

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Tommy G. Thompson, Governor
George E. Meyer, Secretary

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May 15, 1997

IN REPLY REFER TO: 2720-2

Ms. Jana Murphy
Flambeau Mining Company
N4100 Highway 27
Ladysmith, WI 54848

Dear Ms. Murphy:

The Department has completed its review of the documents submitted by Flambeau Mining Company pertaining to pit backfilling. Specifically, the three documents are, 1997 Backfilling Plan for Stockpiled Type II Material (March 1997), Addendum No. 1 to the 1997 Backfilling Plan for Stockpiled Type II Material (April 17, 1997), and Updated Resident Project Representative Manual (April 1997). Flambeau must respond to the following comments and questions before implementing the 1997 Plan.

1997 Backfilling Plan for Stockpiled Type II Material

1. Inconsistent units are reported for specific conductance in the report. Most of the tables and discussion refer to uS/cm, but in Tables 4-9, 4-14 and 4-18 the units are mS/cm. Please indicate if these are the appropriate units or simply a typographical error.
2. In regard to classifying material for purposes of determining the appropriate limestone addition rate, section 4.1.6 states "The accuracy of the classification improves when one hour conductivity and pH criteria are used." If the accuracy of the classification improves with the use of the shake flask test, why does the proposed plan use the paste determinations for purposes of classification?
3. What is the justification for establishing the conductivity criteria at 2200 uS/cm? In reviewing the data presented in Figure 4-10, it would appear that the criteria could reasonably have been set at a value around 1800 uS/cm.
4. Results presented in section 4.4 do not absolutely establish that the Type I material will not require on-going sampling and analyses as backfilling of that stockpile occurs. Additional discussion between the department and Flambeau Mining Co. concerning the procedures used for Type I material handling will be needed.

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5. The stated objectives for sampling and analyzing backfilled material were to confirm the adequacy of the limestone addition rate and verify the effectiveness of the blending of the limestone with the waste rock. While the results presented in the report would seem to indicate that these objectives were achieved, there is no explicit statement to that effect. Please indicate whether the stated objectives were satisfied through the testing program.

Updated Resident Project Representative Manual

1. Section 3.1.3 - Provide additional detail concerning the methods for delineating the boundaries of areas requiring different limestone addition rates. Whatever methods are used, the delineation must be obvious to the operators, QA/QC staff and Department inspectors.

The manual should also include a contingency with a fallback limestone application rate if, for some reason, the laboratory is unable to provide the analytical results in a timely manner.

2. Page 7 - In the case of large areas of C class material with varied application rates, use of an average rate is not acceptable. Either the actual rate for each block must be applied or, if a single application rate is desired, the highest rate should be applied over the entire area.

3. Section 3.2 - We have concerns with the application of limestone directly from the over the road dump trucks used to transport the limestone to the site. If this procedure is used, when will the limestone material testing, described in section 3.2.2, be conducted? The results of these analyses must be obtained prior to application of the limestone. If the testing issue is resolved, this method could be used in large areas of uniform application rates, but it is not clear how direct delivery of the limestone could be used in areas where multiple application rates are warranted. How would the proper weight of limestone be determined for the discrete blocks of waste material?

Only material for which representative test results have been obtained should be used in the backfilling operations. As described in the report, test results must be obtained prior to use of the material so that adjustments in the rate of application can be made to compensate for lower quality material.

4. Page 12 - The manual should specify a tolerance limit for compaction and procedures to ensure this limit is achieved. It is our understanding that compaction to the 85% Proctor is the current target implemented in the field.

5. Section 4 - It is unclear why Flambeau believes the testing described in this section is "voluntary". Much of the information described here, particularly the alkalinity/acidity testing and density testing of backfilled material are necessary components of a sound QA/QC program to verify the effectiveness of the backfilling procedures. Test results should be provided to the department and modifications to the testing program must not occur without department concurrence.

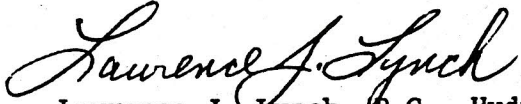
6. Section 4.2.1 - It is not clear what is meant by "new (other than already tested) Type II waste rock". Please clarify this reference.

7. Appendix A, step 5 - The protocol should include specific measures for determining when the pH and conductivity reading have "stabilized". Please indicate how this determination is made.

Further, we also expect Flambeau to continue the practice of providing weekly schedules of anticipated backfilling activities to the Department and notifying the Department in a timely manner if significant deviations from the schedule develop over the course of the week. Schedules and notification of significant changes should be sent to me and to Ken Markart in Rhineland.

Please contact me if you have any questions or additional concerns regarding this matter.

Sincerely,



Lawrence J. Lynch, P.G., Hydrogeologist
Statewide Mining Team Leader
Bureau of Waste Management

LJL:pc

cc: Jerry Sevick - Foth & Van Dyke
Ken Markart - NCD
Tom DeWitt - NWD
Tom Portle - WA/3

FM
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**Kennecott
Minerals**

May 16, 1997

Mr. Lawrence J. Lynch
Statewide Mining Team Leader
Bureau of Waste Management
101 South Webster Street
Madison, WI 53707-7921

Dear Mr. Lynch:

RE: 1997 Backfill Plan - Response to Department Comments (File Ref. 2720-2)

Flambeau Mining Company (Flambeau) had provided to the Department for review three documents pertaining to the pit backfilling, 1997 Backfilling Plan for Stockpiled Type II Material (March 1997), Addendum No. 1 to the 1997 Backfilling Plan for Stockpiled Type II Material (April 17, 1997), and Updated Resident Project Representative Manual (April 1997) (Updated RPRM). Until the Department provided approval for the 1997 Backfilling Plan, Flambeau continued backfilling operations in accordance with the Department approval dated October 25, 1996. Pursuant to the Department's comments dated May 15, 1997, Flambeau is providing this response prior to implementing the 1997 Backfilling Plan on May 19, 1997.

Following are the Department's comments with Flambeau's response immediately after.

1997 Backfilling Plan for Stockpile Type II Material

WDNR Comment 1: *Inconsistent units are reported for specific conductance in the report. Most of the tables and discussion refer to $\mu\text{S}/\text{cm}$, but in Tables 4-9, 4-14 and 4-18 the units are mS/cm . Please indicate if these are the appropriate units or simply a typographical error.*

Flambeau Response: The units in Tables 4-9, 4-14, and 4-18 should be $\mu\text{S}/\text{cm}$.

WDNR Comment 2: *In regard to classifying material for purposes of determining the appropriate limestone addition rate, section 4.1.6 states "The accuracy of the classification improves when one hour conductivity and pH criteria are used." If the accuracy of the classification improves with the use of the shake*

flask test, why does the proposed plan use the paste determinations for purposes of classification?

Flambeau Response: Paste determinations were selected for classification purposes for the following reasons: 1) turn around for classification of waste rock is accelerated; 2) accuracy demonstrated by testing was determined to be adequate; and 3) conservatism which has been built into the classification method does not require a higher degree of accuracy. In addition, as outlined in Section 4.5.1.3 of the March 1997 report, two separate cutoff criteria were established for material classification based on the test work done in the fall and winter of 1996/97. These criteria take into consideration the effect of the duration of the paste parameter extractions.

WDNR Comment 3: *What is the justification for establishing the conductivity criteria at 2200 $\mu\text{S}/\text{cm}$? In reviewing the data presented in Figure 4-10, it would appear that the criteria could reasonably have been set at a value around 1800 $\mu\text{S}/\text{cm}$.*

Flambeau Response: The 2200 $\mu\text{S}/\text{cm}$ criterion is based on the relationships between the acidity versus conductivity and sulfate versus conductivity as determined by the 1996/97 testing program.

Figure 1 attached shows a plot of the acidity measured in the column tests as a function of the conductivity. The plot clearly shows that the acidity in the range where conductivity is below 2,200 $\mu\text{S}/\text{cm}$ is very low. Acidity becomes significant only above this conductivity, and it therefore represents a reasonable criterion.

Figure 2 attached shows a plot of the sulfate concentration as a function of conductivity. Since sulfate salts in the pore water represent acidity with the exception of calcium and magnesium, and since conductivity is a direct indication of the sulfate concentration as shown in Figure 2, conductivity can be used to infer acidity in the pore water. Figure 2 shows that the sulfate concentration exceeds 2,000 mg/L only above a conductivity of about 2,200 $\mu\text{S}/\text{cm}$. Below this conductivity the sulfate concentration flattens out at about 1000 mg/L, which represents equilibrium conditions with gypsum and will have calcium associated as the cation. The difference in sulfate concentration between gypsum equilibrium and the cut-off of 2,200 $\mu\text{S}/\text{cm}$, i.e. 2,000 less the 1,000 mg/L, represents acidity. (Assuming that the difference in the sulfate concentration represents acidity is very conservative since magnesium which will not be precipitated at a pH of 7 may also be dissolved in the pore

water.) A sulfate concentration of 1000 mg/L represents an acidity of about 20.8 meq/L. At a solids to liquid ratio of 1:1, as used in the paste (and leach extraction) procedure, this represents an available acidity of 20.8 meq/kg, or an acidity of about 1.04 mgCaCO₃ eq./g. This is equal to an alkali demand of 1.04 mgCaCO₃ eq./g, or 2.08 lb/ton. If this is multiplied by 1.48, as determined for the limestone availability etc., an alkali application rate of 3.07 lb/ton would result. Compared to the planned application rate of 4.2 lb/ton for the Class A materials, the criterion of 2,200 µS/cm is conservative.

The use of a 2,200 µS/cm criterion to differentiate between Class B and C material is conservative because below the indicated pH free acidity is of prime concern. The lowest paste pH observed in the field is on the order of 1.5 s.u. This represents an acidity of about 31.6 meq./kg or an acidity of about 1.58 mg CaCO₃ eq./g. This is equal to an alkali demand of 3.16 lb/ton or 4.64 lb/ton as corrected for limestone availability. This value added to the maximum salt equivalent alkali addition rate of 3.07 lb/ton is equal to an addition rate of 7.71 lb/ton, which is less than the 8.4 lb/ton Class B material application rate.

WDNR Comment 4: *Results presented in section 4.4 do not absolutely establish that the Type I material will not require on-going sampling and analyses as backfilling of that stockpile occurs. Additional discussion between the Department and Flambeau Mining Co. concerning the procedures used for Type I material handling will be needed.*

Flambeau Response: Flambeau recognizes the need for discussions with the Department regarding handling of Type I material. A submittal to the Department describing Type I handling procedures is forthcoming.

WDNR Comment 5: *The stated objectives for sampling and analyzing backfilled material were to confirm the adequacy of the limestone addition rate and verify the effectiveness of the blending of the limestone with the waste rock. While the results presented in the report would seem to indicate that these objectives were achieved, there is no explicit statement to that effect. Please indicate whether the stated objectives were satisfied through the testing program.*

Flambeau Response: The sampling of backfilled material confirmed that the limestone was effectively blended during the relocation process. While the target pore water pH was met for the backfilled material, some variability in the paste parameters can be tolerated in the backfill without adversely affecting pore

Mr. Larry Lynch
Wisconsin Department of Natural Resources
May 16, 1997
Page 4

water quality. Therefore the objectives for sampling and analyzing backfilled material were found to be met.

Updated Resident Project Representative Manual

WDNR Comment 1: *Section 3.1.3 - Provide additional detail concerning the methods for delineating the boundaries of areas requiring different limestone addition rates. Whatever methods are used, the delineation must be obvious to the operators, QA/QC staff and Department inspectors.*

The manual should also include a contingency with a fall back limestone application rate if, for some reason, the laboratory is unable to provide the analytical results in a timely manner.

Flambeau Response: The limestone application rate boundary areas on the Type II Stockpile will be determined as follows:

Limestone application to each established application area will be conducted under the direct supervision of the QA/QC project representative responsible for limestone application documentation. A lift plan for each application area, including the established boundary points, will be used by the limestone QA/QC project representative in conjunction with the limestone calculations establishing the quantity of limestone required for each application area. To control the limestone application process, application area boundaries will be delineated by placing flagging or lath at the application area boundaries. The flagging or lath will be labeled with the applicable x,y coordinates.

Flambeau does not intend to backfill material for which analytical data is not available. The relatively large stockpile area will provide sufficient flexibility to allow backfill operations to continue in other areas where analytical data is available.

WDNR Comment 2: *Page 7 - In the case of large areas of C class material with varied application rates, use of an average rate is not acceptable. Either the actual rate for each block must be applied or, if a single application rate is desired, the highest rate should be applied over the entire area.*

Mr. Larry Lynch
Wisconsin Department of Natural Resources
May 16, 1997
Page 5

Flambeau Response: In the case of large areas of C class material with varied application rates, the actual rate for each block of material will be used or the highest rate incorporated within the large area of C class material will be used as the application rate.

WDNR Comment 3: *Section 3.2 - We have concerns with the application of limestone directly from the over the road dump trucks used to transport the limestone to the site ...*

Only material for which representative test results have been obtained should be used in the backfilling operations. As described in the report, test results must be obtained prior to use of the material so that adjustment in the rate of application can be made to compensate for lower quality material.

Flambeau Response: Flambeau will not directly deposit limestone on the waste rock. The limestone stockpile area will continued to be used. Limestone will be quantified by weighing prior to application on the designated area.

Flambeau has established limestone specifications for its suppliers. Testing of the limestone has been completed by Flambeau prior to contracting with its suppliers to determine if the material they will supply meets the specifications. As stated in Section 3.2.2 of the Updated RPRM, Flambeau is testing the limestone on a specified schedule to verify that it continues to meet specifications. This process is common in the construction industry (ie, as applied to landfill clay liner installation). History to date indicates that the process in use at the mill is quite effective. Flambeau does not feel it is necessary or appropriate to further test limestone prior to use.

WDNR Comment 4: *Page 12 - The manual should specify a tolerance limit for compaction and procedures to ensure this limit is achieved. It is our understanding that compaction to the 85% Proctor is the current target implemented in the field.*

Flambeau Response: The Field Compaction Test (August 1996) reported on a study performed during June 1996 which demonstrated that a minimum of two passes of a sheepsfoot compactor or haul truck achieves optimum compaction. Two passes of compaction determine the release of a backfill area for further backfilling. Density measurements are used as a means to verify that two passes continue to remain sufficient; not as a means of lift release.

Mr. Larry Lynch
Wisconsin Department of Natural Resources
May 16, 1997
Page 6

WDNR Comment 5: *Section 4 - It is unclear why Flambeau believes the testing described in this section is "voluntary". Much of the information described here, particularly the alkalinity/acidity testing and density testing of backfilled material are necessary components of a sound QA/QC program to verify the effectiveness of the backfilling procedures. Test results should be provided to the Department and modifications to the testing program must not occur without Departmental concurrence.*

Flambeau Response: Flambeau refers to the testing as "voluntary" since the testing is not specifically required by standard, code or permit requirements. Flambeau has chosen to incorporate the testing described in Section 4 into its QA/QC plan. The results of previous test work (lab and field) indicate that the methodology utilized during backfill does result in sufficient alkali amendment and optimal compaction. All QA/QC data will be readily available for review by Department representatives at the Flambeau Mine site.

Flambeau will discuss with the Department any proposed modifications to the QA/QC program. An example of a modification would be the suspension of a test. Field refinements will occur as necessary to meet the intent of the QA/QC program. An example of a refinement would be the adjustment to the specific lab procedures.

For your information, Specific Gravity (s.g.) Testing for Type II Material will be completed in accordance with ASTM C 127 - *Test Method for Specific Gravity and Absorption of Coarse Aggregate* not ASTM D 854 - *Standard Test Method for Specific Gravity of Soils*, as stated in Sections 4.2.1 and 4.2.2.1 of the Updated RPRM.

WDNR Comment 6: *Section 4.2.1 - It is not clear what is meant by "new (other than already tested) Type II waste rock." Please clarify this reference.*

Flambeau Response: "New (other than already tested) Type II waste rock" refers to waste rock which substantially differs from materials previously tested. A Substantial difference will be determined by soil/rock characteristics which may include geology, lithology, gradation, coloration, density, etc.

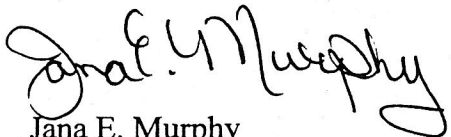
WDNR Comment 7: *Appendix A, step 5 - The protocol should include specific measures for determining when the pH and conductivity reading have "stabilized". Please indicate how this determination is made.*

Mr. Larry Lynch
Wisconsin Department of Natural Resources
May 16, 1997
Page 7

Flambeau Response: The pH and conductivity meters used in the Flambeau lab are equipped with "ready" indicators that determine when the pH or conductivity reading has stabilized. Lab technicians require the instrumentation to indicate it has stabilized prior to recording the measurements.

If you have any questions regarding this submittal, please contact me at (715) 532-6690 Ext. 742.

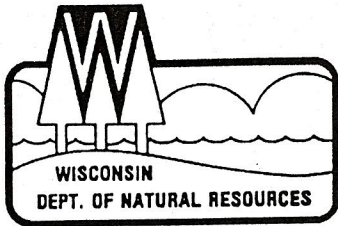
Sincerely,



Jana E. Murphy
Environmental & Reclamation Manager

Attachments

cc: Jeff Earnshaw, Flambeau
Ken Markart, WDNR
Thure Osuldsen, Rusk Co.
Melvin Spencer, Rusk Co. Zoning
Al Christianson, City of Ladysmith
Tom Riegel, Town of Grant
Jim Hutchison, Foth & Van Dyke



FILE 21
State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Tommy G. Thompson, Governor
George E. Meyer, Secretary

PO Box 7921
101 South Webster Street
Madison, Wisconsin 53707-7921
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May 30, 1997

IN REPLY REFER TO: 2720-2

Ms. Jana Murphy
Environmental & Reclamation Manager
Flambeau Mining Company
N4100 Highway 27
Ladysmith, WI 54848

Dear Ms. Murphy:

The department has reviewed Flambeau's responses to the issues raised in my letter to you, dated May 15, 1997, concerning the 1997 Backfill Plan. Flambeau's responses were contained in your letter to me dated May 16, 1997. In addition, department staff have observed the backfilling operation, conducted under verbal authorization by the department, and have determined that the methods being employed are acceptable. Based on our review of the response document and field observations, the department hereby approves the 1997 Backfill Plan and associated Resident Project Representative Manual.

There are two issues which need additional clarification and discussion. First, we will need to discuss the proposed methods for testing the Type I stockpile to verify the appropriate alkaline addition needs, if any, as backfilling of that material proceeds. Secondly, as we discussed at our meeting on May 19, 1997, the QA/QC information collected from backfilled material (comment 5 in the May 15th letter) must be submitted to the department. We will likely need to discuss in greater detail how this information should be provided along with the means of interpretation of the results. Finally, I want to reiterate the expectation that Flambeau continue the practice of providing weekly schedules of anticipated backfilling activities to the Department and notifying the Department in a timely manner if significant deviations from the schedule develop over the course of the week.

Please contact me if you have any questions or additional concerns regarding this matter.

Sincerely,

Lawrence J. Lynch, P.G., Hydrogeologist
Statewide Mining Team Leader
Bureau of Waste Management

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