

Composting Animal Carcasses Removed From Roads: An Analysis of Pathogen Destruction and Leachate Constituents in Deer Mortality Static Windrow Composting

Perspective Virginia recorded more than 48,700 deer-vehicle crashes in FY 2011. The Virginia Department of Transportation (VDOT) is responsible for retrieving and disposing of animal carcasses found along state-maintained roads (this is known as mortality management). VDOT spent an average of \$4.1 million annually on carcass removal and disposal from FY 2007 through FY 2011.

VDOT maintenance facilities use two main methods of disposing of these carcasses: delivering them to landfills or burying them beside the road within the state right of way. The number of VDOT's viable roadside areas for burials is decreasing, and carcass disposal at landfills often involves high fees, long worker travel distances to and from the landfill and increasing landfill restrictions against accepting animal road mortality.

A 2010 study conducted by researchers at the Virginia Transportation Research Council (now the Virginia Center for Transportation Innovation and Research [VCTIR]) investigated mortality management methods VDOT could use at its maintenance facilities (see [VTRC 10-R7](#)). The study concluded that the use of static compost windrows is a promising mortality management option for transportation agencies.

Static compost windrows are mounds composed of deer carcasses layered with a carbon source, such as wood chips. Workers do not need to turn the piled materials; the piles are left undisturbed while the composting process completes.

Researchers at VCTIR conducted the windrow composting study to determine the extent of pathogen destruction — specifically *E. coli*, *Salmonella* and a roundworm — and potential seepage of contaminants listed in state regulatory standards (ammonia, chloride, total organic carbon, and nitrate) from static windrow composting of deer mortality. The research team concluded that with properly constructed windrows, the high temperatures reached during the composting process destroy the indicator pathogens.

The team also found that only 2 percent of the precipitation that fell on windrows left the piles in the form of leachate (liquid from precipitation that seeps through the composting material) and that the natural soil filtration of leachate further reduced the concentrations of deer mortality contaminants to low levels. This resulted in a nominal loss of nitrate and other contaminants from the windrows.

These findings were important evidence for VCTIR to share with the Virginia Department of Environmental Quality (DEQ), the state agency that enforces the state composting regulations. Discussions with DEQ may lead to increased prospects of using windrow composting at VDOT area headquarters to save time and money.

The 2010 study had found that 46 of the 189 VDOT area headquarters frequently used landfills and traveled away from routine maintenance routes to dispose of deer carcasses. In that study, researchers estimated that if those 46 VDOT area headquarters switched to using windrow composting in their maintenance areas or along routine maintenance routes, VDOT could save approximately \$515,440 in labor costs and landfill fees annually. With fewer trips to disposal facilities, VDOT also would save substantially on fuel and reduce carbon emissions.



Researcher Bridget Donaldson collects samples of pathogens from a static windrow

For the full report, search [12-R12](#) at vtrc.virginiadot.org. For more information about the research, contact Bridget M. Donaldson, VCTIR senior research scientist, Bridget.Donaldson@vdot.virginia.gov

Background VCTIR initiated this study of the environmental implications of static windrow composting as a follow-up of the 2010 study. The earlier study found that a majority of the VDOT maintenance area staff surveyed saw a potential benefit from having additional carcass management options to reduce disposal costs and labor. In addition to windrow composting, the 2010 study identified two types of vessel composting as promising options applicable in Virginia. A subsequent 2013 report (VCTIR 13-R8) gave the results of pilot studies of the two vessel composting options.

The U.S. Environmental Protection Agency promotes the benefits of implementing composting programs within a state transportation department. Composting provides an alternative waste management strategy that can reduce the production of greenhouse gases and the buildup of carbon in soil.

Four state transportation agencies use animal mortality windrow composting: New York, Montana, West Virginia, and Kentucky. To increase the implementation prospects of windrow composting by VDOT, the windrow composting study was needed to assess its ability to destroy pathogens and potential impacts, if any, on water quality.

Research and Recommendations The research team constructed compost windrows of road-killed deer mortality layered in wood chips and monitored them for one year under typical weather conditions. The researchers analyzed the windrows for pathogen destruction and filtration of leachate contaminants through the underlying soil.

High temperatures attained within the windrows as a result of the composting process reduced the indicator pathogens *E. coli* and *Salmonella* 99.99 percent by day seven. *Ascarids*, parasitic roundworms, were deemed nonviable by day 77. Soil filtration of the low volume of leachate leaving the deer mortality windrows effectively reduced concentrations of ammonia, chloride and total organic carbon. Nitrate, a contaminant of particular regulatory concern, had an estimated mass contaminant loss of 1.9 pounds per acre, considerably less than nitrate loss from fertilizer applied to crops.

VDOT’s Environmental Division and VCTIR have followed up on the study recommendation to brief DEQ on the study results. DEQ and VDOT are discussing a memorandum of agreement that would revise the composting requirements applicable to VDOT. This would increase the prospects that VDOT would implement composting of animal mortality in static windrows. The technique is particularly suitable for VDOT area headquarters with large lots as well as those in rural areas. Once constructed, static windrows require little maintenance. The resulting compost would be suitable for VDOT to use to control erosion and establish vegetation where needed.

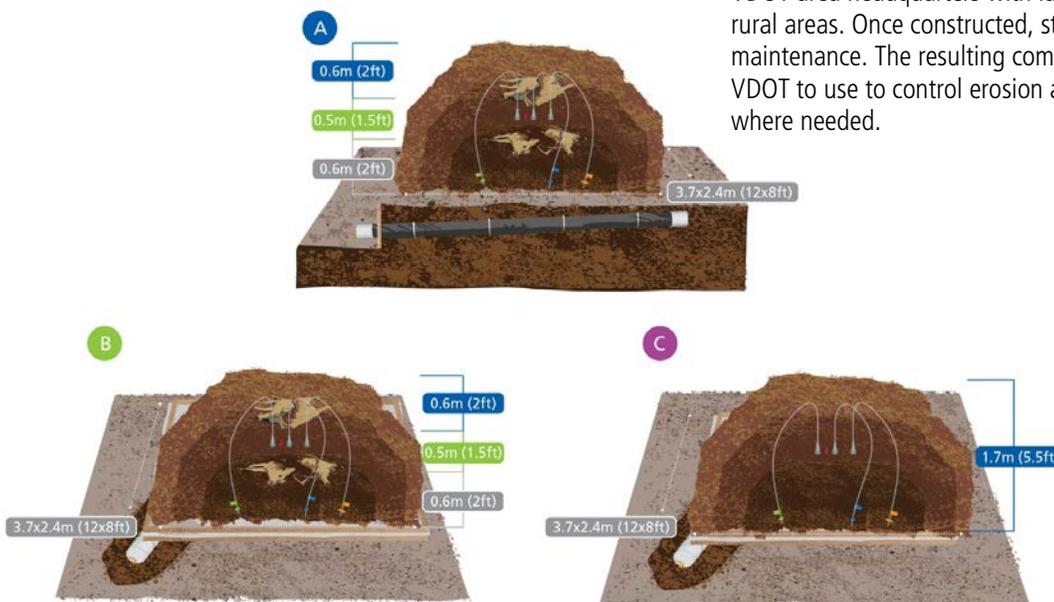


Figure 5 (from VCTIR research report 12-R12). Illustrations of plot design, windrow construction and placement of flasks containing pathogens: windrow 1 (A); windrow 2 (B); and control pile (C). A data logger was placed between the pathogen flasks in all three piles.

This brief does not necessarily reflect the official views or policies of VDOT, the Federal Highway Administration or the Commonwealth Transportation Board. It does not constitute a standard, specification or regulation. Inclusion of manufacturers’ or trade names or trademarks is for identification purposes only and is not to be considered an endorsement.
© 2014, Commonwealth of Virginia. All rights reserved.

The Virginia Center for Transportation Innovation and Research (VCTIR) is proud to contribute to VDOT’s reputation as a national transportation leader. VCTIR greatly appreciates the cooperation and support of VDOT and the Federal Highway Administration.