Geosyntec consultants

Certification for Liquid Flow Rate Through Alternative Composite Liner

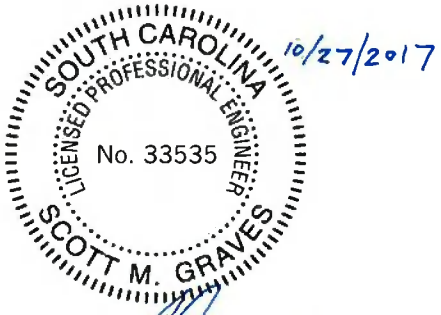
Federal CCR Rule: 40 CFR §257.70(c)(2)

CCR Unit: WGS Class Three Landfill (CCR Landfill)

Certification:

I, **Scott M. Graves**, a qualified professional engineer registered in the state of **South Carolina**, have compared the liquid flow rates through the lower component (i.e., a geosynthetic clay liner (GCL)) of the alternative composite liner for the above-referenced CCR Unit, and for two feet of compacted soil with a hydraulic conductivity of 1×10^{-7} cm/sec. The liquid flow rate comparison was made by calculating flow rates through these components using the prescribed "Equation 1" given in 40 CFR §257.70(c)(2), which is derived from Darcy's Law for gravity flow through porous media. Based on this comparison, I find and certify that in my professional opinion, using Equation 1 the liquid flow rate through the lower component of the alternate composite liner (the GCL) is no greater than the liquid flow rate through two feet of compacted soil with a hydraulic conductivity of 1×10^{-7} cm/sec, and thus the alternative composite liner meets the requirements of 40 CFR §257.70(c).

Seal and Signature:



Firm Seal

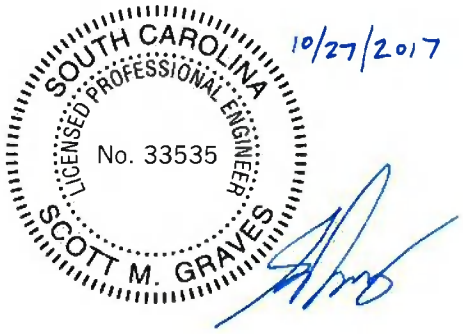
Printed Name: Scott M. Graves

PE License Number: 33535 State: South Carolina

Written by: Y. Bholat Date: 10/9/2017 Reviewed by: S. Graves Date: 10/9/2017

Client: Santee Cooper Project: Winyah Generating Station Project No.: GSC5242 Phase No.: 01BT

LIQUID FLOW RATE COMPARISON – LOWER COMPONENT OF COMPOSITE LINER



SEALED FOR CALCULATION PAGES 1 THROUGH 2

PURPOSE

The purpose of this evaluation is to compare the calculated liquid flow rate through the lower component of the alternative composite liner proposed for the WGS Class Three Landfill (i.e., CCR Landfill) to the calculated liquid flow rate through two feet of compacted soil with a hydraulic conductivity of 1 x 10^{-7} cm/sec. This comparison is being performed pursuant to the requirements of 40 CFR §257.70(c)(1) and (2).

METHODOLOGY

The methodology prescribed by 40 CFR §257.70(c)(2) is used to make the liquid flow rate comparison, as required. Accordingly, the liquid flow rate for each condition is calculated using "Equation 1" (per §257.70(c)(2)), shown below.

$$q = k\left(\frac{h}{t} + 1\right) \qquad \text{(Eq. 1)}$$

where, q = flow rate per unit area ($cm^3/s/cm^2$), k = hydraulic conductivity of the liner (cm/s), h = hydraulic head above the liner (cm), and t = thickness of the liner (cm).

LIQUID FLOW RATE CALCULATIONS

A hydraulic head on the liner of 0.2 inches was used for this analysis. This is based on the facility-specific design of the leachate collection and removal system, and in particular the as-designed and specified engineering properties of the leachate collection drainage layer geocomposite that will be placed above the geomembrane component of the composite liner. Using these properties, the calculated peak head on the liner is 0.2 inches, as documented in the *Winyah Generating Station Class Three Landfill Permit Application* approved by the South Carolina Department of Health and Environmental Control (DHEC) on 15 September 2017 [Permit #LF3-00042].

Compacted Clay Soil

The hydraulic conductivity and thickness of compacted soil used in the evaluation are $1x10^{-7}$ cm/s and 2 feet (24 inches), respectively, as designed, and consistent with 40 CFR §257.70(c)(2). The resulting liquid flow rate using Eq. 1 is calculated as shown below.

$$q = 1x10^{-7}\ cm/s\left(\frac{0.2\ in * \frac{2.54\ cm}{in}}{24\ in * \frac{2.54\ cm}{in}} + 1\right) = \mathbf{1x10^{-7}}\ \frac{\boldsymbol{cm^3}}{\boldsymbol{s * cm^2}}$$

Geosynthetic Clay Liner (GCL)

The hydraulic conductivity and thickness of the lower component of the alternative composite liner (i.e., a GCL) used in the evaluation are $5x10^{-9}$ cm/s and 0.5 cm, respectively, as designed and specified in the *Winyah Generating Station Class Three Landfill Permit Application* approved by the South Carolina Department of Health and Environmental Control (DHEC) on 15 September 2017 [Permit #LF3-00042]. The resulting liquid flow rate using Eq. 1 is calculated as shown below.

$$q = 5x10^{-9}\ cm/s\left(\frac{0.2\ in * \frac{2.54\ cm}{in}}{0.5\ cm} + 1\right) = \mathbf{1x10^{-8}}\ \frac{\boldsymbol{cm^3}}{\boldsymbol{s * cm^2}}$$

CONCLUSION

A comparison of the liquid flow rates presented above using Eq. 1 shows that the calculated flow rate through the lower component of the alternative composite liner (i.e., the GCL) is no greater than (and in fact is ten times less than) the liquid flow rate through two feet of compacted soil with a hydraulic conductivity of 1 x 10^{-7} cm/sec, thereby showing that the requirements of 40 CFR §257.70(c)(1) and (2) are met.