

## **Nitrate Contamination and Remediation in shallow aquifers - near the Farmer's Elevator Company in Sylvan Grove, KS, USA**

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Environmental investigations revealed that nitrate as nitrogen (NO<sub>3</sub>-N) in groundwaters and soils at the Farmer's Elevator Company Site in Sylvan Grove, Kansas exceeded the MCL established by the U.S.EPA of 10 mg/L. In 2011, four monitoring wells were installed on the property and a continuous study is undergoing to monitor the groundwater conditions. Remedial actions including phytoremediation and soil excavations to reduce both aqueous and soil nitrates have been completed at this site. The purpose of the study has been to examine the changes in concentrations or extent of high NO<sub>3</sub>-N levels, to propose potential source(s) if any persist, and to evaluate the effectiveness of the remedial actions implemented. Results from spring 2014 indicate that NO<sub>3</sub>-N in the groundwater and soil still remained higher than MCL values. NO<sub>3</sub>-N concentrations in the groundwater ranged from 2 to 46 mg/L and soil concentrations averaged 2,329 mg/kg at the site. There was an improvement at well MW-4 which is located down gradient from the remediation site. The range of δ<sup>15</sup>N- NO<sub>3</sub><sup>-</sup> values (+10–20‰) for all wells is recognized as probable animal wastes, suggest organic sources for the N<sub>2</sub>; however possible overlap of inorganic fractions (fertilizer induced) were indicated down-gradient from the fertilizer storage facility at MW-4 well. There is an improvement in NO<sub>3</sub>-N concentrations during the study period (2011-2015) at MW-4 (91.2%). However, at MW-2 and MW-3 NO<sub>3</sub>-N concentrations have slowly increased over the previous four years (36.3%, 37.1% respectively). At well MW-1 NO<sub>3</sub>-N concentrations remained well above the MCL at 47mg/L. Isotope data indicates that the high NO<sub>3</sub>-N concentrations at MW-1 are not due to the original fertilizer spill, rather, it is exhibiting δ<sup>15</sup>N values more consistent with a higher fraction of organic nitrates. Since MW-1 is located up-gradient from the fertilizer spill site, and closer to and down gradient from a livestock operation, it is likely that a second source unrelated to the Farmers Elevator Company site may be responsible for the high NO<sub>3</sub>-N concentrations at MW-1. Results indicate that the remediation of the Farmers Elevator Company site has been modestly successful. The persistence of high NO<sub>3</sub>-N concentrations up gradient from the site at MW-1 is likely resulting from a source outside the study area that needs further intense investigation.