NEBRASKA
DEPT. OF ENVIRONMENT AND ENERGY

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Earthen Liner Test Methods for New Livestock Waste Control Facilities Fact Sheet

Earthen liner tests are often required to assure compliance with percolation requirements as detailed in Title 130 – Livestock Waste Control Regulations.

Verification of the percolation rate is required, in a manner approved by the NDEE pursuant to Chapter 8 of Title 130.

Testing result reports submitted to NDEE should include a narrative summary, explanation for any unusual results or situations, explanation and summary of test results, explanation of any corrective actions taken, and recommendations for construction or determination regarding the adequacy of the constructed liner.

Perform post construction tests using ASTM Standard Tests - ASTM D 1587 for sampling, ASTM D 4220 for preserving and transporting samples, and D 5084 for permeability testing (B parameter > or = 0.95). Percolation rate should be determined using Darcy's Law based on the maximum design head, liner thickness, and saturated hydraulic conductivity.

The number of tests taken is normally dependent on the expected surface area of the planned LWCF, although the NDEE may change this requirement as determined necessary. For example: A large shallow LWCF may not require as many sidewall samples or a large deep LWCF may require additional sidewall samples but fewer floor samples.

Typically, the NDEE requires a ***minimum*** of one sidewall sample and one floor sample when the planned liquid surface area is up to one acre.

For **each acre increment**, add one floor sample.

For **every two acres increase**, add one sidewall sample.

For example, if the surface area is **1.4 acres** (i.e., in the 1-to-2-acre range), the normal requirement would be 2 floor samples and one sidewall sample.

For **2.4 acres**, 3 floor and 2 sidewall samples.

For **3.4 acres**, 4 floor and 2 sidewall samples**.**

Retest and or rework options for failed samples should be specified in the **Construction Quality Assurance plan**.

Generally, failed samples should be accounted for by 3 passing tests in the immediate area or by reworking the represented area and retest.

Combination of pre/during/post testing would include at least one boring or other sampling of the planned liner material, ASTM D 5084, to verify that the soil material could be compacted to provide an acceptable liner, ASTM D 698 Standard Proctor test to determine acceptable compaction (moisture and density), and material characteristics testing to identify the material used (i.e. sieve and hydrometer analysis, plasticity index, etc.) and acceptable ranges (i.e. % sand, etc.).

Pre-testing report should include a recommendation on liner construction methods as well the thickness of the liner and number and thickness of lifts.

The pre-construction testing should include specification ranges for moisture and density to be followed during construction. Note that this pretest does not guarantee success of the liner material. Variability in the material itself, construction techniques, and weather all affect construction and suitability of a compacted earthen liner.

Construction phase testing would include moisture and density testing to verify that construction was within the specified ranges identified in the initial testing. At least 1 moisture/density test should be taken for each acre (for each lift) during construction. Post-construction test numbers should be determined by the NDEE, with no fewer than one side wall and one floor sample. Material analysis is needed to verify that liner material was consistent with the material initially tested.

Post-test results should include a scale map of field location where samples or work was done. Identify retest and or rework options taken for failed samples at all stages and state the expected seepage rate, based on Darcy’s Law using the liner thickness maximum head capacity expected where the sample was taken.

The NDEE may consider reducing post-test requirements where admixtures, such as bentonite, are used -- provided adequate measures are included on the **Construction Quality Assurance Plan**.

acre range*	floor tests	sidewall tests
0 - 1	1	1
1 - 2	2	1
2 - 3	3	2
3 - 4	4	2
4 - 5	5	3
5 - 6	6	3
6 - 7	7	4
7 - 8	8	4
8 - 9	9	5
9 - 10	10	5

Questions?

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