

April 2, 2007  
File: 2499.4

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 - 2007  
Cayuga Mine, Cargill, Inc.  
Seneca and Tompkins Counties, New York

Gentlemen:

John T. Boyd Company (BOYD) received a letter<sup>1</sup> and digital data from Cargill Deicing Technology (Cargill) on February 20, 2007 as a supplement to the 2006 Annual Report. The letter included a supporting report from Rock Mechanics Assist<sup>2</sup> and RE/SPEC<sup>3</sup>. 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 report received by BOYD starting with the 2006 Annual Report. The Annual Report<sup>4</sup> was received by BOYD on

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<sup>1</sup> Plumeau, David, 2007, untitled letter to Vincent A. Scovazzo, John T. Boyd Company, February 20.

<sup>2</sup> Rock Mechanics Assist, 2007, an untitled letter from Gary Petersen to David Plumeau of Cargill Deicing Technology, January 15.

<sup>3</sup> DeVries, Kerry L., Paul E. Nelson, Leo L. Van Sambeek, and William M. Goodman, 2007, "Mine Stability Assessment, Cayuga Mine," RESPEC Topical Report RSI-1913, prepared for Cargill Deicing Technology, January.,

<sup>4</sup> Cargill Deicing Technology, 2006, "Annual Report for Mine File #709-3-29-0052; Cayuga Salt Mine, Application ID# 0-9999-00075-00001," signed by Steve Horne, to Joseph Moskiewicz, NYS Department of Environmental Conservation, January 5.

March 6, 2007 from NYSDEC. This report was stamped received by NYSDEC on January 12, 2007.

These documents were reviewed for their adherence to conditions of the Permit<sup>5</sup> and in regard to discussions held at the Cayuga Mine among NYSDEC, Cargill, and BOYD on July 10, 2006.

#### 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."

A certification dated January 1, 2007, is included in the annual report and is signed by Steven J. Horne, Mine Manager – Cargill Deicing Technology.

**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."

The Annual Report states that Cargill "...is not aware of non-routine incidents..." but goes on to say that "A small floor rock roll was encountered in the U-57 panel and the E-3 panel continues to encounter a rock roll..." "Both of these have been or are being mined through..." Cargill, in their letter to BOYD<sup>1</sup> notes. "...work has begun on re-

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<sup>5</sup> 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.

evaluating the geologic anomaly previously identified on seismic lines north of Frontenac Point. At this time, development mining has stopped in the NW-2 mains...”

- The Cargill letter to BOYD also notes that “The U-40B area continues to converge more rapidly than was expected. The frequency of reading those instruments has been doubled, and plans are under way to begin backfilling that region with waste salt as soon as the conveyor system can be extended to U-42. This will be accomplished by April of 2007 at the latest. A barrier zone of 700 feet radius has been established to prevent any new mining influence from affecting the area. Sub-panels driven off U-54 will not approach the U-40B panel closer than 700 feet. An electronic closure monitoring system and three new stations have been installed to allow closer monitoring of the behavior in U-40B.”

Mr. Petersen<sup>2</sup> studied and reported on the conditions in the U-40B area and concluded that “There are a couple of areas where the closure rates are higher than typical, but not unstable. One of these areas is the U-40B Panel ... Even though the closure in U40B is higher than typical, the overall closure rates are decreasing ... indicating a stable panel.”

RESPEC<sup>3</sup> concurs with this assessment noting: “...The measured closure in Unit 40B is not perceived as particularly unusual or anomalous but it does warrant continued monitoring”. Part of RESPEC’s recommended monitoring included optimizing the seismic array to detect seismic events that may occur over U40B panel.

**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 format were supplied by Cargill to fulfill this condition. They are:

- Cargill Deicing Technology, 2006, “Cayuga Mine, 3YR Planning Map, 2006/2007 Fiscal Yr.” December, as “3 YR MINE PLAN 06-07(updated12-27-06md).dwg” also included as hard copy as Attachment 1A, Scale 1" = 500' to the Annual report.
- Cargill Deicing Technology, 2006, “Cayuga Mine, 3YR Planning Map, 2006/2007 Fiscal Yr.” December, as “Royalty.dwg” also included as hard copy as Attachment 1B, Scale 1" = 300' to the Annual report.
- Cargill Deicing Technology, 2006, “Cayuga Mine, 6 Level Workings, 3YR Planning Map, 2006/2007 Fiscal Yr.” December, as “mine outline with 1 yr mine plan (updated 1-17-07md).dwg” also included as hard copy as Attachment 1C, Scale 1" = 700' to the Annual report.

- Cargill Deicing Technology, 2006, "Cayuga Mine Closure (Inches)" as "cayuga mine contour closure jul-2006.dxf," July, included as a hard copy attached to the Annual report.
- Cargill Deicing Technology, 2006, "Cayuga Mine Closure Rate (Inches/Year)" as "cayuga mine contour rate jul-2006.dxf," July, included as a hard copy attached to the Annual report.
- Cargill Deicing Technology, undated, untitled as "Rock Roll Map.dwg,"
- Cargill Deicing Technology, undated, as "Complete Mine Overlay w\_Surface Subsidence."
- Cargill Deicing Technology, 2006, "Cayuga Mine, 4 Level Pond Map," January, as "4 Level Pond Map DEC06.Dwg." included as a hard copy, Scale 1" = 600' attached to the Annual report.

These maps show the extent of mining, proposed three-year mine plan, instrument locations, subsidence monument locations, closure, closure rates, and shorelines of both the 4 Level flooding and of Cayuga Lake. A short description of current and planned mining operations aided in understanding these maps.

**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. ..." "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."

Cargill forwarded closure stations in the form of Excel files. Mr. Petersen reviewed this data and presented his findings in the 2007 Rock Mechanics Assist letter<sup>2</sup> concluding:

- "It is concluded after a review of the rock mechanics data that the mine is globally stable."

- “There are a couple of areas where the closure rates are higher than typical, but not unstable. One of these areas is the U-40B Panel, and the other is where SW-2 crosses U-12.”

Closure measurement data are significant because they offered insight into the collapses, and inundation of the Retsof Mine. Sustained closure rates of 0.04 inches/day were measured in stable areas of the Retsof Mine, while in the failure areas, closure was regularly measured with sustained rates over 0.65 inches/day with onset of failure around 1.65 inches/day. 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 520 closure stations read in 2006 and supplied by Cargill, it was noted that none of the readings exceeded 0.65 inches/day. Below is a list of the ten highest measured closure rates in 2006 for areas of recent mining and for areas away from recent mining.

Table 1  
Top 10 Closure Rates in Areas of Recent Mining

Closure Station	Rate of Closure, in/yr	Last Recorded Rate of Closure, in/yr
U57PIN #11	0.4440	0.0535
U57PIN #15	0.3800	0.0192
U56PIN #8	0.3550	0.0090
U57PIN #13	0.3450	0.0180
U56PIN #9	0.3270	0.0058
U57PIN #7	0.3110	0.0058
U54PIN #23	0.2637	0.0442
mU57PIN #5	0.2510	0.0031
U57PIN #14	0.2510	0.0323
U62PIN #2	0.2380	0.0016

Table 2  
Top 10 Closure Rates Away from Recent Mining

Closure Station	Rate of Closure, in/yr	Last Recorded Rate of Closure, in/yr
NW2PIN #61	0.2485	0.0118
NW2PIN #62	0.2010	0.0031
U54PIN #19	0.1960	0.0177
NW2PIN #68	0.1630	0.0053
NW2PIN #63	0.1546	0.0149
NW2PIN #65	0.1503	0.0306
NW2PIN #66	0.1224	0.0190
U54PIN #11	0.1203	0.0157
U54PIN #10	0.1185	0.0157
NW2PIN #66	0.1085	0.0421

BOYD offers the following comments:

- Closure reading for recently mined areas are typically high. These readings, where concentrated in the U-54, U-56, U-57, and U-62 panels, are not higher than anticipated, and all show dramatic reduction in closure rate over time indicating the ground is stable or is stabilizing.
- High closure readings throughout the mine are near panels of recent mining or are affected by recent developments. These include U-54 (older areas) panel and the Northwest 2<sup>nd</sup> Main. Recent closure reading show that the closure rates for these areas are also reducing showing the ground is stable or is stabilizing.
- Rock Mechanics Assist<sup>2</sup> discusses the rapid closure rate in U-40B Panel. None of these rates were high enough to rank among the top ten. BOYD's review of these rates shows them to be 2.5 to 3.5 times rates measured at other similar location. However, there is a higher percent extraction in this area and higher rates should be expected. In BOYD's September 19, 2006 letter<sup>6</sup>, this area was discussed;

“U40B panel represents a major instability that, if not checked, can result in panel or global instability of concern to NYDEC. Many of the pillars observed were hour-glass shaped and spalled. The roof for the most part was stable, but did show signs of stress. To counteract this instability Cargill is moving waste salt fines into the area, and stacking the fines to within 1 to 2 inches of the roof. Plans are underway to place the fines in contact with the roof.”

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<sup>6</sup> John T. Boyd Company, 2006, “2006 Visit and Meeting at Cayuga Mine, Cargill, Inc.,” Letter to Mr. Steven M. Potter of New York State Department of Environmental Conservation, from Vincent A. Scovazzo, File: 2499.5, DRAFT, September 19.

In light of these 2006 closure readings, the panel does not appear to be an area of major imminent instability. However, this area is of concern and BOYD expects Cargill to proceed with the backfill operation.

RESPEC addresses this subject by noting, "Currently, the closure rate in the U40B is about 0.75 inches per year, which is about three times greater than typical closure rates currently exhibited in older panels at the mine. Based on the measured closure trend of U40B and other closure stations throughout the mine, the closure rate in U40B is expected to be less than 0.5 inches per year within 3 years. Thus, closure in Unit 40B is not perceived as particularly unusual or anomalous..."

- Rock Mechanics Assist<sup>2</sup> discusses the rapid closure rate where SW 2 Panel crossed the U-12. Again this site does not have closure rates in the top ten. BOYD does not view this area as unstable or anomalous.
- Station locations and frequency of readings are acceptable for providing an indication of global mine and panel stability.
- Closure station results provide a strong indication that the Cayuga Mine is globally stable.

Rock Mechanics Assist provided two maps to aid in review of the closure measurements:

- "Cayuga Mine Closure Rate July 2006"
- "Cayuga Mine Closure July 2006"

**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." "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.

No subsidence surveys were completed but it is reported that recommendations made by Rock Mechanics Assist on modifying the subsidence grid have been completed. A subsidence survey is to be completed in 2007. Review of these readings and comments on the modified grid will be undertaken during the review of the 2007 annual report.

**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 averages 24 gallons per minute (gpm) with sources from the shafts and ED plant. Water discharge has been reduced from 18 gpm to 0 because of the completion of the second phase expansion of the ED treatment plant. Cargill estimates that 17 years of storage remain on 4 Level.

The following were included in the Annual Report to document water storage on 4 Level:

- Cayuga Mine, 2006, "4 Level Pond Map, Updated: 6 Dec 2006," scale 1" = 600', January. Note that the map date is likely in error, possibly January 2007 or December 2006. This map shows the pond limit as of January 2007 a date which contradicts the Annual Report that notes the pond levels were checked in November. This map is also presented as AutoCAD file "4 Level Pond Map DEC06.Dwg."
- Excel file "UG Pond Volume Calculation 6Dec06.xls." Note that this spreadsheet shows that 18,272,329 gallons of brine have been added to 4 Level in 2006. This spreadsheet is also included as a table in the Annual Report.

RESPEC<sup>3</sup> noted Cargill directs excess storm water into the 4 Level where it erodes the pillars. They note that this "...practice raises concern both for the local stability of the #4 salt level and the creation of leakage to the underlying #6 salt level..." However, this storm water is not now being directed into the #4 Level.

**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.

SPDES data and a short discussion are 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 also notes in the Annual Report that Cayuga Mine has not been cited by MSHA 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 with NYSDEC, Cargill, and BOYD should be arranged. 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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