

Protecting geomembranes from animal damage

By Andrew Mills and Timothy D. Stark

Resisting animal and insect attacks on geomembranes is an interesting problem. Geomembrane installers and manufacturers have had numerous geomembranes damaged by bears, deer, coyotes, birds, beavers, and ground squirrels (Figures 1 and 2). In most cases, the damage is incidental to something else the animal is seeking. Deer damage the liner with their hooves trying to climb out. Bears dig through the liner to try and find something on the other side (organic matter left under a liner in a retrofit, for example). Coyotes burrow under the liner on slopes to create a den that doesn't freeze.

The most problematic animals are, depending on the geography, ground squirrels, prairie dogs, and various species of gophers. They create extensive tunnel systems that weaken the slopes of the berm (dam). They frequently bite through the liner, which then floods their tunnels, leading to significant leakage. Containment from these pests is usually done with a "biotic barrier" that is essentially a deep trench at the top of the berm that is filled with larger stones (75mm to 100mm). A 1.5m-deep biotic barrier will often keep the ground squirrels back far enough from the liner. They can colonize near the outside of the slope, but at 3-to-1, the horizontal distance underneath the barrier is too far for them to tunnel. It would be 5.5m horizontally from the barrier to the liner and another 5.5m from the outside of the berm to the barrier. Essentially, it is a cutoff wall for critters.

When dealing with burrowing animals or insects, the use of a biotic barrier is suggested. It is relatively easy to build and is fairly effective. It is important to recognize the tunneling behavior of the animal that you are excluding: digging depth, horizontal tunneling distance, and so on.

Direct consumption of plastics can be more problematic. Termites, as well as rats and mice, have been known to eat through wire coverings. In many cases, the plastic was flexible polyvinyl chloride (PVC). The softness of the PVC is often considered the problem. However, there are two additives in soft PVC that may be contributing factors. These two additives are the plasticizer epoxidized soybean oil and the lubricant stearate. Although the soybean oil is chemically modified, it may still retain an attractant to an

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Andrew Mills is a research and technology manager at Layfield Group Limited in Edmonton, Alberta, Canada.

Timothy D. Stark is a professor of civil engineering at the University of Illinois at Urbana-Champaign.

animal/insect looking for food. Stearate is most often made from animal fats taken from the meat-rendering industry. The epoxidized soybean oil can reach about 5% in PVC and stearates about 0.1%. The possible attractant values of stearates and soybean oils are speculative, and there is no research to support that speculation.

In researching this problem, it was found that often the plastics were surrounded by a large amount of “bait wood” in order to get the termites chewing. Therefore, the termites may not have been targeting the plastic, but the plastic was in their way as they were trying to get to something else to eat. Since plastics in general are fairly soft, it is often easier for an animal to chew through the plastic than to work around it. Occasionally, stearates are used as lubricants on polyethylene plastics (process aids). The levels are low, but they bloom to the surface and would be sitting on the surface of the plastic.

There are plastics available with additives to prevent insect and animal attacks, as well as tarp materials that contain hot pepper extract to deter rodents. Insecticides can also be added to the plastics, if needed. Because some manufacturers also make food-grade plastics on the same equipment, they are not able to pursue the use of insecticide additives.

It has been found that the best practice for excluding animals and insects from geomembranes is to create a physical barrier between them and the liner. This can often be a trench filled with gravel, a buried line of galvanized mesh, or a berm core with large gravel sizes. The area adjacent to the liner must be kept

as sterile as possible—no grass, trees, or topsoil should be present. A paved road on top of the berm is best. It is imperative that no organics (wood, roots, sewage, or manure) remain in or under the liner system. If the critters think something appealing is there, the plastic will not prevent them from getting to it.

References


- Bell, A. (1984/1985). “Plastics that termites can’t chew.” *Ecos*, 42 (Summer). http://www.ecosmagazine.com/?act=view_file&file_id=EC42p32.pdf (April 6, 2017).
- Lenz, M., Creffield, J. W., Evans, T. A., Kard, B., Vongkaluang, C., Sornnuwat, Y., Lee, C.-Y., Yoshimurag, T., and Tsunodag, T. “Resistance of polyamide and polyethylene cable sheathings to termites in Australia, Thailand, USA, Malaysia, and Japan: A comparison of four field assessment methods.” <https://publications.csiro.au/rpr/download?pid=csiro:EP115340&dsid=DS13> (April 6, 2017). 



FIGURE 1 Close-up of damage to PVC geomembrane from deer hooves



FIGURE 2 Beaver damage to geomembrane liner