

Enviro™ Cover Controls Odours in Landfills

It is a common requirement for landfills to control odours from municipal solid waste by covering deposited waste with an earthen or alternative daily cover (ADC) material.

Enviro™ Cover is a non-reusable polyethylene ADC, which is a technically “impermeable” material to gaseous movement because it has no interconnected pores. Gas molecules including water vapour, methane and other odorous gases move extremely slowly through Enviro™ Cover only as a vapor phase via molecular solubility and diffusion, in a process known as permeation. As a result, Enviro™ Cover effectively contains odours which are generated from the landfill working face.

ASTM Test Method E96

At present, there is no widely accepted direct method to test the capability of an ADC material to control odours in the field. The American Society for Testing and Materials (ASTM) recommends in the ASTM Standard Guide D6523 (Ref. 1), Standard Guide for Evaluation and Selection of Alternative Daily Covers (ADCs) for Sanitary Landfills, “For slurries and geosynthetics, an odour control test should be conducted to assess performance. For these materials a permeation test, Test Method E96, is suggested, correlating the movement of water vapours through an ADC layer to the movement of odour layers through such layer. Water vapour loss through the ADC should be less than 3,000 g/m²/day.”

Two of the thinnest Enviro™ Cover grades, 1.5 mil daily Enviro™ Cover and 2.0 mil Progressive Daily Cover, were tested with ASTM Test Method E96 (Ref. 2) by an independent ISO 9002 certified laboratory (Ref. 3). The test results (Table 1) show that water vapour loss through the 1.5 mil Enviro™ Cover was 0.023 g/m²/day, only 1/130,000th of the ASTM’s recommended daily value. Enviro™ Cover has different grades ranging from 1.5 to 9.0 mil thickness. The thicker Enviro™ Cover films provide a longer pathway to water vapour loss and have a more superior odour control capability.

Table 1 Water Vapour Transmission Test Result

(ASTM Test Method E96 tested by an independent ISO 9002 certified laboratory, Precision Geosynthetic Laboratories, PGL Job No. 010965)

Enviro™ Cover Grade	Water Vapour Transmission (g/m ² /day)
1.5 mil Daily Enviro™ Cover	0.023
2 mil Progressive Daily Cover	0.011

(Note: ASTM recommends that water vapour transmission through an ADC should be less than 3,000 g/m²/day)

Comparison with Soil Cover

Using the water vapor transmission data of the 1.5 mil daily Enviro™ Cover and making assumptions about typical temperature, humidity and pressure, the permeability of water vapour through the 1.5 mil daily Enviro™ Cover is calculated in Appendix 1 to be roughly 6 x 10⁻¹⁷ m/s. This is 1/167,000,000th of the typical permeability of well-compacted clay of 1 x 10⁻⁸ m/s (Ref. 4). Therefore, Enviro™ Cover deployed over the active working face is far more effective than soil in controlling odours through the cover material.

International Acceptance

In many cases, compliance with statutory odour control requirement, amongst other operating requirements, is tested by means of a demonstration or trial for each landfill site. When a demonstration/trial proves that an ADC complies with the requirements, the ADC is accepted. The most meaningful indication of an ADC's odour control capability is its worldwide acceptance and use.

In the United States of America, Enviro™ Cover has been evaluated independently in many states by EPA's requirements and has been approved in many states such as California, Oregon, South Carolina, North Carolina, Nebraska, Texas, New York, Minnesota, Utah, Illinois, Indiana, Arkansas, and Arizona. The number of states approving Enviro™ Cover is continuously increasing.

Enviro™ Cover has also been evaluated in many countries by their respective odour control standards. It has been approved for use in many countries such as Canada, Argentina, Australia, England, Erie, Finland, North Ireland, Wales and Scotland. From the extensive acceptance and use of Enviro™ Cover, it is evident that Enviro™ Cover meets the US and international standards in odour control.

Appendix 1: Permeability Water Vapour through 1.5 mil Daily Enviro Cover

P_s = pressure of saturated vapor at a given temperature
 H = relative humidity - 60%
 T = 23 °C

At $T = 23$ °C, $P_{s,1} = 21.068$ mm Hg

$$P_s = 21.068 \times 133.3 = 2808 \text{ Pa}$$

The vapor pressure is $p = H \times P_s$.

$$p = 0.6 \times 2808 = 1685 \text{ Pa}$$

Water Vapor Transmission WVT = 0.023 g/m².24h for 1.5 mil daily Enviro Cover (Table 1)

WVT = $p \times w$ (w is the permeance)

$$w = \frac{\text{WVT}}{p} = \frac{0.023 \times 10^{-3}}{8.64 \times 10^4 \times 1685} = 1.58 \times 10^{-13} \text{ kg/m}^2 \cdot \text{Pa} \cdot \text{s}$$

Permeability $k = w \times g \times t$ (where $g = 9.81 \text{ m/s}^2$, t is the thickness = 1.5 mil = $38 \times 10^{-6} \text{ m}$)

$$k = 1.58 \times 10^{-13} \times 9.81 \times 38 \times 10^{-6}$$

$$k = 5.89 \times 10^{-17} \text{ m/s}$$

Reference

1. The American Society for Testing and Materials, ASTM D6523-00, "Standard Guide for Evaluation and Selection of Alternative Daily Covers (ADCs) for Sanitary Landfills"
2. The American Society for Testing and Materials, ASTM Test Method E96-00, "Standard Test Methods for Water Vapor Transmission of Materials"
3. "Precision Geosynthetic laboratories, Test Report PGL Job No. 0.0965, November 7, 2001"
4. Mark Cadwallader, Cadwallader Technical Services, Conroe, Texas, "Gas & Odour Suppression: A Comparison of Polyethylene Film Alternative Cover (AC) and Daily Cover Soil"

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