Certification for Liquid Flow Rate Through Alternative Composite Liner

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

CCR Unit: Santee Cooper Cross Generating Station Class Three Landfill (CCR Landfill)

Certification:

I, **Fletcher M. Wood**, 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, or GCL) of the alternative composite liner for the above-referenced CCR Unit, and for two feet of compacted soil with a hydraulic conductivity of $1x10^{-7}$ cm/s. 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 alternative composite liner (the GCL) is no greater than the liquid flow rate through two feet of compacted soil with a hydraulic conductivity of $1x10^{-7}$ cm/sec, and thus the alternative composite liner meets the requirements of 40 CFR §257.70(c)(2).

SOUTH CAROLINA LICENSED PROFESSIONAL ENGINEER No. 24767 FLETCHER M. WOOD

Fletcher Wood

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Date: 2024.11.21 16:38:59 -06'00'

SOUTH CAROLINA WORLEY GROUP INC. No. C01505 CERTIFICATE OF AUTHORIZATION

Seal and Signature: _____ **Firm Seal**

Printed Name: Fletcher Wood

PE License Number: 24767 **State:** South Carolina

LIQUID FLOW RATE COMPARISON – LOWER COMPONENT OF COMPOSITE LINER

Federal CCR Rule: 40 CFR §257.70(c)(1) and (2)

CCR Unit: Santee Cooper Cross Generating Station (CGS) Class Three Landfill (CCR Landfill)

SEALED FOR CALCULATION PAGES 1 AND 2

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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 CGS CCR Landfill to the calculated liquid flow rate through two feet of compacted soil with a hydraulic conductivity of $1x10^{-7}$ cm/s. This comparison is 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), as follows:

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

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)
t = thickness of the liner (cm)

LIQUID FLOW RATE CALCULATIONS:

A hydraulic head above the liner of 3 inches was used for this analysis. This is based on the facility-specific design of the leachate collection and removal system, as documented in the Cross Generating Station Class Three Landfill Permit Application approved by the South Carolina Department of Health and Environmental Control (DHEC) on March 27, 2013 [Permit #LF3-00007]. As a general rule, the leachate collection and removal system is designed to maintain a peak daily head on the liner equal to less than the thickness of the 0.2-inch thick geocomposite drainage layer installed directly on top of the liner. However, the exception to this rule is along a portion of the leachate collection pipe trenches, where the system is designed to maintain a maximum head on liner equal to less than 3 inches. The more conservative value of 3 inches is therefore used in this analysis.

Compacted Clay Soil:

The hydraulic conductivity and thickness of compacted soil used in this 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 follows:

$$q = 1 * 10^{-7} \frac{cm}{s}\left(\frac{3\ in * 2.54\frac{cm}{in}}{24\ in * 2.54\frac{cm}{in}} + 1\right) = 1.1 * 10^{-7} \frac{cm^3}{s * cm^2}$$

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 Cross Generating Station Class Three Landfill Permit Application approved by the South Carolina Department of Health and Environmental Control (DHEC) on March 27, 2013 [Permit #LF3-00007]. The resulting liquid flow rate using Eq. 1 is calculated as follows:

$$q = 5 * 10^{-9} \frac{cm}{s}\left(\frac{3\ in * 2.54\frac{cm}{in}}{0.5cm} + 1\right) = 8.1 * 10^{-8} \frac{cm^3}{s * cm^2}$$

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 specified GCL) is no greater than the liquid flow rate through two feet of compacted soil with a hydraulic conductivity of $1x10^{-7}$ cm/s, thereby showing that the requirements of 40 CFR §257.70(c)(1) and (2) are satisfied.