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OMYA – Verpol Plant

February 21, 2007

James V. Surwilo
Technical Assistance Section
Waste Management Division
Department of Environmental Conservation
Agency of Natural Resources
103 South Main Street
Waterbury, VT 05671-0404

Re: Omya Solid Waste Facility Interim Certification Application: Reply to SWP Review of Omya Response to Technical Review Comments

Dear Mr. Surwilo:

The following is submitted in reply to your letter of January 16, 2007, received on January 22, 2007. As with the prior Solid Waste Program ("Program" or "SWP") review comments, Omya appreciates the attention to detail that has been displayed on this project and the Program's recognition of Omya's sincere efforts to respond to the Program's requests. In that connection as well, Omya appreciates the Program's recognition that some items, including those related to the ongoing "Section 5 Study", are new and complex and cannot be addressed completely in the thirty day timeframe the Program imposed. In addition to responding to the Program's specific requests, Omya will address those items below.

In preparing the following reply, both in an effort to reduce the volume of paperwork and to simplify subsequent review, we have excluded those issues as to which the Program has determined Omya's responses are acceptable or sufficiently address the Program's questions and concerns. Stated otherwise, with the exception of a few points for clarification, the following reply addresses only the items that the Program believes remain unresolved, specifically including those noted in **boldface font**.

Turning now to the review comments, this document and the enclosures provide Omya's responses to the January 16, 2007 technical review comments. As mentioned above, only the comments that were identified by VTDEC as needing further clarification or explanation are presented. For clarity, the comment response sections are organized as follows:

- First, VTDEC's April 18, 2006 technical review comments are presented in bold face;
- Second, VTDEC's January 16, 2007 technical review comments are presented in italics with boldface type as presented in the comment letter; and
- Last, Omya's responses are presented in common type.

COMMENTS AND RESPONSES

Volume II of III – Site Characterization Report, Monitoring Plan, and Supporting Data:

Part C-1, Site Characterization Report - IV. Tailings Description

Comment:

- **The Program believes that worst case numbers should be applied in consideration of leachate data or Omya should provide a detailed explanation on why worst case numbers should not be applied, taking into account the information contained in the above paragraph.**

Table 8 of the Site Characterization Report has been amended to reference the range of extractable TOHI. ***The narrative in the first paragraph of amended page 20 needs to be revised also.***

Response:

The narrative in the specified section of the Site Characterization Report (SCR) has been revised. A revised copy of page 20 is enclosed.

Comment:

- **Please provide the Program with a validated method that will be used for sampling tailings solids if such testing were required as a condition of the certification, if issued, and how will they be analyzed.**

Obviously, there have been ongoing concerns with sampling and analytical methods based on the Spring 2006 and subsequent sampling results. The overall monitoring plan is discussed below, our response here will remain with the specific issue: the analysis of tailings solids for TOHI. At this point, regardless if a certification is issued or not, tailing solids analysis will be required in the future. With the unresolved questions regarding potential interferences with the AG24 method for surface and groundwater samples, is this method at all suitable for determining the flotation reagent concentration in the tailings? Please see pages 11 - 12 below. Please describe the status of the validation process for the LC/MS method as it applies to solid samples, and a timeframe for its completion. The process need not be completed within the 30-day timeframe to respond to this letter, but we expect future monitoring events, beginning in Spring 2007 to include tailings solids sampling and analysis.

Response:

Omya believes that the AG24 method continues to have utility as a tool for determining the presence of flotation reagent in the solids. Omya recognizes, however, that some other, more precise and compound specific method might have greater merit, particularly if one can be determined or developed to determine the flotation reagent concentration in the tailings. In that

regard, Omya has been working with STL Sacramento and with STL Burlington in an effort to demonstrate and validate the LC/MS method for use with solid samples. That effort is ongoing, and will continue until resolution. Due to the nature of the materials, the flotation reagent's affinity to the solids, and the complexity of method evaluation, review, and development, we are not now in a position to provide a definitive timeframe for completion. (As and example, and as the Program is aware, the development of the LC/MS/MS method for flotation reagent in an aqueous solution has consumed the better part of two years, that method is being reviewed by EPA, and its final validation has not been issued.) We intend to work diligently toward the end of achieving a method for use with solids and propose to report monthly to the Program on progress toward that end.

Comment:

- **Please provide the Program with information on the degradation of acrylamide monomer in an anaerobic environment such as the buried tailings, and whether the acrylamide monomer's degradation in an anaerobic environment will make a difference in groundwater quality.**

The revised Site Characterization Report has added text regarding acrylamide monomer's degradation in an anaerobic environment, including a reference to a study finding breakdown rates of up to 55% in a two-week period. The citation for this work is unspecific; however, there is documentation enough in the literature that demonstrates that acrylamide does decompose in both aerobic and anaerobic environments, such as surface water and soils, in days or weeks, rather than in months or longer. Acrylamide is a concern, however, due to its known health effects, resulting in a low drinking water standard. There does not appear to be much published research into acrylamide monomer's fate in a bedrock aquifer, but the one oft-quoted report, CONWAY, E.J., et al, (1979) Assessment of the Need for and Character of Limitations on Acrylamide and its Compounds, *USEPA, apparently questions its biodegradability in such an environment.* ***Please provide any additional information that you have acquired either on acrylamide's behavior in the bedrock, or whether biodegradation will occur to such a degree prior to placement in the TMA that mobility and persistence in the bedrock aquifer is moot?***

Response:

We have not found additional literature information specific to acrylamide's behavior in carbonate bedrock aquifers. As you mention, there does not appear to be much published research in this regard. We did contact Dr. Nancy Kinner, Director of the Bedrock Bioremediation Center at the University of New Hampshire, regarding her involvement with the Hallandsas Tunnel project in Sweden. While the project did involve groundwater contamination stemming from the use of acrylamide-containing grouts to seal bedrock fractures, Dr. Kinner's proposed research into the biodegradation of acrylamide in bedrock did not move forward; rather Dr. Kinner's research switched focus to the biodegradation of trichloroethene in bedrock.

Notwithstanding the lack of additional literature on the subject, it is worth noting that acrylamide has been shown to degrade relatively rapidly in both aerobic and anaerobic environments, its presence has been documented in relatively few tailings samples (4 of 28), and it never has been

detected in groundwater samples collected at the site, all of which support the conclusion that acrylamide degradation within the TMAs is likely.

The most current monitoring data, as reported in H&N's January 15, 2007 "Fall 2006 Monitoring Report" (Appendix 3, pages 18-22) show that, of the 52 on-site groundwater samples and 39 off-site groundwater samples collected, acrylamide was not detected in any sample. Similarly, acrylamide was not detected in the 27 surface water samples that have been collected (Id. Appendix 3, page 57).

The extent of further efforts to identify degradation pathways or to estimate degradation rates for chemicals released at TMAs is dependent on the results of detailed monitoring downgradient of the TMAs. If new monitoring data suggest that acrylamide is migrating in groundwater at levels of concern, further evaluation of degradation potential may be appropriate.

Comment:

- **Please provide the Program with additional information on the following contaminants (Isopropyl Benzene and Bis (2 ethyl hexyl) phthalate) found in groundwater samples and explain why they were not considered in the site characterization report.**

Omya reports that the two compounds in question, isopropyl benzene and bis (2 ethyl hexyl) phthalate, are related to the orthophenylphenol spill in November 2000. Neither of these compounds is believed to be breakdown products of OPP. ***Is there some other relationship to the spill, or possibly to the equipment used during sampling?*** *We recognize that no isopropyl benzene or bis (2 ethyl hexyl) phthalate has been detected in groundwater since 2001.*

Response:

Omya appreciates the Program's recognition that no isopropyl benzene or bis (2 ethyl hexyl) phthalate has been detected in groundwater since 2001. Our previous response was "Following the OPP spill, some compounds that ***are believed to be*** breakdown products of the OPP biodegradation were found in groundwater." [Emphasis added]. To clarify our previous response, we believe that the isopropyl benzene *potentially may* be an OPP breakdown product, but we did not intend to imply a definitive statement. Considering the molecular structure and possible degradation pathways, we believe that OPP could form isopropyl benzene as an intermediate degradation product. The isopropyl benzene also may have originated from historic petroleum use at the site. The bis (2 ethyl hexyl) phthalate is not necessarily related to OPP degradation, but is commonly present in analytical laboratories and occasionally is detected in samples due to laboratory or sample contamination.

Further, we note that the isopropyl benzene was detected only on two occasions and in only one well at the site (well 2), and bis (2 ethyl hexyl) phthalate was detected only once (well 96-1), out of six years of sampling to date. Levels of isopropyl benzene (0.0013 ppm on 3/30/2001 and 0.0018 ppm on 7/26/2001) were very low, and the compound is not regulated in the environment. The level of bis (2 ethyl hexyl) phthalate (0.0053 ppm) is in compliance with the Vermont

Drinking Water MCL and the Vermont Groundwater Enforcement Standard, both of which are 0.006 ppm. Finally, both these substances are target compounds of the analytical tests that are part of the routine monitoring program, so we are continuing to monitor for their possible presence.

Comment:

- (Not originally bulleted and italicized; and paraphrased) **As written the TGA results are interesting, but unless the information presented can be elaborated upon, or confirmed with additional research, the Program does not believe the data provides supplementary evidence that is particularly useful in the tailings evaluation or supportive of the application. The same conclusions are applicable to the TOHI testing that was performed on the core samples.**

Thank you for elaborating on the methodology of thermo-gravimetric analyses. The method would appear to be appropriate to determine the percentage of moisture and organic matter in the tailings. We continue to believe that there are excess variables, an insufficient data set, and inconclusive results to allow the utilization the information that was obtained to any great degree.

For instance, it is asserted that levels of tall oil in the tailings have been consistent over time, but supporting information is lacking particularly in light of the uncertainty of the past analytical methods. *Certainly OMYA is aware of the volume of TOHI used and the volume of tailings produced over time, so that a gross mass balance can be calculated. However, it is doubtful that every gallon of tailings slurry leaving the plant contains the identical amount of TOHI, and that level of precision would be necessary in order to perform a meaningful comparison of TOHI concentrations at various depths of the TMAs. Further, the weather at the time of disposition, changes in the settling process, natural organic matter, e.g., leaves in the fall, and mineralogical differences in the tailings, and other unknowns could cause TGA results to vary.*

Again, we agree that TOHI is readily biodegradable in the environment and that older tailings, those at depth, likely have less TOHI bound due to biodegradation. The TGA analyses have little importance in our review. The response is acceptable.

Response:

Omya believes the TGA results constitute helpful information that should not be ignored and appreciates the Program's acknowledgment that the method would appear to be appropriate to determine the percentage of moisture and organic matter in the tailings. It is important to note that Omya never has claimed that "every gallon of tailings slurry leaving the plant contains the identical amount of TOHI [based flotation reagent]" and for that reason, has utilized conservative mass balance values in its evaluations.

To clarify, the testing of the TMA core samples and the analysis of the biodegradation of TOHI was not intended to be a precise quantification; rather, we were interested in a qualitative

assessment of how TOHI biodegrades in the TMA environment. For a qualitative assessment, it is not appropriate or reasonable to attempt to measure every gallon of tailings slurry produced at the plant. Rather, the assessment was based on clear and distinct trends of decreasing TOHI concentrations with increasing age (i.e., depth) of the core samples. The data support the conclusion that some level of TOHI biodegradation does occur in the TMAs. This conclusion may be more an academic observation than essential evidence in support of the application; nonetheless we believe that the level of detail used in the analysis is appropriate for the intent of the study.

Part C-1, Site Characterization Report - V. Site Description

Comment:

- **Please provide the program with information showing how Omya excluded the possibility that some or all groundwater may not be discharged at the surface features listed and measured but may continue to travel through bedrock fractures off-site to the north or northwest in the general direction of groundwater flow.**

- **That being the case, is it accurate to assume that all groundwater discharges along these surface features near the property boundary?**

- **Could groundwater migrating further than the proximal discharge points also account for the difference between the calculated discharge rates on Page 34 (122 and 156 GPM) and the measured discharge rate of 31 to 33 GPM?**

Omya's response to these comments is satisfactory and helpful to further understand groundwater flow in the vicinity of the site. The Site Characterization Report has been revised to include additional discussion of groundwater flow and discharge locations. However, the preliminary presentation of the "Section 5 Study" highlighted several data gaps in relation to groundwater flow. Key data gaps include: horizontal gradient for groundwater flow, lack of groundwater elevations downgradient of the Verpol Plant and west of the Kane and Drake Quarry, and the effect of the Pittsford Italian Quarry on the groundwater flow regime. After completion of the Section 5 Study, or at an appropriate intermediate time, the Program may require the installation of additional monitoring wells or additional monitoring activities to refine the current conceptual groundwater flow model applied to the site.

Response: Omya appreciates the Program's statement that Omya's response to these comments is satisfactory and helpful to further understand groundwater flow in the vicinity of the site. With regard to the reference to the "Section 5 Study", it is important to note that the Program's reference was to a preliminary draft of the Phase I Report, which since has been modified. Further, even though some data gaps were identified on a preliminary basis, the final decision regarding the existence and extent of the data gaps and how they are to be filled remains to be completed in Phase II of the "Section 5 Study." Furthermore, the "Section 5 Study" is not scheduled to be completed for approximately a year. Nonetheless, Omya is committed to completing the work detailed in the pending "Section 5 Study" Phase II scope of work that is

intended to confirm and validate the conclusions previously determined by the current conceptual groundwater flow model completed to date.

The anticipated schedule for the Section 5 Study is as follows:

- March 2007 – Completion of the Development and Drafting of the Phase II Detailed Scope of Work
- April through September 2007 – Commencement & Completion of the Field Activities
- October through December 2007 – Commencement & Completion of Data Analysis and Report Preparation
- January 2008 – Submittal of Final Report & Presentation to the Vermont Legislature

Omya will incorporate additional monitoring activities, if required by the VTDEC, during or after the completion of the "Section 5 Study" if the current conceptual groundwater flow model is found to be different from what has been determined to date.

Part C-1, Site Characterization Report - VII. Compliance with the Siting Standards for the Vermont Solid Waste Management Regulations

Comment:

- **Please provide convincing evidence that tailings management does not unreasonably increase noise levels.**

Your response states that Part E of the original application notes that the movement of tailings occurs during two, 6-week periods of the year, generally fall and spring. I do not find that information in Part E, or in quite those specific terms. Section 3.2 explains that each settling cell can hold about six months of tailings, and that the dewatered tailings are removed periodically, but the time interval and the seasonality is new information. Thank you for the useful information that tailings removal is quieter than the 70 dB limit set for the Velpol [sic] *Plant.* ***Are there any other source of tailings management related-noises that would be louder than the actual movement from the settling cells to the TMAs? E.g., water pumping or vegetation maintenance***. [BOLD assumed]

Response:

There are no TMA-related noises that are louder than the actual movement of tailings product from the settling cells to the TMA. Routine activities associates with the TMAs (*e.g.*, pumping water, maintaining vegetation) do not generate noise levels greater than that of the equipment used to transport tailings product, and may be of level and duration similar to activities typical of nearby residences and businesses. Again, it is helpful to keep in context that all activities at the site are governed by a specific noise limitation and at no time has any of the activities (singly or collectively) been found to exceed that limit.

Omya, Inc. Verpol Plant Tailings Monitoring Plan (dated August 15, 2005)

Comment:

1. *On page 9, footnote 4, there is a discussion of the pending Liquid Chromatography/ Mass Spectroscopy (LC/MS), and its use in lieu or in conjunction with Method AG24. Because the LC/MS method has not been approved, and may not even be necessary, the footnote may be deleted. If the method is approved and its use is warranted, the plan can be revised at that time.*

2. *…The monitoring results report should include a description and/or table that explains the process of asking permission, whether permission was granted, and, if not any reason that was given. The report should also indicate any changes to the off site water supplies, e.g., reported problems, new well, new property owners, etc. Please revise the plan as necessary.*

3. *Please revise the plan to require collection of field data (pH, temperature, conductivity, oxidation reduction potential) for off-site locations.*

4. *Please revise the plan to coincide with the QA/QC provisions of the Program's Groundwater Quality Monitoring Procedure….*

5. *…Assuming a 30-day turnaround time from the laboratory, we are suggesting that routine results be submitted to this office within 60 days of completed sample collection, which is the standard for landfills that we regulate….*

6. *…Representative samples from representative locations must be collected and analyzed for total and leachable contaminants of concern, during each semi-annual monitoring event…. Please provide additional information on how tailing samples be collected and analyzed.*

Clearly, there have been a number of issues that have come to light in the past number of months regarding sampling and analytical procedures, and those issues have been corroborated by the work of the "Section 5" consulting team. Rather than responding strictly on the questions above (although they remain valid), the Program believes that it is prudent for OMYA to perform an open revision of the current monitoring plan. That is, all sections of the current plan should be reviewed critically and revisions made as needed to correct or improve the plan. We understand that these revisions, particularly redeveloping the QA/QC procedures, will strain the 30-day deadline, but the monitoring plan must be acceptable for the application to be technically complete. The revisions should include, but not be limited to:

- **The establishment or improvement of sample collection QA/QC procedures, including training and experience of personal; sampling collection SOPs; oversight of field personal, accurate field data collection; field, trip, and equipment blank collection; and chain-of-custody procedures.**

Response:

Enclosed is Heindel & Noyes revised Site Monitoring Plan for groundwater and surface water monitoring to incorporate the improvement of sample collection QA/QC procedures, including training and experience of personal; sampling collection SOPs; oversight of field personal, accurate field data collection; field, trip, and equipment blank collection; and chain-of-custody procedures.

In addition, it is expected that the Section 5 Consultant will be preparing a detailed Field Sampling Plan for groundwater and surface water monitoring for Omya's review and consideration. A routine for Quality Assurance and Quality Control will be outlined in a corresponding Quality Assurance Project Plan (QAPP).

The 2007 Spring Monitoring Event will be performed in accordance with one or a combination of those two plans, assuming they are approved in time to allow their use and implementation.

- **Assurances that laboratory QA/QC plans are in place, adequate, and will be adhered to.**

Response:

Omya has met with and has determined to employ the services of the Severn Trent Laboratories, both in Burlington, Vermont and in Sacramento, California, to perform tests and analyses heretofore performed by Endyne, Inc. Assuming they can be ready to perform the analyses (*e.g.* AG24), it is expected that the STL laboratories will be utilized for future Monitoring Event sample analysis either in replacement for or in conjunction with Endyne, Inc. as the circumstances warrant. Omya (and the State) will review STL's QA/QC plan and auditing program to ensure adequacy and compliance.

The QAPP understood to be in preparation by the Section 5 Study Consultants will include QA/QC guidance for laboratories and the relevant QA/QC information will be given to the laboratory for review prior to sample analysis. The laboratory's internal QA/QC plans will be reviewed by the Section 5 Study Consultants to ensure compliance with the QAPP.

- **A review, and revisions if necessary, of current monitoring locations. For examples: Is it scientifically valid to continue to sample all the water supplies that have been monitored in the past? Are all of current groundwater and surface water locations essential, are there other locations that should be monitored, that have not been.**

Response:

All current locations sampled during the 2006 Fall Monitoring Event will continue to be sampled during the upcoming 2007 Spring Monitoring Event. In addition, it may be necessary to conduct additional groundwater sampling in connection with the anticipated Section 5 Study Field Monitoring Plan. The details of and extent to which additional sites will be required by the Section 5 Study are not known at this time.

The usefulness of existing locations will be assessed following completion of the 2007 Spring Monitoring Event. If additional locations are identified as potential pathways, they will be included in the monitoring plan and implemented in future events.

- **The chosen analytical method for flotation reagent has been in flux and needs to be clearly established. Most recently, the discussion has been about using Method AG-24 as a screening tool, and LC/MS as the confirmatory analysis. There remains some question about the merit of AG-24 at all for environmental samples; that the uncertainties about interferences have not been completely resolved, and need to be. That is, were the positive sample results due to laboratory errors, sampling errors, tap water usage, equipment performance or unrelated compounds that absorb light similar wavelengths? The program recognizes that the use of AG-24 to screen out true negative results will require less reliance on the more expensive and logistically complicated LC/MS method. Conversely, there is a stigma associated with locations being found to contain "flotation reagent," by one method, only to be absolved by another. The program believes that prior to the approval of AG-24, these questions must be resolved**

Response:

The LC-MS method for analysis of Omya's flotation reagent will be used during the upcoming 2007 Spring Monitoring Event and in future rounds. The AG-24 method will not be used for the analysis of water samples until the question of "false positives" is resolved.

- **The USEPA is conducting a review of the LCMS analytical method for the flotation reagent. The target for completion of this review was mid-January 2007. Our understanding is that the review is ongoing but not finished. If any issues or suggested changes develop from the EPA review, they must be incorporated in the monitoring plan. If the review is not completed within the 30-day response time of this letter, these changes will be incorporated prior to the next scheduled sampling event.**

Response:

Omya understands that a response to this comment is not required at this time as VTDEC is awaiting recommendations from USEPA regarding the validation of the LC-MS analytical method. Following receipt of USEPA's recommendations, VTDEC will share those recommendations with Omya and STL for a determination whether the LCMS analytical method is acceptable.

- **Establishing improved, consistent data presentation.**

Response:

This comment already has been addressed; improvements have been made as of the most recent monitoring report (H&N's January 15, 2007 "Fall 2006 Monitoring Report").

Volume III of III – Engineering Design and Operations Plan

Part D: Engineering Design – Appendix "Slope Stability Calculations"

Comment:

- *There are notes on three of the boring logs (2, 3, and 8) and it is not clear which of these were the samples used for the direct shear testing...Please clarify that these samples are representative of the different apparent densities in the tailings, and if they are not please explain why they are not… That is, should not a sample of older tailings from the bottom of the TMA be identical to a fresh sample out of the discharge pipe if the moisture content and compactive effort during remolding is the same?*

The Application has been revised to better identify which samples were used for testing. Samples were selected for testing that represented the lowest strength material, or the most conservative input. The Program agrees that tailings from the pipe discharge and from the TMAs differ in density and moisture content. The gist of this original comment, and other comments by VTrans, was why the samples collected from the borings were collected at various depths - combined in one instance - then remolded to preset values, rather than the in-situ conditions suggested by their location in the TMA. ***Put another way, could not fresh tailings or decades old tailings from deep in a TMA be remolded to 95 PCF and 13% moisture?*** *While the blow counts were informative as to the relative density (and likely, moisture) collecting disturbed samples seems questionable. Table 2 on Page 5 of 6 implies that the shear test results represent shallow and medium depth tailings, and the narrative implies the two tests reveal the range of internal friction angles ($30.9^o – 36^o$) for all in-situ tailings. It would seem that because the tailings composition should be identical, and each sample was remolded identically, the results simply represent the variability of the strength of those two samples, and not the broader range of tailings anywhere in the TMAs.*

I spoke to Eric Steinhauser about the response to slope stability analysis comments and have also discussed the response with VTrans. Again, the likelihood is that the tailings' material strength parameters used in the slope stability analysis are reasonable, if not precise. Additional sampling, testing, or data refinement should not alter the conclusions of the slope stability analysis; that is, that the slopes will be stable under both static and seismic conditions. That being said, to conclude the record, please answer the bolded question above.

Response:

"Fresh" and "decades old" tailings product can be remolded to a dry unit weight of 95 lbs/ft^3 with a moisture content of 13 percent. Collection of "disturbed" samples of tailings product from the TMAs was performed because the in-place tailings product were not placed naturally and are by definition disturbed. The purpose of the TMA drilling program was twofold: (i) obtain relative strength information by means of the standard penetration test (ASTM D1586); and (ii) obtain samples of tailings product for laboratory strength testing (ASTM D3080).

The tailings product samples selected for testing were obtained from the "weaker" zones encountered in the TMAs. Strength testing was performed on samples of the "weaker" material that were remolded at a moisture content representative of the moisture content of the in-place tailings product to a dry unit weight less than the dry unit weight that would be expected during placement of the tailings in the TMA.[1] (By testing the "weaker" material, the results of geotechnical tests should be conservative.) Based on the various geotechnical testing programs performed on the tailings product, the total unit weight for the material appears to be about 110 lbs/ft^3. In addition, moisture content testing of tailings product samples obtained from the "weaker" material indicated consistent moisture content of approximately 13 percent. Copies of the moisture content test results are enclosed with this response.

Comment:

3. *It would seem that the tailings placed in a slurry would have a very high moisture content. Has this material been dewatered? If not, how has the moisture content been accounted for in the modeling?*

The response states that the tailings material is dewatered prior to placement in the TMAs. ***The response does not indicate whether the moisture content, regardless of the percentage, is accounted for in the model. The response is not satisfactory.***

Response:

As stated in the initial response, the tailings product slurry is dewatered in settling basins prior to being moved to the TMAs where additional dewatering occurs. As noted in the response to the comment above, the in-situ moisture content of the tailings product sampled in the TMAs (*i.e.*, the "weaker" material) was measured to be about 13 percent.

It is to be noted that moisture content is not a direct input parameter for slope stability evaluations. The stability evaluations presented in the Application use the Mohr-Coulomb strength model, which is defined by the following equation:

$$\tau = \sigma_n + c \tan \phi$$

where:
- τ = shear stress (lbs/ft^2);
- σ_n = normal stress (lbs/ft^2);
- c = cohesion (lbs/ft^2); and
- ϕ = friction angle (degrees).

[1] By definition, dry unit weight (γ_d) is equal to the total unit weight (γ_t) divided by 1 plus moisture content (w) ($\gamma_d = \gamma_t / 1 + w$). Based on geotechnical reports, γ_t of the tailings product is 110 lbs/ft^3. Therefore, at a moisture content of 13 percent (as measured in the laboratory for tailings product samples obtained from the TMAs), γ_d is about 97 lbs/ft^3. Strength testing was performed at a γ_d of about 95 lbs/ft^3.

Moisture content is not a discrete parameter of the analytical slope stability model. Rather, the influence of moisture content is accounted for in the strength properties (*i.e.*, ϕ and c), which are measured through laboratory testing (*e.g.*, direct shear tests, as presented in Attachment E to the Slope Stability Calculation). For the direct shear tests (ASTM D3080) performed for the Application, samples of "weaker" tailings product from the TMAs were remolded to a moisture content of about 13 percent and a dry unit weight of about 95 lbs/ft^3 (or a total unit weight of about 107 lbs/ft^3), which is considered to be representative of the tailings product based on the geotechnical data available to date.

Part D: Engineering Design – Section 6.0 Stormwater Management

Comment:

- *Please confirm with the Solid Waste Program that this (contacting the WQD regarding stormwater permits) has been accomplished.*

The response relates that Omya has one stormwater permit relating to the Verpol Plant and surrounding area, and will be submitting an application for a General Permit, based in part on the results of the Solid Waste Certification process. The Solid Waste Program will be informed when the application is submitted. ***Please provide an update as to the status of all water-related permits.***

Response:

Renewal for Omya's authorization to discharge process water under NPDES Permit No. 3-0395 was issued on October 12, 2006. The permit expires on September 30, 2011.

Renewal of Omya's authorization to discharge stormwater under Permit No. 3512-9010 was issued on May 20, 2004. The permit expires on August 5, 2010.

Omya received authorization to discharge stormwater under the Multi-Sector General Permit No. 4508-9003 on November 28, 2006. A Stormwater Pollution Prevention Plan (SWPPP) will be implemented by May 15, 2007.

Part D-4 Closure/Post Closure Plan – Section 6.0 Post-Closure Plan

Comment:

- *The Post-Closure maintenance plan does not include regularly scheduled vegetation cutting. Please amend the post closure plan to include the frequency of mowing. The Plan should further detail what the quarterly inspection will consist of, and what the responses will be if a deficiency or problem is discovered. Examples include poor vegetation growth, eroded areas of the cap, and siltation of drainage appurtenances.*

The response states that regular cutting of the vegetation on the closed TMAs is not being proposed. ***Does this connote that Omya will let natural succession occur, or only that mowing***

will be done as-needed rather than at predetermined intervals? *The Application now includes an Attachment outlining items to be noted during the post-closure inspections, and responses to any deficiencies found. The Attachment is satisfactory.*

Response:

The Closure/Post Closure Plan was revised to state that annual mowing of the vegetation will be performed. Revised document is enclosed.

Part E Operations Plan – Section 3.4 Placement in TMAs

Comment:

- *Provide an approximate percentage of the tailings that are lower moisture and sent to the Dolomite Quarry versus what is higher moisture content tailings and sent to the Kane & Drake Quarry. If tailings are moved from the Kane & Drake to the Dolomite Quarry please detail the process, amount, timing, etc.*

The response states that approximately 40% of the tailings is the coarser-grained, lower moisture material. No tailings are transported from the Kane & Drake to the Dolomite Quarry.

Response:

Although no response to this comment specifically is required, Omya wishes to clarify the movement of tailings product between the Kane & Drake and Dolomite Quarries. While the initial response indicated that tailings product was not intended to be moved between the two TMAs, current site conditions require that material be moved in order to manage the TMAs properly and to achieve the grades proposed in the Application. Specifically, Omya is managing the Kane & Drake and Dolomite TMAs within the grading plans submitted with the Application. Because the grading plans, and the schedule for grading, anticipated issuance of the Interim Certification in 2006, with the passage of time, tailings product must be managed and relocated between the two TMAs in order to comply with the configurations set forth in the Application and VTDEC's requirement that tailings product may not be placed in the Loveland TMA.

Comment:

- *Please explain in detail how the residual decant water and stormwater which is ponded in drying cells in the Kane and Drake TMAs are conveyed back into the process water system.*

The response indicates that the process water is conveyed through pumps and appurtenances that have been in service for many years, but does not elaborate on or illustrate the system. ***Can it be diagrammed or explained further?***

Response:

Enclosed is the flow diagram of the Omya water circulation system and an aerial map depicting the conveyance of water on the plant site together with an associated narrative. The documents were submitted to the Vermont Wastewater Management Division in conjunction with Omya's 2006 application for renewal for authorization to discharge process water under NPDES Permit No. 3-0395.

That concludes the Program's review of your responses to our original comments. The ongoing issues with the recent environmental monitoring results and floatation reagent analytical methods was not a part of our original comments, but need to be addressed as noted in the "arrowed" paragraphs on pages 12 –13 above. Meanwhile, the Section 5 Study work has been progressing as the application review continues. The Program cannot delay a decision regarding the certification application until after the Section 5 Study in completed; however, neither can we ignore any pertinent conclusions of the study to date. Please address these issues that were introduced in the first phase of the Section 5 Study:

Comment:

- **The flotation reagent is readily biogradable** [sic] **in an aerobic environment, but information regarding its biogradability** [sic] **in an anaerobic environment such as internal to the TMAs, is scarce. Further, it is not well understood what daughter compounds, at what concentrations, may the flotation reagent degrade into, in the environment of the TMAs. We realize that the Section 5 Study will be working on closing this data gap in Phase II. However, within the 30-day timeframe Omya must propose a plan to research this issue.**

Response:

A literature search already has been performed into the environmental fate and breakdown products of the flotation reagent. Results of the Section 5 Study thus far have noted that the daughter products generally are less toxic and less persistent than the flotation reagent, and are biodegradable into non-toxic end products. The Section 5 Study "Final Phase I Report" dated January 31, 2007, specifically, "Study Area 1: Section 1.2 Hydrogeology Data Assessment" discusses the overall data needs assessment on pages 30 – 31 and comments directly on this issues in parts 2.1 and 2.2 of the table on page 34.

Based on the information known to date, we do not believe that further research is warranted. In the event that either the Section 5 Study or the VTDEC requires that a specific study is necessary, Omya will perform additional research on this issue.

Comment:

- **Given the flow pattern of process storm and stormwater, the Pittsford Italinate** [sic] **Quarry may be a key hydrogeologic control for the water balance of the site, but**

site characterization work in support of the application downplays its significance. Please respond in detail in the 30-day timeframe.

Response:

We do not believe it correct to say that the work in support of the Application downplays the significance of the PIQ. The Site Characterization Report did assess the effects of the PIQ, but not as an isolated component of the site. We took the approach of analyzing the hydrogeology of the overall site, rather than isolating individual components. Groundwater and surface water flow patterns at the site are well understood. Certainly the PIQ has a role in the water balance at the site, and our studies have revealed that water can infiltrate to or exfiltrate from it. Groundwater elevation measurements, contour mapping, and measured gradients and flow directions have been consistent regardless of the water level in the PIQ or whether it was being pumped, indicating that the management of the water in the quarry does not significantly alter the hydrogeology of the site.

The groundwater contour mapping includes PIQ elevations, and the data and maps in the appendices of the SCR document the PIQ water levels and the groundwater elevations, contours, gradients, and flow directions.

In the June 2006 revised SCR, Page 10 (methods section) states:

> "Water levels in the wells **and the onsite rock quarries** have been measured at various times of year including spring high water levels, as well as drought low levels, to determine the gradient and flow direction of the bedrock aquifer water surface. The data have been analyzed by standard hydrogeologic methods; well potentiometric surface elevations have been contoured on accurately-scaled maps to indicate the groundwater flow directions. Measurements of the groundwater flow direction have been analyzed from the following dates:
>
> - March 19, 2001 (winter conditions, ground snow-covered)
> - May 15, 2001 (spring conditions, following significant snowmelt)
> - July 26, 2001 (summer conditions, drought)
> - October 31, 2002 (fall conditions, average water levels)
> - November 6, 2003 (fall conditions, average water levels)
> - June 27, 2005 (summer conditions, average water levels)
> - October 25, 2005 (fall conditions, high water levels due to recent heavy rainfall)"
>
> [emphasis added]
>
> The results of this work are then presented on page 33:
>
> "Water level measurements were obtained in the network of bedrock wells and quarries at the site and were used to develop groundwater contour maps to indicate the direction of flow in the aquifer. Wells #2, #5, 96-1, 96-2, A, B, C, D, E, F, C-2, G, H, and I, have been measured to determine the aquifer potentiometric surface. Additionally, the water

surfaces in the Dolomite, Dogleg, **and Pittsford-Italian Quarries** were measured when a free water surface was present…

A typical groundwater contour pattern is shown on the bedrock geologic map, page 5 of appendix 1.… This map is based on data collected during November 2003 following a period of average rainfall; similar patterns have been measured in a wet spring (May 2001) and summer drought (July 2001), indicating the consistency of the flow pattern through different hydrologic conditions. Pages 9-13A of appendix 1 show **groundwater contour maps from March 2001, May 2001, July 2001, October 2002, June 2005, and October 2005 and all show the same general pattern of groundwater flow**." [emphasis added]

The only statement that is not made in the SCR is to point out that PIQ water levels and pumping status were variable during the different measurements dates listed. PIQ water levels can be found in appendix 2, pages 46 – 47. Pumping status is not discussed (we were not recording that) but the resulting water level is what could affect groundwater flow.

In the event that either the Section 5 Study or the VTDEC requires that a specific hydrogeologic study of the PIQ is necessary, we expect the study could include the following:

- Measurement of water input to, and withdrawn from, the quarry over a period of several months, including metering of water pumped to and from the quarry; and water flowing into the quarry via gravity penstocks.

- Measurement of precipitation and evaporation at the site.

- Installation of groundwater monitoring wells in the unconsolidated soil around the quarry.

- Measurement of water levels in the quarry, in the bedrock groundwater, and in the water table in the nearby monitoring wells in the unconsolidated soil.

- Evaluation of the data to assess under what conditions (i.e., at what water levels, during which weather conditions, etc.) does water flow between the quarry and groundwater; at what rates; and over how large an area does the quarry exert an influence.

Comment:

- **The current monitoring well network may be inadequate to fully characterize groundwater quality in discrete, active fracture zones downgradient of the TMAs. Within the 30-day timeframe, please respond whether you agree, and if so, detail how this data gap will be closed.**

Response:

We do not agree that the monitoring network is inadequate. Nonetheless, in the event that either the Section 5 Study or VTDEC requires that collection of additional data from discreet, active fracture zones is necessary to satisfy a secondary purpose (e.g., a Section 5 concern), we would propose to utilize borehole geophysical surveys to identify the actively flowing discreet fracture zones within wells downgradient of the TMAs. Building upon the characterization work already completed (e.g., aquifer pump testing, well drilling logs, and down-well camera exploration), borehole geophysical instruments can be used to identify dimensions and ambient flow rates within individual fractures. Some of the following instruments could be used if additional geophysical data were to be collected: heat-pulse flowmeters, resistance meters, temperature and spontaneous potential sensors, calipers, and acoustic televiewers.

As a next step, sampling of water quality from the individual fractures could be performed using inflatable packers to isolate individual fractures identified from the geophysical characterization.

Comment:

- **Groundwater elevations and gradients are not well represented west of the Kane & Drake Quarry and Verpol plant. Should addition wells or peizometers** [sic] **be installed to close this data gap? While we do not expect additional wells to be installed in the next 30 days, please respond as to whether you agree that this represents an area insufficiently monitored.**

Response:

We do not believe that the area west of the Kane & Drake Quarry and Verpol Plant is a key location requiring additional study, as the area to the west is topographically significantly higher in elevation than the TMAs. Groundwater contour maps from several years of monitoring at various times of year (i.e., spring melt, summer drought), show a significant gradient in the bedrock groundwater, which directs flow away from the area west of the Kane & Drake Quarry and the Verpol Plant. Geologic map analysis, observations of bedrock outcrop strike and dip, and fracture trace analysis all corroborate the groundwater contour mapping and indicate that groundwater from the TMAs does not flow towards this area.

As noted above, additional wells are not needed west of the TMAs in support of the Application; however, the Section 5 Study or VTDEC may require that groundwater data from the area west of the Kane & Drake Quarry is needed to satisfy a secondary purpose (e.g., a Section 5 concern)..

Comment:

- **The contaminant transport model assumed the uniform groundwater flow through the bedrock, similar to flow in an unconsolidated deposit, which may underestimate the velocity of contaminants is a discrete bedrock fracture. Please respond as to whether this may significantly alter the model results.**

Response:

The site characterization did not include measurement of groundwater velocities within discrete bedrock fractures, nor is it believed practicable to do so. Furthermore, the data available are not sufficient to construct a model to simulate contaminant transport within discrete fractures, nor do the available groundwater monitoring data suggest that such a model is necessary (for instance, site monitoring data indicate the general absence of TMA constituents in groundwater).

The assumption of uniform groundwater velocity through the bedrock may underestimate or overestimate the actual groundwater velocity within discrete bedrock fractures if present. It should be noted that the uniform groundwater velocities used in the modeling effort were based on assumed effective porosity values published for fractured carbonate rocks. As such, the velocities represent best estimates of the average velocity of groundwater flow through fractured rock. One effect of non-uniform groundwater velocities is dispersion, a variable accounted for in the modeling effort using a published empirical power law specific to carbonate rocks. In addition, a sensitivity analysis was performed using groundwater velocities and dispersivities approximately one order of magnitude higher than the base condition with little material effect on the model results, which again, are supported by site monitoring data demonstrating the absence of constituents of concern in groundwater.

It also is noted that other contaminant attenuation mechanisms not explicitly accounted for in the modeling effort, such as matrix diffusion, could play a larger role in a model developed to simulate contaminant transport within discrete fractures. Consideration of such attenuation mechanisms in concert with discrete fracture flow may offset the inference that potentially higher groundwater velocities within discrete fractures would result in increased distances of contaminant transport.

Comment:

- **It was noted that the concentration of flotation reagent in the supernatant of a TMA can be appreciably higher than the TCLP results that were used as an input in the contaminant transport model. Would increasing the flotation reagent concentration by an approximate factor of 20 (0.47 mg/L to 9.58 mg/L) significantly alter the model results? This and the previous comment must be addressed in the 30-day timeframe.**

Response:

The TCLP results were used to develop initial concentrations for the modeling effort because that data were considered representative of the concentrations of flotation reagent that reasonably might be anticipated to leach from the tailings to site groundwater. The supernatant samples were unfiltered grab samples, which were observed to contain significant particulate load which is not representative of the leachate that could exit the TMAs. Given the strong sorptive behavior of the flotation reagent and the particulate content of the supernatant samples, the concentration of floatation reagent in the supernatant likely is biased high. Nonetheless, increasing the initial concentration of the flotation reagent by a factor of 20 is not

expected to affect the model results materially due to the highly sorptive and readily degradable character of the flotation reagent.

Comment:

Finally, after reviewing the application documents again, we have two unrelated comments on closure, closure costs, and financial responsibility: One, is cost of quality control testing included in the Probable Closure Construction Costs? It does not seem to be. And, two, while the Program has agreed that tailings are acceptable as capping material, but if the TMAs must close at some point in time prior to maximum approved grades, should there be a cost associated with transferring tailings? For instance, given the proposed operations plan, the Loveland Quarry would need to be brought up to a mounded configuration, and the tailings by which to do so would – the Program assumes – be transported from one of the other TMAs. This extra cost does not appear to be included in the closure cost estimate.

Response:

Part D-4, Attachment B (Opinion of Probable Construction Cost) has been revised to include costs for: (i) performing quality assurance testing; (ii) moving tailings product between TMAs to achieve closure grades; and (iii) relocating tailings product from the settling basins to the TMAs, including foreclosure of the Loveland Quarry. The revised Part D-4 narrative, as well as Attachments B, D, and E are enclosed with this response. Furthermore, as requested by VTDEC, the Application includes a series of TMA filling sequence plans (see Sheets 3 through 10 of the Engineering Drawings) that illustrate the anticipated TMA grading on a yearly basis. Because each of the filling sequence plans was designed to meet the requirements for closure, the amount of tailings product that would have to be moved or regraded is limited.

Again, let me express my appreciation for the Program's thorough attention to Omya's application. If you require anything further, please do not hesitate to contact me.

Sincerely,

Michael Laurent
Environmental Manager

Attachments: