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New York State Department of Environmental Conservation
Bureau of Resource Management & Development
Division of Mineral Resources
625 Broadway, Third Floor
Albany, NY 12233-6500

Attention: Mr. Steven M. Potter
Director

Subject: Annual Report Review - 2008
Cayuga Mine, Cargill, Inc.
Seneca and Tompkins Counties, New York

Gentlemen:

John T. Boyd Company (BOYD) received from Mr. David Plumeau an untitled letter[1] dated February 2, 2009, from Cargill Deicing Technology (Cargill) on February 4, 2008, as submittal of the 2008 Annual Report. The letter was accompanied by hard copies of maps. The letter, the maps as AutoCAD® files, and other data were included on an accompanying CD.

On February 20, 2009, BOYD received another letter[2] from Mr. David Plumeau, an untitled letter dated February 12, 2009. This letter was accompanied by additional maps, which were also included on a CD as AutoCAD files. A final letter[3] with additional maps and a CD was received by BOYD on March 13, 2009. The

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[1] Plumeau, David, 2009, untitled letter to Vincent A. Scovazzo, John T. Boyd Company, February 2.
[2] Plumeau, David, 2009, untitled letter to Vincent A. Scovazzo, John T. Boyd Company, February 12.
[3] Plumeau, David, 2009, untitled letter to Vincent A. Scovazzo, John T. Boyd Company, March 9.

accompanying digital data included consultant reports: five reports from Mechanics Assist[4,5,6,7,8] and one from Itasca Consulting Canada Inc[9].

On February 15, 2006, Mr. Steven M. Potter, Director, Bureau of Resource Management & Development of the New York State Department of Environmental Conservation (NYSDEC), requested that BOYD review all documents, digital data, and annual reports received by BOYD starting with the 2006 Annual Report.

The documents were reviewed for their adherence to conditions of the Permit[10] and in regard to discussions held at the Cayuga Mine among NYSDEC, Cargill, and BOYD on August 6, 2008. The Cargill 2008 Annual Report is accepted but falls short in the following areas:

- The permit requires a mine manager signed certification stating that all mining related activities conform to the permit and the approved plans, or that variances have been reported and managed. No certification was included in the Annual Report.
- Cargill did not report on non-routine incidents or include a statement that no non-routine incident occurred. In addition, no statement was included in the Annual Report about MSHA reports in connection with any non-routine mining incidents or MSHA documents addressing these incidents.
- All AutoCAD maps supplied were overlays, and unfortunately, no AutoCAD base map was included. The base map used in this review was taken from last year's annual review.
- Some notations on the extensometer drawings require explanation. BOYD suggests that these drawing be discussed during the 2009 site visit.
- No map or overlay is included to show roof falls and floor rolls.

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[4] Rock Mechanics Assist, 2008, an untitled letter from Gary Petersen to Mark Crandall of Cargill Deicing Technology, March 29, concerning new shaft.

[5] Rock Mechanics Assist, 2008, an untitled letter from Gary Petersen to Bill Gracon of Cargill Deicing Technology, April 15, concerning subsidence on the east end.

[6] Rock Mechanics Assist, 2008, an untitled letter from Gary Petersen to Bill Gracon of Cargill Deicing Technology, March 27, concerning March mine visit.

[7] Rock Mechanics Assist, 2008, an untitled letter from Gary Petersen to Bill Gracon of Cargill Deicing Technology, April 16, concerning subsidence on the west shore.

[8] Rock Mechanics Assist, 2008, an untitled letter from Gary Petersen to Bill Gracon of Cargill Deicing Technology, September 26, concerning September mine visit.

[9] Hudyma, Marty, 2008, "Cayuga Site Visit Report – February 2008" to David Plumeau of Cargill Deicing Technology, 27 March.

[10] New York State Department of Environmental Conservation, Division of Environmental Permits, Region 7, 2003, "Permit" DEC Permit # 0-9999-00075/00001, expiration December 31, 2007, January 6.

- No SPDES data, or discussion on SPDES, were included in the Annual Report.

Discussion of Annual Report

The Annual Report submitted by Cargill is in response to special conditions 7 through 13 of Permit Number 0-9999-0075/00001. These special conditions and Cargill's responses are summarized below:

Special Condition 7—requires Cargill to submit an Annual Report, which is required to include items "a" through "g" of Special Condition 7.

Special Condition 7.a.—requires the inclusion of the Mine Manager's signed certification that "all mining related activities...were in conformance with this permit and the approved plans, or that variances have been reported and managed."

No certification was included.

Special Condition 7.b.—requires "A summary of all non-routine mining incidents as defined in Special Condition 8. ..." Special Condition 8 defines non-routine as "incidents during mining, processing, or other mine related activities that may adversely affect mine stability, ground and surface water or other natural resources, or the health, safety, welfare or property of the general public." Special Condition 9 expands on Special Condition 8 by requiring Cargill to submit "all correspondence with the Mine Safety and Health Administration involving non-routine mining incidents...". During a meeting held on August 17, 2004, between Cargill, NYDEC, and BOYD, it was agreed that statements will be included in the Annual report "to point out known, encountered, or discovered geologic and geotechnical anomalies and mine action to address such anomalies."

Previous Annual Reports would include a statement that Cargill "...is not aware of non-routine incidents..."; however, such a statement is not included in this annual report.

- For the third year in a row, the annual report has noted that Cargill is re-evaluating the geologic anomaly previously identified on seismic lines north of Frontenac Point and that no further mining will be done toward the northern reserves until that evaluation shows that it is prudent to mine. In this annual report, Cargill notes that they have "... RESPEC conducting a re-evaluation of the geologic anomaly ..." and "... the geologic anomalies that are being encountered in the south reserves (S-3, E-3, and E-4 areas)".

- The Cargill letter to BOYD[1] again notes that "The U-40B area continues to converge more rapidly than was expected. The increased frequency of instrument readings continues. Backfilling that region with waste salt has been ongoing since August, 2007 focusing on the panel intersection areas first. The operators are using a pusher blade to stack the waste salt tighter to the roof. In addition a barrier zone of no

mining within 700 feet radius is being maintained to prevent any new mining influence from affecting the area."

Special Condition 7.c.—requires "An updated Mining Plan Map depicting the current extent of mining activities, and the proposed advancement of the working face for the subsequent three years." At the August 2004 meeting, it was agreed that in addition "A mine map showing instrumentation location and type and shore line..." will be included in the Annual Report.

Mine maps in AutoCAD and hard copy formats were supplied by Cargill to fulfill this condition. All AutoCAD maps supplied were overlays, and unfortunately, no base map was included. The base map used in this review was taken from last year's annual review. The maps provided are:

- An untitled, AutoCAD file, Complete Mine Overlay w_Surface Subsidence.dwg, created January 2009, shows the land topography and subsidence monument locations. No hard copy supplied.
- A hard copy map, Cargill Deicing Technology, 2008, "Cayuga Mine, 3 YR Planning Map, 2008/2009 Fiscal Yr." 1" = 1000', December, and AutoCAD file, 3 YR MINE PLAN 08-09(updated 12-26-08md).dwg.
- Two hard copy maps, both with the same title block; Cargill Deicing Technology, 2008, "Cayuga Mine, Mine Royalty Map, 2008/2009 Fiscal Yr." December, one map for the southern portion of the mine at a scale of 1" = 300' and the other for the northern portion at a scale of 1" = 600', and AutoCAD file, ROYALTY.dwg, created January 2009. Map shows fiscal year production areas from 6/1/02 through 12/31/08.
- An untitled map showing the backfill plan and filled areas for Yard U-40B and AutoCAD file, U-40B.DWG, created January 2009.
- A hard copy map, Cargill Deicing Technology, 2009, "Cayuga Mine, 4 Level Pond Map, Updated: 17Dec 2008", Scale 1" = 600', January, and AutoCAD file, "4 Level Pond Map MLRP Version Dec07.Dwg", created January 2009.
- A hard copy map, Cargill Deicing Technology, 2008, "Cayuga Mine Closure (Inches) Sep-2008", showing closure of the 6 Level, no AutoCAD file included.
- A hard copy map, Cargill Deicing Technology, 2008, "Cayuga Mine Closure Rate (Inches/Year) Sep-2008", showing closure of the 6 Level, no AutoCAD file included.
- A hard copy map, Cargill Deicing Technology, 2008, "Cayuga Mine Closure (Inches) Oct-2008", showing closure of the southeast corner of 6 Level, no AutoCAD file included.
- A hard copy map, Cargill Deicing Technology, 2008, "Cayuga Mine Closure Rate (Inches/Year) Oct-2008", showing closure of the southeast corner of the 6 Level, no AutoCAD file included.

- A hard copy map, Cargill Deicing Technology, undated, "Cayuga Mine, 6 Level Workings, Conversion Stations" and AutoCAD file, "Convergence Map w-Basemap Outline.dwg", created January 2009.

- Several untitled maps were received as hard copy and AutoCAD files to show locations of extensometers, including:

  - 20 Belt Area.dwg—Created March 5, 2009.
  - Inspections located on Basemap dwg.dwg—Created March 5, 2009.
  - SP Horizontal Roof Ext Dwg to Excel.dwg—Created February 16, 2009.
  - U5 Instrumentation.dwg—Created March 6, 2009.
  - U58.dwg—Created March 2, 2009.
  - U61.dwg—Created March 2, 2009.
  - Updated SurgeBin Inspection 8_25_05.dwg—Created February 16, 2009.
  - W1_1 Tunnel 8 Door Insp 11_16_05.dwg—Created March 2, 2009.

  Some notations on these drawings require explanation. BOYD suggests that these drawings be discussed during the 2009 site visit.

The supplied maps show the extent of mining, proposed mine plan, subsidence monument locations, shorelines of both the 4 Level flooding and of Cayuga Lake, and instrument locations and movements. Not included is a map showing roof falls and floor rolls. Included previously was the untitled AutoCAD file Rock Roll Map.dwg showing sixth level mine map and roof and floor rolls.

Special Condition 7.d.—requires the annual report to include a "summary of in situ measurements of rock mechanics required by Special Conditions 12." Special Condition 12 requires the measurement and collection of in situ rock mechanics data "in accordance with the approved Mined Land Use Plan." The data is to include "plots of relevant graphs. ..." Furthermore, "Exceptions to anticipated trends in rock behavior shall be noted and explained. ..."

At the August 2004 meeting, it was agreed that "All rock mechanics data" would be incorporated in the Annual Report, "including, but not limited to, all instrumentation readings and observations from the initial readings to present. Data for subsidence, closure, and extensometers are to be provided electronically. These electronic files are to include raw and processed data, graphs, and explanations of any inconsistencies and anomalous readings including reasons for abandonment, reinstallation, etc., along with applicable observation in the vicinity of the instrument such as floor heave, water inflow, etc. Future reports are to contain comment on whether, in the opinion of Cargill, the instrument readings support or conflict with prior stability models especially in areas employing new mine, panel, or main configurations."

Closure measurements can be evaluated to indicate possible instability in three ways:

1. By studying the graphs of the rate of closure over time. The shape of these graphs indicates areas of instability, areas of concern, and areas of stability. Mr. Petersen evaluated the closure in this manner.

2. By establishing trigger values for total closure. This method is applicable in harder, less viscous rock, but not applicable for the Cayuga Mine, as stable closure in salt will continue until the openings are closed.

3. By establishing trigger values for long-term closure rates. Since this is not being completed by the other investigators, BOYD applied such trigger rates in its evaluation of the closure readings.

Closure rate data are significant because they offered insight into the collapses and the inundation of the Retsof Mine. Sustained closure rates of 15 inches/year or less were measured in stable areas of the Retsof Mine, while in the failure areas, closure was regularly measured with sustained rates over 230 inches/year with onset of failure around 600 inches/year. Although Retsof and Cayuga mines have different overburden and material properties, in the general sense, a comparison seems warranted for a relative indicator of stability.

In BOYD's review of the closure stations readings in 2008 and supplied by Cargill, it was noted that none of the readings exceeded 230 inches/year. Below is a list of the 10 highest measured closure rates in 2008 for areas of recent mining and areas within 1,000 ft of any mining that occurred in 2008.

Top 10 Closure Rates in Areas of Recent Mining

Closure Station	Rate of Closure, in/yr	Last Recorded Rate of Closure, in/yr	Notes
U56PIN #28	412.3	4.28	Mining Break-through
U58PIN #14	123.7	12.01	Initial Reading
U56PIN #29	92.7	10.22	Mining Break-Through
U58PIN #8	86.5	2.74	Initial Reading
E4PIN #2	83.2	11.6	Initial Reading
U56PIN #32	77.7	4.47	Initial Reading
U58PIN #17	76.2	25.14	Initial Reading
U54PIN #5	70.6	16.03	Initial Reading
U56PIN #38	66.7	47.6	Initial and 2nd Readings
U56PIN #35	64.5	16.30	Initial Reading

Top 10 Closure Rates Away from Recent Mining

Closure Station	Rate of Closure, in/yr
NW1PIN #25	1.329
U61PIN #2	1.253
NW2PIN #31	1.223
NW2PIN #33	1.209
NW2PIN #32	1.168
U12PIN #102	1.154
U55PIN #2	1.083
NW2PIN #26	1.013
U52PIN #2	0.971
NW2PIN #20	0.957

U-40B panel (the fill area) was considered separately from the top 10 lists since it is being filled due to instability. The top 10 closure rates for U-40B panel ranged between 0.895 inches/year (1B) to 1.402 inches/year (U40BPIN #7). The rates are not significantly different from the top 10 closure rates away from recent mining. Five closure stations were monitored on 4 Level and ranged from 0.297 to 0.591 in/yr. BOYD offers the following comments:

- Closure readings for recently mined areas are typically high. The highest of these readings near active mining was concentrated in the U-56 (6 of the 10) and U-58 (3 of the 10) panels, with only 2 of the 10 readings occurring in other areas: U-54 and E-4 panels. All of these 10 stations show dramatic reduction over time, indicating the ground is stable or is stabilizing. It is not surprising to BOYD that the concentration of these readings is located in the west side panels (9 of the 10) of the NW2 Mains, as all three of these panels were in production in 2008.

- For the 10 highest closure rates away from active mining, eight of them occurred within a 1,500-ft stretch along the NW2 Mains, and another is in U-61 panel close to the NW2 Mains. As noted in a prior annual review, the NW2 Mains and their panels appear to be closing at a higher rate than openings farther south.

- Rock Mechanics Assist[6] (RMA) also noted that the NW2 Mains are behaving differently, "In general there has been an increase in roof problems in the NW2 area compared to the NW1 area." In another letter by RMA[8] they note, "The NW2 area has performed differently from other areas of the mine in that the abutment notches are failing sooner and with greater intensity than what has been typical in the past..." Also, RMA notes, "The closure in this area does not seem to be any different than NW1..." BOYD questions that statement. They also note that "Some think the rocks are weaker in this area." This is a distinct possibility.

Extensometer data was included for the fist time and also reviewed. None of this information was alarming; however, extensometer 1 in the U-58 panel showed

movement 10 times that of the other extensometers. The location of this instrument could not be located on the supplied maps. However, it designation places it in the U-58 panel and it is another supporting reading that the northern part of this mine is behaving differently than the other portions of the mine.

Cargill notes that they have upgraded "...the microseismic monitoring system to digital format, doubled the number of geophones, and doubled the area being monitored." The Itasca[9] report discusses the plans and improvements for this system.

Special Condition 7.e.—requires the annual report include a "summary of subsidence monitoring data required by Special Condition 11." Special Condition 11 requires "Subsidence monitoring shall be conducted in accordance with the approved subsidence monitoring plan contained within the approved Mine Land Use Plan." Furthermore, "Exceptions to the trends shall be noted and explained. ..." Points applicable to Special Condition 7.e. were agreed upon at the August 2004 meeting and are noted above under Special Condition 7.d.

BOYD in its 2007 annual review, examined the subsidence data discussed in the 2008 Annual Report. These measurements were completed in December 2007. The subsidence data were reviewed by RMA in two letters, one concentrating on the east shore[5] of the lake and the other on the west[7] shore. RMA concluded in these letters that "...the subsidence over the east section of the mine is what is expected. The highest subsidence is at Station 38 along 34 South at around 1.1 feet from July 1979 to December 2007, about 28½ years." Additionally, "It is concluded from the subsidence measurements that the east end of the mine is stable."

RMA, in addressing subsidence on the west shore, based on a survey completed in January 2008, concluded that "The movement observed is appropriate and no instability appears to be indicated." RMA noted a heave in the subsidence profile and questions that this heave may be related to mining. Heave at the edge of a subsidence profile is sometimes associated with a stiff, thick rock unit near the surface. Since this area is associated with the Taugannock Delta and no stiff rock layer is at the surface, and considering the time of the year, this upward movement may be due to frost heave.

Special Condition 7.f.—requires the inclusion of "Information regarding the source and volume of any water inflow into the mine, and the disposition of such water." At the August 2004 meeting, it was agreed that a discussion about water disposal in 4 Level would be included in the Annual Report, noting: "Updates of Level 4 filling including data on shore line advance".

Cargill reported the total water inflow to 4 Level was 10,886,400 gallons, down from 13,507,200 gallons in 2007, the third year of decline. With this lower inflow, Cargill

estimates that 24.2 years of storage remain on 4 Level. Cargill reports that "A pumping system is being installed to bring the production shaft water to the ED plant for processing. This will reduce 16 gpm of shaft water inflow to about 7 gpm (at higher concentration) for mine storage, further extending the life of the ponds." Cargill included a 4 Level pond map, as noted above, and an Excel file, "UG Pond Volume Calcualtion 17Dec08.xls", which was created on January 7, 2009.

Special Condition 7.g.—requires the inclusion of "A summary of all other monitoring data required under the terms of this permit or Department SPDES permit issued to Cargill."

No SPDES data, or discussion on SPDES, were included in the Annual Report.

Special Condition 8—addresses non-routine incidents and is discussed under Special Condition 7.b.

Special Condition 9—addresses Mine Safety and Health Administration reporting involving non-routine mining incidents and is discussed under Special Condition 7.b. Cargill included no statement in the Annual Report about MSHA reports in connection with any non-routine mining incidents.

Special Condition 10—addresses reporting requirements "Prior to undertaking any material change in the approved mining methods or techniques. ..." This condition does not require the reporting to occur in the Annual Report.

Cargill makes no note of planned changes to the mine's configuration.

Special Condition 11—addresses subsidence monitoring as discussed under Special Condition 7.e. above.

Special Condition 12—addresses rock mechanics monitoring as discussed under Special Condition 7.d.

Special Condition 13—addresses the reporting and recording of citizen complaints. Cargill notes in the Annual Report that "no written citizen complaints" were received.

Site Visit

A site visit to discuss these findings and to discuss shaft designs with NYSDEC, Cargill, and BOYD should be arranged. Suggested areas of the mine to visit would include NW2 Mains between panels U-53 and U-57, U-59, U-40A, and U-40B panels, and the 20 Belt area.

Discussions at this meeting should include:

- The areas where the Annual Report was incomplete as addressed above.
- RESPEC re-evaluation of the geologic anomaly previously identified on seismic lines north of Frontenac Point and the geologic anomalies that are being encountered in the south reserves (S-3, E-3, and E-4 areas).
- The planned lake-borne seismic exploration program planned for May 2009, with processing and analysis during the summer and fall of 2009.
- Planned modification mentioned in Cargill supplied documents such as a new shaft, alternate slopes, and surge bin galleries.

Please contact us if you require additional information or if we may be of further service.

Respectfully submitted,

JOHN T. BOYD COMPANY
By:

Vincent A. Scovazzo
Director of Geotechnical Services

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