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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 - 2009
Cayuga Mine, Cargill, Inc.
Seneca and Tompkins Counties, New York

Gentlemen:

On February 2, 2010, John T. Boyd Company (BOYD) received from Mr. David Plumeau a letter¹ dated January 29, 2010, from Cargill Deicing Technology (Cargill). Included with this letter was the 2009 Annual Report², hard copies of maps and a CD. This CD included electronic copies of the maps as AutoCAD® files, extensometer and closure readings, and a consultant report from Mechanics Assist³. Additional data was received via email from David Plumeau on March 11, 2010.

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.

¹ Plumeau, David, 2010, untitled letter to Vincent A. Scovazzo, John T. Boyd Company, January 29.

² Cargill Deicing Technology, 2009, "Annual Report for Mine File #709-3-29-0052; Cayuga Salt Mine, Permit ID#0-9999-00075-00001," from Russell Givens to Matthew Podnieszinski of NY Bureau of Resource Development Section.

³ Rock Mechanics Assist, 2009, an untitled letter from Gary Petersen to Bill Gracon of Cargill Deicing Technology, April 10.

The documents were reviewed for their adherence to conditions of the Permit⁴ and in regard to discussions held at the Cayuga Mine among NYSDEC, Cargill, and BOYD on September 16, 2009. The Cargill 2009 Annual Report is accepted but falls short in the following areas:

- RESPEC's re-evaluation of geologic anomalies and the seismic analysis was expected in this Annual Report.
- Most AutoCAD maps supplied were overlays, and unfortunately, no AutoCAD base map was included thus, the conversion map was used as the base.
- No map or overlay is included to show roof falls and floor rolls.
- Surfer® files were not reviewed. *convergence type + rate included in this file*
- No notes or reports from Frank Locotos are included in the Annual Report. — *no rock mechanic analysis - he is just a bolt salesman.*
- The Cayuga Mine has not received any citations from MSHA regarding non-routine mining incidents, but no note was made of reports or letters from MSHA concerning any non-routine mining incidents.

At the next meeting, Cargill, NYSDEC, and BOYD should discuss submitting the maps only as AutoCAD files with no hard copies. Surfer files will continue to be supplied as hard copies or converted to an AutoCAD file.

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 was included on page 1 §13.a.1.

⁴ 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.

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.”

Cargill included a statement in the Annual Report page 1, § 13.a.2 that “The Cayuga Mine is not aware of any non-routine incidents ...” that would affect mine stability, ground and surface water, natural resources, and the general public.

Noted in the Annual Report;

- For the fourth year in a row, the annual report has noted that Cargill is 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 last year’s 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)”, which is reiterated in this year’s letter to BOYD. Also noting that
 - “No further mining will be done toward the northern reserves until that evaluation shows that it is prudent.” And,
 - “Lake borne seismic exploration was conducted in June of 2009, with processing and analysis during the fall of 2009.”
- Further addressing U-40B, Cargill’s letter to BOYD¹ notes that “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 have used 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 unduly affecting the area. A map of the backfill progress and plans is included here.” This map was included as file U-40B.DWG which was created and last modified January 28, 2010 and contains a map entitled “Backfill Map – U40B, Mapped 1/19/10” and shows area filled and to be filled and the location of the micro-seismic wire. The hard copy map title was “Backfill Map – U40B”.

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:

- A hard copy map; Cargill Deicing Technology, 2009, "Complete Mine Overlay Map, Cayuga Mine, 6 Level Workings" scale 1" = 1,400' and AutoCAD file; Complete Mine Overlay w Surface Subsidence.dwg created and last modified January 29, 2010, shows subsidence monument locations, shore line, and 4 Level. No hard copy supplied.
- A hard copy map; Cargill Deicing Technology, 2009, "Cayuga Mine, 3 YR Planning Map, 2009/2010 Fiscal Yr." scale 1" = 700', December and AutoCAD file; YR MINE PLAN 09-10(updated12-09-09md).dwg created and last modified January 28, 2010. This map shows planned expansion through fiscal year 2012-2013.
- A hard copy map; Cargill Deicing Technology, 2009, "Cayuga Mine, Mine Royalty Map, 2009/2010 Fiscal Yr." December, scale of 1" = 700' and AutoCAD file; ROYALTY.dwg, created January 2009. Map shows fiscal year production areas from 6/1/02 through 12/31/09. Legend is in need of an update.
- A hard copy map; Cargill Deicing Technology, 2009, "Cayuga Mine, 4 Level Pond Map, Updated: 8 Dec 2009", Scale 1" = 600', January and AutoCAD file; "4 Level Pond Map MLRP Version 8Dec09.Dwg" created and last modified January 28, 2010. This map shows filled levels to January 1, 2010 and remaining potential pond area.
- AutoCAD file; "4 Level Convergence Map.dwg" created and last modified January 28, 2010. This map shows closure station locations.
- A hard copy map; undated, "4A Level Instrumentation Map", scale 1" = 100' and AutoCAD file, "4A Level for JT Boyd.dwg" created and last modified January 22, 2010. This map shows closure stations locations.
- A hard copy map; undated and untitled, dcale 1" = 100' and AutoCAD file; "4-Level GAs Old Pond Drift.dwg", created and last modified January 28, 2010.
- A hard copy map; undated and untitled, scale 1" = 50' and AutoCAD file; "PAMELPASS.DWG" created and last modified January 29, 2010 showing new installation locations of extensometers along 13 belt.
- An untitled AutoCAD file; "Screen Plant Horizontal Roof Ext Dwg to Excel.dwg" created and last modified January 13, 2010 showing map and cross-section view of installation locations of near horizontal extensometers in the roof of the screen plant gallery.

- A hard copy map; undated, "Unit # 5 Screenplant," Scale 1" = 50' and AutoCAD file; "Screen Plant Instrumentation.dwg" created and last modified January 28, 2010 showing instrument locations in and around the screen plant gallery.
- A hard copy map; undated, "Current Surge Bin Instrumentation Map as of 9-09" and AutoCAD file; "Surge Bin instrument Map to JT Boyd.dwg" created and last modified January 28, 2010. showing instrument locations in and around the screen plant gallery.
- A hard copy map; undated, "4 Level Base Map, Scale 1" = 100'.
- A hard copy map; Cargill Deicing Technology, 2008, "Cayuga Mine Closure (Inches) Sep-2009" showing closure of the 6 Level. A Surfer file; "Cayuga Mine Contour2009 Closure Sep-2009.srf" created and last modified January 25, 2010. Surfer files were not reviewed.
- A hard copy map; Cargill Deicing Technology, 2008, "Cayuga Mine Closure Rate (Inches/Year) Sep-2009" showing closure of the 6 Level. A Surfer file; "Cayuga Mine Contour2009 Rate Sep-2009.srf" created and last modified January 25, 2010. Surfer files were not reviewed.
- A hard copy map; Cargill Deicing Technology, undated, "Cayuga Mine, Convergence Pin Map" scale 1" = 700' and AutoCAD file; "Convergence Map w-Basemap Outline.dwg" created and last modified January 28, 2010.

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 of Rock Mechanics Assist (Cargill geotechnical consultant) 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 for 2009, it was noted that none of the readings exceeded 230 inches/year. Below is a list of the 10 highest measured closure

rates in 2009 for areas of recent mining and areas within 1,000 ft of any mining that occurred in 2008 or 2009.

Top 10 Closure Rates in Areas of Recent Mining

Closure Station	Rate of Closure (in/yr)	Last Recorded Rate of Closure (in/yr)	Notes
U58PIN#19	98.915	5.020	Initial rate
U54DPIN#11	90.885	1.186	2nd rate
U58PIN#17	76.163	9.646	Initial rate
E5PIN#5	71.175	12.273	Initial rate
E5PIN#2	69.289	10.756	Initial rate
U54DPIN#12	67.160	7.057	Initial rate
U58PIN#23	66.691	11.576	Initial rate
E4PIN#4	57.305	5.854	Initial rate
E5PIN#6	57.050	8.349	2nd rate
U54DPIN#5	55.480	7.057	2nd rate

Top 10 Closure Rates Away from Recent Mining

Closure Station	Rate of Closure (in/yr)	Last Recorded Rate of Closure (in/yr)	Notes
U12PIN#102	1.629	0.924	near U14 and U16
U12PIN#14	1.148	0.730	Installed perm. rod
W1PIN#7A	0.942	0.501	Reading marked with a ?
U12PIN#28	0.931	0.927	Reading marked with a ?
U12PIN#32	0.919	0.830	Reading marked with a ?
U49PIN#12	0.919	0.919	
U49PIN#10	0.869	0.869	
U54PIN#1	0.827	0.827	
U53PIN#2	0.818	0.527	
W1PIN#2	0.812	0.750	78.9°F, 50% H

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 in the area of U-40B panel ranged between 0.876 inches/year (U44PIN#2) to 3.426 inches/year (U40B Digital 3B). The rates are not significantly different from the top 10 closure rates away from recent mining but they are higher than last year. Rock Mechanics Assist⁵ (RMA) also noted this condition; "It is a little disconcerting that we do not understand why the closure rate trend is increasing, but the increase is small and the area is well on its way to being backfilled..."

⁵ Petersen, Gary, 2009, Untitled letter from Rock Mechanics Assist to Bill Gracon of Cargill Deicing Technology, April 10.

Five closure stations were monitored on 4 Level and ranged from 0.297 to 0.545 in/yr and five closure stations were monitored on 4A Level and ranged from 0.134 to 0.421 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 three areas; the U-54D (3 of the 10 readings), U-58 (3 of the 10, same as last year), and E-5 panels (3 of the 10), with only one reading occurring elsewhere: E-4 panels. All of the 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 (6 of the 10) of the NW-2 Mains, as all three of these panels were in production in 2008 and 2009.
- The 10 highest closure rates away from active mining, occurred throughout the mine with 4 of 10 occurring in U-12 Panel, 2 along 20 Belt, 2 in U-49 Panel and one each in U-53 and U-54. Noted in prior annual reviews, the NW-2 Mains and their panels appear to be closing at a higher rate than openings farther south. However, this is not the case this year with closure more even throughout the mine suggesting mine stability but is contradicted by a slight increase in overall closure rate throughout the mine.
- RMA⁵ also noted the high closure rates in panel U12 and Belt 20. for U12, RMA specifically pointed to stations 102 and 14 and cautions that "This is starting to look a little bit like U-40B." For Belt 20, RMA is more concerned with W1PIN#6A than those noted by BOYD.
- RMA noted poor ground conditions for the U-61 Panel and theorizes that this is the result of 1) the panel sitting idle for a long period of time, 2) stopping on a rock roll, and 3) build up of abutment stress in front of the panel. The first two points are likely the case. RMA suggests two solutions 1) narrowing and splitting the stress control fingers at panel edge without addressing the reason for these fingers and 2) use of an 8 ft to 10 ft long 7/8 in. diameter Dywidag® type bolt with 2 ft to 3 ft of resin for an anchor. The bolt recommendation may be for all "high stress areas" and not particularly intended for U-61. The grade of the bolt was not recommended. Closure results did not draw attention to this area.

This is the second year for the inclusion of extensometer data. A measurement of 1 in./yr is often accepted as a convenient point in examining extensometer data as this value is close to, but normally less than, the value required for bed separation (opening of bedding planes). Thus, none of this information was alarming; however, BOYD was unable to determine the rod readings units but assumed them to be in inches. Extensometer 1 in the U-58 panel last year showed movement 10 times greater than other extensometers.

The data on the extensometers did not note whether the extensometers were located in the roof or rib with the exception of those located in the screening plant area and those located in the surge bin roof. Only those in the screen plant noted the inclination. This should be addressed in the next annual report.

The top ten extensometer rates for 4 Level all occurred in the roof and pillars of the surge bin area, and 6 of the top 10 were from two stations; 25 and 27. RMA⁵ also noted that "The area of the Surgebin that has the highest rate of roof expansion ..." and "This area has been bolted numerous times and has experienced several bolt failures over the years." It was noted on December 9, 2009 that the extensometers in the area of 4 Level pump station are now inaccessible and will no longer be monitored.

Top 10 Extensometer Rates for 4 Level

Extensometer Location	Station	Bay 1 Rate of Movement, in/yr	Bay 1-2 Rate of Movement, in/yr	Bay 2-3 Rate of Movement, in/yr	Total Rate of Movement, in/yr
Surge Bin Roof	#27	0.000	0.281	0.014	0.295
Surge Bin Roof	#27	0.000	0.281	0.014	0.295
Surge Bin	#25	0.115	0.063	0.075	0.253
Surge Bin	#25	0.183	0.154	-0.098	0.239
Surge Bin	#25	0.183	0.154	-0.098	0.239
Surge Bin Roof	#22	0.000	0.224	0.012	0.235
Surge Bin Roof	#27	0.000	0.208	0.004	0.212
Surge Bin	#50	0.103	0.071	0.004	0.178
Surge Bin Roof	#22	0.000	0.160	0.011	0.171
Surge Bin	#50	0.082	0.061	0.009	0.152

The top ten extensometer rates on the 6 Level were all in the screen plant area.

Top 10 Extensometer Rates for 6 Level

Extensometer Location	Station	Bay 1 Rate of Movement, in/yr	Bay 1-2 Rate of Movement, in/yr	Bay 2-3 Rate of Movement, in/yr	Total Rate of Movement, in/yr
Sreen Plant Pillar	H-Pillar A-Hole 3 Tun	0.020	0.017	0.243	0.281
Sreen Plant Horizontal	STA 4B	0.003	-0.003	0.238	0.238
Sreen Plant Pillar	G-Pillar B-hole 1 Tun	0.046	0.066	0.103	0.215
Sreen Plant Pillar	H-Pillar A-Hole 3 Tun	0.012	0.037	0.155	0.205
Sreen Plant Pillar	H-Pillar A-hole 1 Tun	0.063	0.047	0.090	0.199
Sreen Plant Pillar	G-Pillar B-hole 1 Tun	0.042	0.057	0.099	0.197
Sreen Plant Horizontal	STA 2B	0.015	0.128	0.035	0.178
Sreen Plant Horizontal	STA 4B	-0.005	-0.005	0.184	0.174
Sreen Plant Horizontal	STA 4A	-0.039	0.044	0.164	0.169
Sreen Plant Horizontal	STA 4A	-0.070	0.008	0.222	0.161

Cargill notes that they have upgraded "...the microseismic monitoring system to digital format, doubled the number of geophones, and doubled the area being monitored."

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 last presented subsidence data discussed in the 2008 Annual Report. These measurements were completed in December 2007 concluding that this data supported a conclusion that the mine is stable.

Section 13.a.5 of the Annual Report noted that "No Subsidence surveys were conducted this year."

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 10,401,624 gallons, down from 10,886,400 gallons in 2009, the fourth year of decline. With this lower inflow, Cargill estimates that 24.3 years of storage remain on 4 Level. Cargill included a 4 Level pond map, as noted above, and an Excel file, “UG Pond Volume Calculation 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.”

SPDES data and a discussion of this data is included in the Annual Report. This data is to be reviewed by NYSDEC.

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 includes a statement on page 6, § 13.c. of the Annual Report that “The Cayuga Mine has not received any citations from MSHA regarding non-routine mining incidence, but does not note reports or letters from MSHA concerning 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 notes “There have been no changes to the Cayuga Mine layout in the past year.” but 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. Suggested areas of the mine to visit would include the screen plant and U-12, U-12A, and E-5 panels.

Discussions at this meeting should include:

- The areas where the Annual Report was incomplete as addressed above.
- The increase in closure rate in the backfill area.
- The slight increase in overall closure rate throughout the mine.
- Extensometer rod reading units.
- Location and inclination of extensometers.

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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