DOCKET TG-072226

EXHIBIT B
TO
DECLARATION OF LARRY FULCHER

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Mr. Larry Fulcher
Weyerhaeuser
MRF and Landfill Manager
PO Box 188
Longview, WA 98632

December 12, 2005

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STATE OF WASH.
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COMMISSION

Re: Weyerhaeuser SW Regional Landfill Waste Composition

Dear Larry:

You have requested my opinion regarding the optimal waste composition for the referenced landfill, also called the "Headquarters" Landfill. As the lead designer for the landfill since its inception, I am very familiar with the site, the nature of the landfill operations, and the geologic setting.

From a technical perspective, waste composition has a primary impact on the internal drainage of the landfill, and on its slope stability. Generally speaking, the more permeable and structural the waste is, the greater the benefit will be for internal drainage and slope stability.

Improved internal drainage will improve slope stability, reduce the post-closure period for collecting leachate at the end of the landfill life, and reduce the magnitude and duration of long-term settlement, which can affect post-closure maintenance. Increased structural integrity will improve the static and dynamic stability of the landfill. Having a higher static factor of safety will increase the site's reliability, and reduce potential movement that would occur in a seismic event.

The landfill was originally designed to accept forest-products industrial wastes, primarily those derived from paper making. Many of those waste types are low in permeability and not highly structural. My recommendation is that this facility always strive to accept as much high-permeability and structural waste, such as construction and demolition debris, as possible. There is no down side to accepting such waste in the landfill, and there are strong technical benefits.

If there are any specific questions regarding this recommendation, please call me at 530-692-9114.

Sincerely,
Thiel Engineering

R. Thiel

Richard Thiel, P.E.

Thiel Engineering P.O. Box 1010, 9768 Yuba Ranch Way, Oregon House,CA 95962 (530) 692-9114 FAX (530) 692-9115

June 5, 2006

Larry Fulcher
Weyerhaeuser
3401 Industrial Way
PO Box 188
Longview, WA 98632

Re: Weyerhaeuser Regional Landfill Geotechnical Recommendations for Waste Stream

Dear Larry:

This letter presents a summary of operational landfilling recommendations relative to slope stability. The letter includes many similar previous recommendations made over the past 12 years, and quantifies the recommended proportion of structural waste to mix with the industrial waste to enhance slope stability.

Background

Because of concerns for slope stability, the master plan for the landfill was designed with relatively flat final fill slopes of 22% (4.5H:1V). During the first two years of operations there were difficulties in filling experienced because the waste could not hold a slope greater than about 20%, and large amounts of pit-run rock were used as structural berms within the landfill to contain the waste. Over time, other operational tactics were employed to improve slope stability which included incorporation of tire-chip drainage fingers within the waste, filling on flatter slopes, more active covering of waste areas with plastic tarps during wet weather, and lime treating the wastewater treatment sludge. In addition, there has been a consistent recommendation from the beginning to incorporate construction, demolition, and other non-putrescible high-strength materials into the waste matrix.

Previous testing of the waste materials has indicated the following characteristics:

- The pulp mill waste has a low unit weight of around 70 pounds per cubic foot. This is just above the unit weight of water. The implication is that if the waste is saturated, the effective confinement pressure on the waste could be very low. The effective confinement pressure is important to develop the waste's shear strength, as discussed in the next bullet.

- Past triaxial shear strength tests clearly indicated that the shear strength of the waste is proportional to its effective confinement pressure. There are two main implications from this: (1) If the waste is saturated at depth without drainage, it may have very little shear strength, yet all of the driving force remains to cause a deep-seated failure; (2) At shallow depths slope stability would continue to be an operational problem since there is very little normal force to mobilize the shear strength.

- The water content of the samples tested were very near to what is called the "liquid limit" of the material. This means that a small sudden loading or vibration could cause the material to flow. The site has experienced this on the working face.

Recommendations for Landfilling

Past experience and testing has suggested various operational techniques to improve landfill stability that should be pursued. Specifically, these recommendations include the following:

- Promote landfill acceptance of as much "structural" waste as possible. A prime example of this would include construction, demolition, and land-clearing debris. Also, most petroleum-contaminated soils (which is an accepted waste stream at the landfill) would serve to increase the overall shear strength of the waste.

- Include drainage fingers such that any point in the waste mass would never be more than approximately 10 feet from a drainage finger (or layer). It is also important that these drainage fingers be well connected to the bottom leachate collection system. This will be more and more challenging as the height of the waste mass grows.

- Try to slope the waste lifts inward to the landfill relative to the face of long-term exterior slopes. This will not only improve slope stability, but also help reduce problems with leachate side-slope seeps.

- Maintaining good drainage at the toe of all waste slopes, and especially for the active slope, has proven to be beneficial, and is a complimentary concept to the overall waste drainage recommendation.

- Certain portions of the waste stream may be amenable to compaction (most likely during the summer). If this is possible, it would serve to increase the overall shear strength of the waste mass, and reduce its potential for absorbing liquids.

- Keep general records of the landfill lift orientations. The current program of conducting aerial surveys every 6 months, and having an operator survey fill locations every month, should be adequate.

Recommendations for Quantities of Structural Waste

Given the importance of this landfill, and the nature of the waste materials, continued aggressive acceptance and inclusion of "structural waste", as defined above, is prudent for the enhancement of the overall slope stability of the facility. The question is how much material should be accepted?

The two main improvements to slope stability that would be provided by structural waste are:

1. Increase in the resistance to slippage along any particular failure plane.

2. Resistance to waste liquefaction and flowing in the event of an earthquake.

Acceptable reliability in the structures stability is created through the design and implemented operational measures. Thus, adding more structural waste continues to add to the system reliability, and decreases the probability of a structural failure.

All systems and structures have a probability of failure, however low. Certainly during the initial stages of the operation the probability of failure was relatively high, as evidenced by the operational slippages that occurred. Through more detailed investigations and intentionally designed operational measures, the operational reliability has been increased. A part of that has been due to the inclusion of structural waste. The extreme would be to fill the entire landfill with structural waste, but that would change the purpose and need of the facility altogether.

The question could thus be stated as follows: given that the purpose and need of the landfill is primarily to provide disposal for industrial waste, what is the optimal balance of structural waste to enhance the slope stability without taking up too much airspace? This is analogous to the "80/20 rule", which suggests that you can get 80% of the benefit with only 20% of the cost. In this situation we might obtain the bulk of the benefit from structural waste while using only a fraction of the airspace.

The shear strength of the pulp mill waste has previously been characterized to range from 20° to 40° friction (Geotechnical Report for Cell 3, Thiel Engineering, Nov. 2004). For purposes of this discussion it is reasonable to presume that we need to consider the lower end of the shear strength spectrum, when the waste is coming in wet and develops pore pressures. Thus, for now, we will presume that the waste strength is 20° friction. The goal is to increase the waste strength to 30° friction to meet the reliability goal that has been established in the previous studies.

The shear strength of structural materials varies depending on the materials, but on average could be characterized with a friction angle of 45°. That is to say, a pile of compacted construction and demolition (C&D) debris could be expected to have an angle of repose of 1:1. In fact, many municipal solid waste (MSW) facilities have been observed with 50-foot high vertical slopes, and C&D debris is usually considered even stronger than MSW. For design purposes, Thiel Engineering uses 45° shear strength for C&D waste.

The question now is how much structural waste having a shear strength of 45° friction is needed to be randomly mixed with waste having a shear strength of 20° friction to result in an average shear strength of 30° friction along a given shear plane? A simple equation can be set up as:

$$p * \tan(45) + (1-p) * \tan(22) = \tan(30)$$

where p = percentage of structural waste. The solution to the above equation is p = 29%. Thus, in general, a reasonable goal for the landfill would be to obtain approximately one-third of its wastestream from "structural" sources. This is not to imply that the landfill is unsafe or would not meet acceptable factors of safety by taking in less than this amount. This conclusion means that the reliability can be enhanced even further by taking in this amount of structural waste.

Is using up one-third of the landfill's capacity counter to the original purpose and need? This is more of a socio-economic question than a technical question, but on the surface it seems that leaving at least two-thirds of the original capacity is a very healthy balance and would provide for the immediate purpose and need. Furthermore, the original landfill economics were based on a much higher annual volume than has been realized since its opening nearly 13 years ago. The original design had anticipated landfill volumes of one million cubic yards per year. The actual volumes have only been about 25% of that, on average. There is a substantial reserve capacity at this site that allows flexibility in adjusting to waste streams. Thus, allowing one-third of the current waste stream to consist of C&D and land clearing type of debris is well within the planned landfill capacity, especially since a certain portion of the landfill capacity, albeit undefined, had been allocated to this type of waste even since the beginning.

Conclusion

Attention to landfill operations is critical at the Weyerhaeuser Regional Landfill site in many regards, slope stability being one of them. Many operational measures have been put in place to increase the slope stability reliability of the site since its initial operations, including the intentional incorporation of structural waste, such as C&D and land-clearing debris, from outside sources into the landfill. This letter has been prepared to quantify the optimal amount of structural waste that should be considered for this site, and a value of approximately 30% has been calculated. Although the landfill could be safely operated with less structural waste, and more would always be better from a technical point of view, a ratio of about one-third structural waste to two-thirds forest products waste is recommended as a desirable goal to maximize reliability. Please call me at 530-692-9114 if you have any questions.

Sincerely,
Thiel Engineering

R. Thiel

Richard Thiel, P.E., RCE #26862