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UNL's Livestock Environmental Issues Committee
Includes representation from UNL, Nebraska Department of Environmental Quality, Natural Resources Conservation Service, Natural Resources Districts, Center for Rural Affairs, Nebraska Cattlemen, USDA Ag Research Services, and Nebraska Pork Producers Association.

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# Interpreting Test Reports of Ground Water Monitoring Wells at Livestock Waste Control Facilities

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Some livestock waste control facilities that are required to have an operating permit by the Nebraska Department of Environmental Quality (NDEQ) are also required to install ground water monitoring wells adjacent to the waste control facility. Ground water monitoring requirements are decided on site-specific considerations. Generally, ground water monitoring may be required where the depth to water is shallow, sediments are sandy, the livestock facility is located in a public water supply's Wellhead Protection Area, or any combination of these and other factors listed in Chapter 13 of Title 130[1] of the Nebraska Administrative Code. At a minimum, one well is installed up-gradient and at least two wells down-gradient from the waste storage facility.

NDEQ has published a Guidance Document[2] that details how these wells are to be constructed and tested. It specifies that these wells are to be sampled twice a year, spring and fall. NDEQ staff review monitoring well test results and base decisions on any actions to be taken on the results, on site characteristics, and on studies done in Nebraska and other states.

Chapter 13 of Title 130 requires that depth to water be measured in these monitoring wells and that they be sampled for nitrate, chloride and ammonia. These chemical tests were chosen because they can be

[1] Title 130 Rules and Regulations Pertaining to Livestock Waste Control (June 2001) (http://www.deq.state.ne.us/, click on Rules & Regulations, Title 130)

[2] Guideline for Ground Water Monitoring Plans at Livestock Waste Control Facilities, 00-002, (http://www.deq.state.ne.us/, click on publications, Ground water program).

[3] Also called ammonium when it is in the presence of water.

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indicators of a leaking storage facility and they are relatively easy to sample for and to analyze.

Nitrate and chloride move through soil and sediments with water. Most ground water already contains nitrate and chloride at some 'background' concentration. Chloride occurs naturally in ground water, but generally at concentrations less than 100 parts per million (ppm). Ground water nitrate and chloride concentrations can vary greatly depending on the history of the site and the conditions up-gradient of it. The federal drinking water standard for nitrates is 10 ppm, and the chloride standard is 250 ppm. There is no drinking water standard for ammonia. Ammonia[3] tends to be held by the negative charges in soil, mostly on clay and organic matter. In the soil, most of the ammonia will be absorbed by bacteria or converted to nitrate. Because of this, ammonia is generally non-detectable in ground water tests. If it is detected, it indicates a point source contamination such as a spill or leak from fertilizer or manure storage. Clay liners for livestock waste control facilities, correctly built and maintained, will retain nearly all the ammonia, phosphorus and other materials in manure. Background levels of these ground water constituents at a site are determined from the up-gradient well and any existing ground water monitoring data available. NDEQ personnel evaluate each set of test results on a case-by-case basis. The levels in the down-gradient wells are compared to the up-gradient well, and all are compared to the background levels.
NDEQ will generally wait for at least two rounds of sampling at a newly built facility before beginning an analysis of the site and any impact to ground water. High initial levels of any of the tested constituents may be due to soil disruption during construction, the liner may still be in the process of sealing, or other circumstances. The process of sealing should occur in the first few weeks after contact with manure. However, it may take months to years to fill the facility and thus all of the sidewalls may not have sealed until filling is complete. Because of varying effluent levels and the drying that occurs, sidewalls are known to allow more seepage than the bottoms.
A big increase between the up-gradient and down-gradient wells in chloride, along with a large change in nitrate concentration, or the presence of ammonia in the down-gradient wells may be an indication of leakage at the waste storage facility. If NDEQ suspects ground water has been impacted by the waste facility, further sampling may be required. Ultimately, the livestock operation may be required to address the problem. Again, all decisions are based on site-specific circumstances.

Monitoring well test results must be sent to NDEQ within 45 days after sampling. They are public information when NDEQ receives them. Additionally, as-built well construction details and geologic logs must be submitted with the first sampling results.

**Notes:**

A recent report of results from ground water monitoring at livestock facilities "Ground Water Monitoring at Selected Livestock Waste Control Facilities in Nebraska", May 2002, NDEQ, is available at: http://www.deq.state.ne.us/, currently listed on the home page. For more information about earthen manure storage and clay liners, see the "Manure Matters" Vo. 4, No.1, "Do Earthen Structures Leak?" by Dennis Schulte. (http://manure.unl.edu/v4n1_98.html)
Nitrate levels in manure are very low, and will stay low in anaerobic conditions. Some water seepage through a clay liner is expected, carrying with it some small, uncharged and negatively charged constituents. Over time the negative

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charges in the clay liner will eventually become saturated with ammonia such that ammonia will be found below the waste facility or in shallow ground water. The duration however is dependent on loading, clay type, and thickness. At this time the facility might be taken out of service.
The ground water table is not flat. Ground water flows very slowly through the sediment pores from the higher elevation (up-gradient) toward the lower elevation (down-gradient). Nearby impact from creeks, canals, rivers, and pumping wells can greatly influence the direction of ground water flow, making it flow in unexpected directions or to vary seasonally.

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