A·C·C
ENVIRONMENTAL
CONSULTANTS

September 28, 2006

Ms. Teresa Clarke
Affordable Housing Associates
1250 Addison Street, Suite G
Berkeley, California 94702

RE: Comments – Proposed Moisture/Vapor Barrier
160 14th Street, Oakland, California
ACC Project Number 6179-014.02

Dear Ms. Clarke:

ACC Environmental Consultants (ACC) has prepared this letter regarding the proposed moisture barrier to be installed during development at 160 14th Street, Oakland, California (Site). In our May 5, 2006 *Subsurface Characterization Report*, ACC identified tetrachloroethene (PCE) in groundwater that likely originates from an adjacent property at 190 14th Street. Based on the findings of a previously prepared Tier 1 Risk Evaluation, the concentration levels of PCE in groundwater at the Site are below the applicable environmental screening level (ESL) for commercial use and do not pose an unacceptable human health risk to future occupants of the proposed development at 160 14th St. However, since a moisture barrier has already been recommended prior to installation of the slab foundation, ACC would like to comment on the benefits of the proposed moisture barrier in regards to the PCE in groundwater issue.

ACC performed a Tier 1 risk evaluation using the published ESL for PCE promulgated by the San Francisco Bay Regional Water Quality Control Board (RWQCB). Based on proposed future Site use, Site location, and the depth to groundwater impacted by PCE, potential indoor inhalation is the only potential complete exposure pathway. According to Table E-1a of the RWQCB guidance manual, the applicable PCE ESLs vary from 120 micrograms per liter (μg/L) in high permeability residential soils to 1,700 μg/L in low/moderate permeability commercial soils, and are summarized in Table 1.

TABLE 1 – PCE ESLs (Table E-1a)

Constituent	Residential Land Use		Commercial Land Use	
	High Perm. Soil	Low Perm. Soil	High Perm. Soil	Low Perm. Soil
PCE	120	500	420	1,700

Notes Concentrations are in micrograms per Liter (μg/L)

PCE concentrations in groundwater ranged from 780 to 820 µg/L in saturated silty sands below 10 feet bgs. Based on estimated soil permeability at the Site, somewhere between low and high permeability, the applicable residential ESL for PCE would be approximately 400 µg/L and the applicable commercial ESL for PCE would be 1,360 µg/L. Site development will be a combination of commercial space and parking on the ground floor so commercial ESLs are applicable. The average PCE concentration of 800 µg/L in groundwater is well below the commercial ESL concentration of 1,360 µg/L.

ACC understands that the recommended moisture barrier for the Site is the Permalon Ply X-210. This high density, cross-laminated polyethylene fabric is highly resistant to tears and punctures and resists stress cracking caused by seasonal thermal expansion and contraction cycles in subsurface soils. Permalon Ply X-210 thickness is 20 mil, the burst strength is 100 pounds per square inch, and the puncture strength is 40 pounds. This polyethylene material, designed to prevent moisture movement in the subsurface, would also represent a substantial barrier to potential PCE movement in soil gas. While native soil permeability is estimated to be low to moderate, the proposed Permalon Ply X-210 moisture barrier would further decrease the already acceptable human health risk associated with PCE by further minimizing or preventing soil gas from migrating vertically to the building foundation.

Based on the findings of subsurface investigation performed at the Site, the results of the Tier I Risk Evaluation, and proposed construction methods including installation of the Permalon Ply X-210 moisture barrier, no significant impacts to human health associated with PCE concentrations in groundwater are indicated. Additional human health risk assessment or installation of a more elaborate vapor barrier is not warranted.

If you have any questions, please contact me at (510) 638-8400, ext. 109.

Sincerely,

David DeMent, PG, REA II
Division Manager / Senior Geologist

Attachment: Permalon Ply X-210 Specifications

Product Information

Permalon® Ply X-210®

- High density, cross-laminated polyethylene resists punctures and tears.
- UV stabilized to withstand prolonged exposure to sunlight.
- Ply X-210 is not prone to environmental stress-cracking (ESC) so it can endure repeated thermal expansion & contraction cycles.
- Meets ASTM standard D-3083 Soil Burial test performance requirements.

Physical Properties and Typical Values

Property		ASTM Test Method	US Value	Metric Value
Thickness		D-5199	20 mil	.50 mm
Weight		D-751	78 lb/1000 ft^2	38.1 kg/100 m^2
1" Load @ Yield	MD	D-882	32 lbf	142 N
	TD		33 lbf	147 Mpa
1" Load @ Break	MD	D-882	70 lbf	311 N
	PSI		3750 psi	26 Mpa
	TD		59 lbf	262 N
	PSI		3070 psi	21 Mpa
1" Elongation @ Break	MD		650 %	650 %
	TD		450 %	450 %
Tongue Tear	MD	D-2261	25 lbf	111 N
	TD		21 lbf	93 N
Trapezoidal Tear	MD	D-4533	35 lbf	156 N
	TD		41 lbf	182 N
PPT Resistance	MD	D-2582	41 lbf	182 N
	TD		40 lbf	178 N
Seam Integrity - 3"	Shear	D-4545	90 lbf	400 N
	Peel		45 lbf	200 N
Dart Impact Strength		D-1709	3.8 lbs	1.7 kg
Puncture Strength		D-4833	40.0 lbs	177.9 N
Hydraulic Burst Strength		D-3786	100 psi	>.779 Mpa

MD = Machine Direction

TD = Transverse Direction

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Fabrication and Installation Guidelines for PERMALON® containment liners

Factory Seams

All factory seams are made using a thermal/pressure fusion technique performed under controlled conditions. Seams are subjected to inspection and testing by Quality Control personnel. This seaming method produces a two inch wide seam that is watertight and comparable in strength to the parent material.

Field Seams

Field Seaming is greatly minimized due to Reef's ability to prefabricate customized and large liners. When necessary, multiple large liners can be seamed in the field using hand-held extrusion welders. Extrusion welding is performed using a welding rod material identical in composition to the base liner material.

Subgrade

It is common practice to install the liner over a two inch layer of sand (or equivalent) or over a layer of geotextile. In addition to protecting the liner, the geotextile helps stabilize the slope subgrade. Liners installed over a subgrade which contains any sharp rocks, roots or other protrusions are subject to puncturing. Any rocks that are not smooth and are greater than ¼ inch in diameter should be removed before installing the liner.

Installation

Permalon liners are specially folded at the factory to make deployment easier. Liners are accordion folded providing easy removal and placement along the edge of the pond area with a minimum of labor. The liner is then pulled across the pond where
it is positioned and secured. Sufficient slack should remain after the liner is secured to allow for thermal cycling. The deployment process is repeated when multiple liner sections are required.

Anchoring Methods

The recommended anchoring method is to dig an anchor trench, insert the perimeter of the liner material into the trench and anchor it by backfilling the trench (See attached "Backfill Instructions"). This is the preferred method because it completely prevents
the ingress of water and wind under the liner. Water under the liner can erode the subgrade and undermine the liner support–leading to liner failure. If wind gets under an open edge, it can quickly convert the liner into a sail.

Pipe Penetrations

Pipes and other penetrations through the liner can be sealed by using a pipe boot. This is a flanged tube fabricated at the factory using the liner material. The tube fits over the pipe and the flange is sealed to the liner with Fab tape. If required, the open end of the tube may be sealed with Fab tape or gasketed and mechanically sealed.

Fab Tape

Fab tape is an asphaltic mastic used to form a durable water tight seal around penetrations through the liner.

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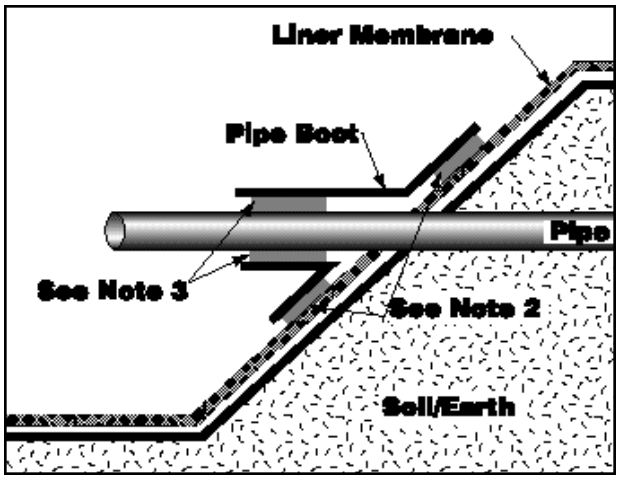
Pipe Intrusion Through PERMALON® Liner Membrane

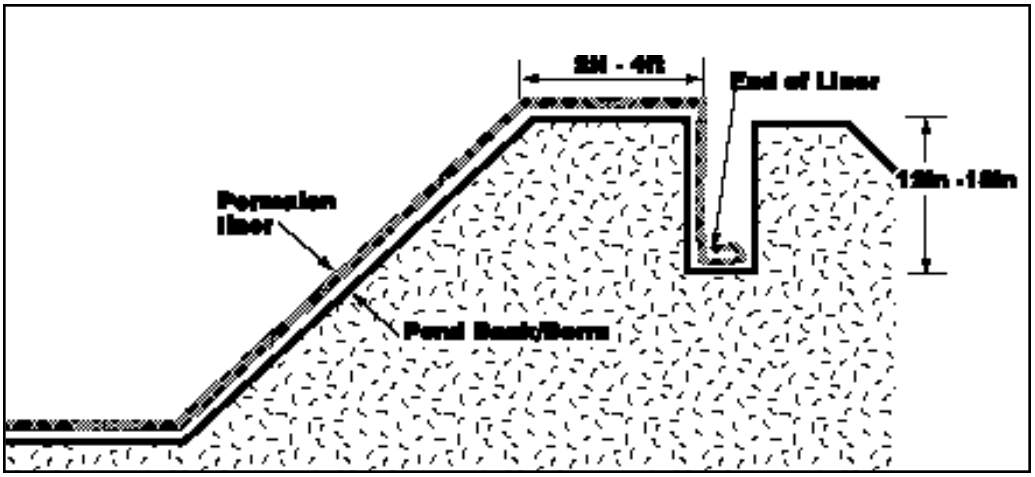


Instructions

1 Place pipe intrusion through liner membrane.
2 Affix liner membrane to pipe boot membrane using a compatible tape.
3 Affix pipe boot membrane to pipe using compatible tape or clamps.

Contractor must provide exact pipe diameter in order for Reef Industries to furnish pipe boots.

Backfill Instructions



Instructions

1 Backfill material should consist of sand or like material and should not contain rocks or hard clay.
2 Sides and base of pond should be clear of large rocks and other debris. Only smooth rocks less than 1/4 inch in diameter should remain.
3 Outer bank side of anchor trench should be slightly lower to prevent dirt from washing into canal or pond.
4 Liner should not be stretched in hot weather because it will contract when cool and cause stress points to occur.

PERMALON® PERMEABILITY PERFORMANCE

WATER VAPOR PERMEABILITY

MATERIAL	PERMEANCE (perms*)	WVTR** gm/hr/m²	WVTR** Grains/hr/ft²	WVTR cm/sec
PERMALON X-150	0.0636	0.0184	0.0264	1.23×10^{-9}
PERMALON X-210	0.0310	0.00884	0.0127	6.0×10^{-10}
VAPORGUARD	0.0142	0.0041	0.0059	2.74×10^{-10}
VAPORGUARD FR	0.0142	0.0041	0.0059	2.74×10^{-10}

*perms= grains / hr / ft² in. Hg

**Environment 73 +/- 3°F 50% Relative Humidity (ASTM E-96)

METHANE PERMEANCE

	PERMEANCE#
PERMALON X 150	1.09 X 103
PERMALON X 210	.710 X 103

#ASTM D-1434 AT 25°C (ml/m² day)

RADON PROTECTION

	THICKNESS CM (INCHES)	RADON DIFFUSION COEFFICIENT	% REDUCTION IN RADON FLUX THRU SLAB†
PERMALON X 150	0.021(.0085)	4.5×10^{-7}	47
PERMALON X 210	0.044 (.018)	4.2×10^{-7}	67

† 10 cm slab with 1 x 10-3 cm²/s radon diffusion coefficient

grains / hr ft² x 0.696 = gm / hr m²
gm / hr m² x 6.45 x10-2 = gm / hr 100 in²
gm / hr 100in² x 24 = gm / 24 hr 100 in²
1 gram = 15.44 grains
1 in Hg = .491 psi
1 m² = 10.76 ft²

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SOIL BURIAL Test

Permalon® X-150®, X-210® and X-210G®

Permalon X-150, X-210 and X-210G materials were subjected to a 30 day soil burial test following standards and procedures as outlined in ASTM D-3083, Section 9.5. Results of this test are outlined below.

PERMALON X-150

TEST METHOD		INITIAL VALUE	AFTER BURIAL TEST	% DECREASE
TENSILE @YIELD	MD	39 lbs	39 lbs	-
	TD	52 lbs	52 lb	-
TENSILE @BREAK	MD	67 lbs	64.5 lbs	3.7 %
	TD	83 lbs	83.5 lbs	-
ELONGATION	MD	900 %	900 %	-
	TD	810 %	810 %	-

PERMALON X-210

PROPERTY		INITIAL VALUE	AFTER BURIAL TEST	% DECREASE
TENSILE @YIELD	MD	85 lbs	98 lbs	-
	TD	95 lbs	101 lbs	-
TENSILE @BREAK	MD	131 lbs	123 lbs	6 %
	TD	143 lbs	138 lbs	3.5 %
ELONGATION	MD	900 %	900 %	-
	TD	740 %	750 %	-

PERMALON X-210G

PROPERTY		INITIAL VALUE	AFTER BURIAL TEST	% DECREASE
TENSILE @YIELD	MD	290 lbs	290 lbs	-
	TD	259 lbs	260 lbs	-
TENSILE @BREAK	MD	156 lbs	142 lbs	9 %
	TD	155 lbs	140 lbs	9 %
ELONGATION		900 %	900 %	-

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