Guidance for the Use of Shredded Tires in Construction of Landfill Drainage Media

Arkansas Dept. of Environmental Quality
Solid Waste Management Division

Solid Waste Management Division (SWMD) staff recognizes that the use of Shredded Tires may provide benefits to the environment and may offer a cost effective management alternative to disposal. However, the environmental risks associated with the use of these materials must be fully taken into account prior to final placement or use.

The following is a guideline for the beneficial use of shredded tires in the construction of landfill drainage media. Please direct specific questions on specific materials to the Solid Waste Management Division.

From the research and analysis of tire chips the Department has reviewed currently, the Department maintains the view that usage of waste tire chips as drainage material is an appropriate use. However, for the waste tire chips to function appropriately an adequate design and Construction Quality Assurance plan must be implemented. The Department therefore believes the following (minimum) criteria must be adhered to in order to provide waste tire chips that will function equivalent to the standard drainage material currently used in most new landfill cell construction throughout Arkansas.

1. Shredded tires should not be placed on the side slopes.
2. All tire chips or shreds shall have the bead be removed. If bead wire can not be completely removed, then a sand layer with a minimum thickness of 6-inches should be placed between the tire chips/shreds and the Flexible Membrane Liner (FML).
3. Less than 15% (by weight) for the tire chips or shreds shall be free of metal fragments that are not at least partially encased in rubber.
4. Tire chips or shreds should be unattached to one another by wires.
5. All tire chips or shreds shall be free of flammable contaminants.
6. All tire chips shall not have belt wires protruding more than 1.5 inches and 75% of tire chips by weight shall have belt wires protruding less than 0.5 inches.
7. The depth of tire chips should be placed so that once the maximum load has been applied; the tire chips will have a minimum depth of 12 inches.
8. Tire chips should not be placed directly on FML. The FML should have some type of protective cover such as an approved textile or sand layer between the FML and the tire chips.
9. Debeaded shredded tires placed above the geotextile should be deployed using a low gross vehicle weight or low ground pressure equipment (<5psi). Equipment travel during deployment of shredded tires must be carefully controlled to eliminate quick starts and stops, sharp turns, and any activity that may result in dragging of the shredded tires across the geotextile protection layers. A test pad, discussed below, can be used to determine the level of damage expected to the FML, if any, for any given combination of geotextile, shredded tires, equipment, and deployment procedures.
10. A filter layer is required to be placed above the shredded tires that form the leachate collection system drainage layer in order to minimize the clogging of the drainage layer and the perforations in the leachate collection system pipes.

11. The gradation should be specified so as not to impede leachate flow into the landfill Leachate Collection Recovery System (LCRS). For example, guidance from the State of California on this topic recommends the following gradation for tire shreds for a hydraulic conveyance considerations in the table provided below.

Table 1: Tire Shred Size, Tire Shreds As Leachate Drainage Material At Municipal Solid Waste Landfills, California Integrated Waste Waste Management Broad, Prepared by, GeoSyntec Consultants, Inc.

SIEVE SIZE[(2)] IN. (MM)	MINIMUM PASSING (% BY WEIGHT)
12 (300)	**100**
6 (150)	**95**
3 (75)	**85**
2 (50)	**50**
#4 (4.75)	**5**

12. Shredded tires must comply with the material and testing specifications contained in Regulation 22 including any requirements for depth, permeability, slope stability, limits on the amount of fines, and material testing prior to use in construction. Due to the compressible nature of shredded tires, the permeability testing should be run under normal compressive loads at least equivalent to the loads that will be created by the maximum height of waste in the phase, and any alternative thickness thinner or thicker than 30 to 48 inches may need calculations and lab test results showing that the compressed thickness of the shredded tires meet the specification of one foot thickness under the weight of the waste.

Test Pads

Deployment of shredded tires must be carried out cautiously so as not to risk the integrity of the FML due to punctures caused by the shredded tires or compaction of the shredded tires. For contractors not having experience in the construction of drainage layers using shredded tire chips, a test pad may be considered as a requirement by the designer. ADEQ suggests that a test pad be constructed to test the combination of FML, geotextile, shredded tires, deployment procedures and equipment before actual placement of shredded tires in the phase to evaluate the risk of damage to the FML. Test pads may reveal the type and extent of damage to be expected, if any, during deployment of shredded tires using a specific geotextile, equipment and deployment methods.

The FML and geotextile can be analyzed to determine if the FML has been punctured or if damage is significant, i.e. a puncture or gouge in the FML or a puncture through the geotextile. Assessment of FML punctures and gouging can be carried out by sight (magnifying glass), touch, probing (wire or blade type feeler gauges), spark testing, and vacuum testing. Assessment of geotextile puncturing can be carried out by looking for bead wire poking through the geotextile, light box testing, or observing scratches that are characteristic of damage to the FML caused by bead wire. In addition, quality assurance/quality control procedures can be adapted to the specific combination of geotextile, shredded tires, equipment and deployment methods being used to minimize damage to the FML. The use of a test pad is especially useful for the first time use of shredded tires by a contractor, or when using new combinations of materials, equipment, and deployment methods.

Test Pits

If shredded tires are to be deployed within 6 inches of an FML, test pits may be used to allow inspection of the FML to verify that no punctures or significant damage has occurred. Procedures for test pit inspection, FML testing, and test pit closure, as well as a contingency plan that includes progressive assessment of the FML if a puncture or significant damage is found in any test pit, may be included in the QA/QC plan for the facility.

Test Pit Inspection

Damage to FML caused by bead wire has been seen in test pits and test pads. Even if a test pad is constructed or lab testing conducted, factors such as equipment operator diligence, differences in materials from one manufacturer to another, and the variability and lack of standards in the quality of shredded tires, has lead ADEQ SWMD to the conclusion that test pits are vital to demonstrate that the FML has not been punctured or that significant damage, i.e. a puncture or gouge in the FML or a puncture through the geotextile, has not occurred during tire shred deployment.

To expose the FML, test pits, large enough to expose at least three square feet of FML should be dug through the deployed tire shred drainage layer. Typical requirements state that test pits should occur at a minimum frequency of one per 40,000 sq. ft. in areas subject to the highest stresses during deployment. If the deployed layer of shredded tires is less than the appropriate thickness, or if the sand layer thickness or geotextile puncture resistance is less than that what is necessary, then an increased test pit frequency (e.g. one test pit per 20,000 sq. ft.) might be provided.

If test pits are specified, ADEQ recommends that test pit digging begin as soon as an area has received the total design thickness of shredded tires so that if any damage is found, deployment practices or material specifications can be changed early during the deployment. Test pits should be closed in a manner that is protective of the FML by stitching or heat bonding patches of geotextile with the overlapping original geotextile back in place and replacing the shredded tires. Construction certification reports should contain detailed information of test pit locations and the results of the inspection and testing of each test pit and extent of any damage or marring.

Punctures and Significant Damage

During inspections of the test pits, assessment of FML punctures and gouging can be carried out by sight (magnifying glass), touching, probing (wire or blade type feeler gauges), spark testing, and vacuum testing. Assessment of geotextile puncturing can be carried out by looking for bead wire poking through the geotextile, light box testing, or observing scratches that are characteristic of damage to the FML caused by bead wire. If any punctures or gouges are present, or if it is determined that the geotextile has otherwise been punctured by bead wire, a contingency plan should be implemented to assess if any additional damage has occurred to the FML. The contingency plan should be part of the QA/QC plan.

Contingency Plan to Investigate Punctures and Significant Damage

If any punctures or gouges are found, or if the geotextile has otherwise been punctured by bead wire, progressive assessment, including an increased frequency of test pits and other actions, will be necessary to verify whether or not the puncture or significant damage observed is an anomaly or is characteristic of the shredded tire deployment. ADEQ recommends that the test pit frequency be increased a minimum of one additional test pit per acre.

If the contractor or engineer can demonstrate that the damage found is an anomaly, then the damage can be repaired, changes can be made to improve protection for the FML if necessary, and deployment can continue along with the increased frequency of test pits. If it is determined, that the punctures or damage discovered are characteristic of the deployment, then it will be necessary to stop deployment of shredded tires and change the deployment parameters in such a way as to provide adequate protection to the FML. In addition, to changing deployment parameters, repair or replacement of the FML that is under the already deployed shredded tires will be necessary.