESPEC in a 2014 report to Cargill might also be replicated at Shaft 4.³

However, until such time as a robust mine closure plan has been presented within the DEIS process, we propose that no further leakage waters should be allowed to be stored in either the under-land mine or the under-lake mine.

² John T. Boyd's letter to DEC dated March 18, 2015, p. 12.

³ 2014 RESPEC report to Cargill cited in *ibid*.

3. While it is true RESPEC vice-president Leo Van Sambeek did conduct years of research on the relationship between ambient humidity and room closure rates inside the under-the-lake portion of Cayuga Salt Mine (Van Sambeek, 2012), it should be noted that up until now Cargill has **never** had permission to store leakage waters in portions of the mine under Cayuga Lake and therefore no research exists that can be drawn on to predict the effects of future water/brine storage in the under-the-lake portion of the mine on global mine stability. Projected water storage closure impacts that Spectra sent to DEC on March 23, 2016, have no authorship, which we find unacceptable.
4. In a 9 May 2016 letter to DEC's Steve Army and DEC consultant Dr. Vincent Scovazzo, Cargill's senior mine engineer David Plumeau wrote that "Past experience with water storage areas...provides the best data to show how the mine is expected to behave near and downwind of the brine storage area."

Mr. Plumeau's statement should trigger substantial concern at DEC for these reasons:

- a) The water storage areas Mr. Plumeau refers to are in the #4 salt layer under the Town of Lansing and are located about 5 miles to the southeast of the proposed new storage location. Bedrock thickness above the mine is several hundred feet greater under the Town of Lansing in contrast to the proposed site. The failure of the Retsof Mine was due in part to extrapolating from data from test panels located under the eastern side of the Genesee Valley where overlying bedrock was relatively thick, to the middle of the valley where the bedrock was thinner and subsequent test panels failed. Beyond that, the in-situ stresses in the buried valley setting are more complex and less favorable to the mining than the upland areas. For Mr. Plumeau to imply that data from the eastern Cayuga Mine is applicable to their under-the-lake mine seems like history repeating itself.
- b) Cargill's ponded water storage experience to date has been in the #4 salt mined voids and not in the #6 salt mined voids. Thus, any putative expectations of similar experience in a different salt layer could be invalid.
- c) Perhaps most notable, Cargill's experience with mine stability in the water storage areas of the #4 salt zone has not been good. In addition to RESPEC's warning in 2014 that the under the town portion of the mine could collapse due to on-going pillar erosion⁴, it should be noted that Cargill ceased gathering room closure data in their Eastern Mine in December 2007 reportedly because that portion of the mine was no longer safe to enter.
- d) The maximum surface land subsidence recorded over the water storage portion of the mine has been 14.4 inches.

⁴ *ibid*

- e) Maximum measured subsidence on the West Shore of Cayuga Lake from May 2011 to December 2014 was 2.4” or 0.7” per year. Based on these rates, RESPEC predicted that “ultimate predicted subsidence” would be “2.5 ft. to 3.5 ft” without any mining of the #5 salt layer.

In summary, Cargill’s own data do not adequately support the argument that shoreline and over the lake subsidence would **not** be affected by as yet untested water storage under the lake.

Handling of Gas Encountered during Drilling

1. Drilling of Shaft #4 will encounter a number of formations which can host substantial quantities of natural gas, including the Marcellus, Onondaga, and Oriskany Formations. Based on the amount of natural gas encountered in Corehole 18, as much as 4.85 million cubic feet of natural gas could be released during the timeframe required to ream and seal Shaft #4. DEC’s negative declaration makes no mention of climate change impacts, and gives the erroneous impression that methane leaking from the Shaft #4 might actually be contained within the mine when in fact it will be vented to the atmosphere within days. The public deserves to hear what the effects of that natural gas leakage will be. Because this constitutes a potentially significant and substantive environmental impact, a DEIS and public hearing should be required.
2. Cargill Cayuga does not report either an Air Emissions Reporting or Greenhouse Gas emissions (eGGRT) to the EPA. This lack of transparency could be harmful, and negatively impact Tompkins County’s and New York State’s efforts to achieve its greenhouse gas emission reduction goals of 80% by 2050.

Well Study

1. In September 2015, Cargill consultant Spectra Environmental Group conducted a survey of well water quality in the area of Cargill’s proposed Shaft #4 project. On September 3, 2016, the DEC released to the public two documents relating to this survey. However, neither document addresses the impact of additional inflows to Shaft #4 on regional bedrock groundwater resources that appear to be already drained by the prolonged inflows to the existing shafts, as documented by the large drawdown of the Onondaga/Oriskany potentiometric surface in Corehole 18. Likewise, neither document establishes a credible base line for residential well water quality in the vicinity of Cargill’s proposed Shaft #4 project. Nor does the NOIA response letter accurately respond to issues raised by the DEC.

This raises several questions:

- a. Why were most results from Cargill's own well on the Shaft 4 parcel never released to the public as part of this study?
- b. Why did the DEC allow Cargill to forego any systematic findings or report of the collated data from the 11 wells? and
- c. Why did Cargill choose to ignore the well data collected and to state erroneously in their NOIA response letter to DEC of 26 Jan 2016 that the Corehole 18 report was the only reliable indication of ground water resources and that ground water resources had been found to be negligible from 0 to 1490 feet below ground surface?

Spectra's own unsummarized well study findings indicate a 60 gpm yield of the Koplinka-Loehr well, which compares to an average yield in Town of Lansing wells in the DEC database of only 8.2 gpm. In addition, Spectra's claim that drawdown effects wouldn't extend >1000 ft to the nearest residential well on Ross Road is unsupported by evidence and inconsistent with the fact that prolonged inflows to the existing shafts produced a drawdown of more than 100 ft, as measured in Corehole 18 located 3.9 miles from the shafts at Portland Point.

2. A salinized beach well on the east shore of Cayuga Lake was surveyed as part of the Spectra well study. This well is located more or less in alignment with the east end of Cargill's U-55 mining panel. A DEIS is needed to determine whether mining-related perturbations may have resulted in the salinization of this artesian well. Profile B in a Year 2000 Sear-Brown study indicates the top of a bedrock fracture zone that communicates with the Cayuga Aquifer does contact the lake water column in this general area of the east shore.⁵ Further investigation is needed to determine whether the salinity in this beach well is from the same source as the saline leakage encountered in the Oriskany formation in Corehole 18.

Characterization of Potential Faulting and Subsurface Stress-Strain

1. There is an unexplained gamma spike which rises from about 20 API units to about 200 API units in the depth interval from about 1510 to 1555 feet on the gamma log for Corehole 18 (well no. 31-109-26509). The interval in question (from about 1510 to 1555 feet depth) appears to be a repeated section of overlying strata which would indicate that a fault intersects the well bore. There may be other, alternative explanations, but given the evidence that this is a

⁵ Sear-Brown. October 2000. Geology/hydrogeology of the Cayuga Salt Mine, Lansing, New York. Cited in Spectra Environmental Group. 2000. Plate 3.1-9 Profile B Ground Water Flow.

repeated section and the evidence of other faulting nearby, the question of a fault intersecting Shaft #4 needs further investigation that can resolve the issue.

2. We note that Bay Geophysical conducted a 2016 seismic survey of Cayuga Lake and the Shaft #4 area, and that this seismic survey would help answer the question of a fault intersecting Corehole 18/Shaft #4. Without having access to the seismic results or the rationale for conducting the seismic survey, it is unclear whether the main purpose of the seismic survey was to investigate the unexplained gamma spike in Corehole 18. As indicated below, the seismic results should be released. Release of the results would help answer the question of a fault intersecting Shaft #4.
3. A Finite Element Analysis (FEA) or similar numerical model needs to be run in order to assess the mine cavity's response to the subsurface tectonic, gravitational, and residual stresses. The FEA or other model should be three-dimensional and needs defensible input values, including realistic values for the ENE-WSW-oriented regional horizontal stress in bedrock, and including realistic treatment of the areas of stress concentration and extensional stress that occur within and under bedrock valleys. The FEA or other model runs should cover the mine as it currently exists and its future configuration at the limit of planned northward expansion.

Withheld Technical Data

1. High Resolution Core photos - These provide fundamental scientific information on the geologic structure and stratigraphy of bedrock surrounding Corehole 18/Shaft #4; they should be made available for review by the public and independent experts.
2. Sonic wireline files recorded during the drilling of Corehole 18 should be should be made available for review by the public and independent experts.
3. Cargill's replies to a DEC request on December 15, 2015, for additional information responding to 11 incomplete areas in Cargill's Shaft 4 application.
4. Seismic data and interpreted results from Cargill's 2016 seismic study of Cayuga Lake and the Shaft #4 area, as conducted by Bay Geophysical. These data and interpreted results provide fundamental scientific information on the geologic structure and stratigraphy of the local bedrock; they should be made available for review by the public and independent experts.

Regulatory Process Issues

Lack of Closure Plan

When DEC raised the financial security for Cayuga Salt Mine from \$1M to \$3.5M effective March 15, 2017, these meager sums requested from the North America's largest privately-held corporation underscore the on-going absence of any rigorous scientifically-grounded closure plan for Cayuga Salt Mine. A Cargill executive was recently unable to state whether or not the mine would be flooded upon decommissioning. A rule of thumb in the room and pillar salt mining industry is that "surface subsidence slows by an order of magnitude when a salt mine is flooded."⁶

However, geologist Raymond Vaughan predicts that if Cayuga Salt Mine is flooded it will then be "game over" with respect to having any control over where the saturated brine contents of the flooded mine would then vent to as the salt creep causes the mine voids to close.⁷ Keeping the mine dry after decommissioning would retain the options for further use for such uses as sequestration of carbon or the storage of compressed air. However, an accidental flooding of Cayuga Salt Mine may—like the Retsof Mine failure in 1994—present a much higher probability of the then flooded mine having a robust hydraulic connection with the Cayuga Lake water column.

No limnological mass balance studies are known to exist that model the amounts of damage to Cayuga water quality that would occur as 13 to 26 billion gallons of saturated brine vented to Cayuga Lake at a range of venting scenarios, including various mine closure rates. For this reason, it is absolutely critical that DEC require a DEIS of the Cayuga Salt Mine that includes an in-depth study of a range of decommissioning scenarios. A company that pays roughly \$10M in annual salaries locally should not be allowed to put at risk a lake containing 9.6 cubic kilometers of fresh water and that may be valued in the multiple billions of dollars.⁸

Breach of SEQR Process with Improper Permit Segmentation

Cargill's 2016 Application to the Tompkins County Industrial Development Agency/Tompkins County Development Corporation, states that Shaft #4 *is not a stand-alone project but will enable Cargill's Cayuga salt mine to expand northward in a manner that would not be possible or feasible without the new Shaft #4.* (See

⁶ Geologist Pierre Berest speaking with John Dennis, April 24, 2017, SMRI Conference, Albuquerque, New Mexico.

⁷ Geologist Raymond Vaughan, written comment submitted to DEC R7 on Dec. 9, 2016.

⁸ A summing of the property assessment values of 2,804 waterfront parcels in Tompkins, Cayuga, and Seneca counties comes to \$1.076B. However, this sum is not a robust proxy for a valuation of the lake itself or its water contents, but simply a simple form of undervaluation that can be readily calculated. It does not include any value for the water itself, the ecotourism values or values of any mineral resources beneath it. CAMAConsultants. April 1, 2017. Valuation of Cayuga Lake. Phase A. 7 pages.

particularly Cargill's statements that "Due to the age of the mine, the underground mine workings are currently over 7 miles from the elevator shafts. Because of the distance, providing fresh ventilation air and safe access to surface in the event of an emergency is becoming increasingly more difficult. A new ventilation and access shaft *is required to safely and productively mine the northern reserves....*" and "The new shaft project is *required to ensure long term operations at the Cayuga Mine....*" emphasis added.) In other words, the new shaft and additional mining appear to be inextricably linked. Under the State Environmental Quality Review Act (SEQR), impacts of the new shaft and additional mining would thus need to be reviewed together in order to avoid impermissible segmentation.

In a 10-page rationale for segmentation⁹ submitted to DEC with a letter from Attorney John Klucsik dated January 7, 2014, the author makes various statements that do not appear to be congruent with the facts. The two segments under consideration were 1) a one-mile tunnel leading from the mine to the proposed location of the vertical shaft and 2) the vertical shaft and related above-ground infrastructure. For the sake of brevity, we will only comment on the first of several questions to which misleading answers were provided to DEC.

DEC question: ***Is there a common purpose or goal for each segment?***

John Klucsik transmitted reply:

No. the purpose of the Life of Mine is to increase the area of underground salt reserves approved for mining. The purpose of any future air shaft would be to provide additional ventilation and an emergency evacuation route as mining progresses northward and to the east.

After mining its first cross lake panel U-12 in the late 1980s, Cargill then mined Panel U-12 for an additional 0.4 miles under land in the vicinity of the Cayuga Nature Center. This panel was slightly wider than subsequent panels and the U12A portion of this panel has reportedly displayed anomalous room closure rates until quite recently despite backfilling of Panel U12A in about 1993. It is notable that Cargill has not subsequently undertaken to mine outside the lake footprint until their request to mine a one mile tunnel leading to the proposed Shaft 4. This panel—labeled U63E—is clearly being mined for the purposes of connecting the mine to the proposed Shaft 4. For Cargill and

⁹ January 7, 2014. Attachment "A". Cargill, Incorporated, Cayuga Salt Mine Justification for Permissible Segmentation of Environmental Review for Underground Life of Mine Expansion and Potential Future Air Shaft and Associated Surface Facilities. 10 pages. Sent by John Klucsik to David L. Bimber, Regional Permit Administrator, regarding "segmentation of environmental review", application DEC 0-9999-00075/00001 MLR.

its attorney to suggest in application materials that the additional 150 acres is a simple and insignificant expansion of mining reserves and nothing more is disingenuous to say the least. Without the tunnel and infrastructure-related side panel, the vertical Shaft 4 component--located about 1100 yards east of the lake--would be isolated and without purpose, unable to provide ventilation and electricity to the mine. Nor would it be feasible for three shifts of workers to commute daily to the northern mine face.

A Cargill map showing further mining areas through 2019 does not show any future mining eastward past Shaft 4 or eastward from any portion of the mine permitted under-lake reserves. It is thus unclear whether the author of the rationale for segmentation provided to the DEC actually believed that an ostensibly standing alone Shaft 4 located about 1100 yards east of the lake would simply begin providing ventilation, electric supply and evacuation access as "mining progresses northward and to the east." While it can't be ruled out that Cargill will at some point mine in an easterly direction from Shaft 4, the implication that the tunnel connecting Shaft 4 to the mine is just an ordinary mining panel is belied by Cargill's own drawings indicating it will conduct ventilation air, electricity and shaft leakage water to the mine through this tunnel. In summary, to state that the two segments share no common purpose is simply not credible. We ask DEC to reconsider its acceptance of such an argument.

Our Request

The public needs more disclosure of any and all risks and supporting information. There is significant potential risk associated with the construction of the proposed Shaft #4, as well as with the mine expansion enabled by the new shaft. The best way to assure protection of the environment and lake safety in this project is to have a fully-informed and transparent review of both permit applications together, thus fulfilling the requirements of SEQR through a DEIS and a public hearing. Surely where this beautiful, environmentally important and economically critical lake is concerned, we can't be too careful. A Retsof Mine type failure under Cayuga Lake could lead to a long-term catastrophic contamination of the water column of Cayuga Lake.

Thank you very much for your time and reviewing these substantive concerns.

Sincerely,



Brian Eden

Chair, Tompkins County Environmental Management Council

Copy: Eric Schneiderman, Attorney General of NYS
Basil Seggos, Commissioner of the NYS DEC