STATEMENT OF BASIS

GROUND WATER DISCHARGE PERMIT UGW210005

Circle Four Farms
Milford, Utah

March 2014

Purpose

Circle Four Farm's groundwater discharge permit, No.UGW210005, is being renewed for a five year permit term. Circle Four Farms operates swine production facilities in Beaver and Iron Counties southwest of Milford, Utah. Manure from each of the swine production facilities is drained into an associated anaerobic lagoon system for treatment and storage. The lagoon systems at farm sites consist of one primary lagoon and one containment basin for evaporation. The primary lagoons and the containment basins are lined with a 40-mil flexible membrane liner (FML).

Table 1: Summary of Circle Four Farms Ground Water Discharge Permits

Permit No.	Complex/County	Facility Type	Farm Nos.	Total Farm Sites
UGW210005	Blue Mountain/Iron	Sow Farms Nursery Farms	42100- 42108 42200- 42203	13
UGW010002	Skyline/Beaver	Sow Farms Nursery Farms Finisher Farms Boar Stud Facility	41101- 41108 41201- 41210 41301- 41323 49170	42
UGW010012	Skyline/Beaver	Smithfield BioEnergy Plant	41301- 41323	–
UGW010008	Blue Mountain/Beaver	Finisher Farms	42301- 42308 42315, 42316	10

Hydrogeology

The Milford basin lies in southwestern Utah, and comprises a 3,004 km^2 area in the Basin and Range physiographic province. The mountain ranges adjacent to the basin are bounded by normal faults and have large coalescing alluvial fans extending into the valley. The principal water-yielding aquifer is a basin-fill aquifer. Sediments that make up the basin-fill aquifer are late Tertiary to Quaternary age and consist of multiple discontinuous layers of silt, sand, and gravel separated by less permeable layers of clay and silt. The basin-fill deposits are at least 270 m thick in the basin center and thin toward the margins. The principal water-yielding aquifer is a basin-fill aquifer. Sediments that make up the basin-fill aquifer are late Tertiary to Quaternary age and consist of multiple discontinuous layers of silt, sand, and gravel separated by less permeable layers of clay and silt. The basin-fill deposits are at least 270 m thick in the basin center and thin toward the margins. [1]

Ground Water Quality

Based on ground water quality data from site-specific monitoring wells, the ground water quality beneath farm sites ranges from Class 1A Pristine Ground Water to Class II Drinking Water Quality Ground Water. Compliance limits for each farm site are summarized in in Appendix I of Permit UGW210005.

As required in Part I.E.5.(c) of the permit, a background monitoring program has been completed by the permittee to collect data for calculating well-specific background ground water quality statistics. This includes background ground water concentrations for total dissolved solids, chloride, bicarbonate, nitrate + nitrite as nitrogen, ammonia as nitrogen, and pH, all of which have been defined for the purposes of determining the applicable protection levels and compliance limits. Most wells have a 10+ year monitoring history. Compliance limits for all farms were evaluated and, where necessary, adjusted based on the previous 5-year monitoring history of the compliance wells. Declining water table levels have affected the water quality in some wells.

Class I Protection Levels. In accordance with UAC R317-6-4.2, Class I ground water will be protected to the extent feasible from degradation due to facilities that discharge or would probably discharge to ground water. Class I protection levels are established in accordance with the following criteria in UAC R317-6-4.2B.

Class II Protection Levels. In accordance with UAC R317-6-4.5, Class II ground water will be protected for use as drinking water or other similar beneficial use with conventional treatment prior to use. Class II protection levels are established in accordance with the following criteria in UAC R317-6-4.5B.

Class III Protection Levels. In accordance with UAC R317-6-4.6, Class III ground water will be protected as a potential source of drinking water after substantial treatment, and as a source of water for industry and agriculture. Class III protection levels are established in accordance with the following criteria in UAC R317-6-4.6B.

Long term ground water elevation monitoring indicates that drought over the last several years is causing a steady decline in the water table elevation due to diminished aquifer recharge. Some monitoring wells with a small water column purge dry, which can affect the quality of the sample.

Compliance Monitoring Program

A ground water monitoring well system has been installed at each of the lagoon systems for the purpose of establishing the ground water gradient at each farm site and to monitor the ground water quality both up-gradient and down-gradient in the uppermost water-bearing zone under the lagoons. Ground water is sampled and analyzed semi-annually for the term of the permit. The following key leakage parameters were selected for compliance monitoring based on their high concentrations in the process water compared to concentrations in shallow ground water:

- Bicarbonate
- Nitrate+ nitrite as N
- Chloride
- Total Dissolved Solids

Field parameters collected for each groundwater sampling event include: pH, specific conductance, and temperature. This list of ground water monitoring parameters may be updated in the most recently revised and approved version of the Circle Four Farms Sampling and Analysis Plan.

Regulatory decisions made as a result of ground water monitoring must take into account the background variability of ground water quality at the sites. Circle Four Farms will not be required to take corrective action if it can be verified that changes in ground water quality are a result of other factors not related to their operations.

Best Available Technology (BAT)

The administration of this permit is founded on the use of best available treatment technology, in accordance with the requirements of UAC R317-6-1.3.

These farm sites each have at least one primary lagoon and a containment basin for evaporation. Primary lagoons and containment basins are lined with a 40-mil synthetic high-density polyethylene (HDPE) FML. The coefficient of permeability for 40-mil HDPE is 2.7×10^{-13} cm/sec (Haxo and Lahey, 1988)[2]. The constructed depth and maximum operating depth of the primary and containment basins at each farm site are included in the construction permits and construction permit applications.

The construction permits require that the lagoon systems must be properly maintained in a manner to prevent excessive odors. The operation and maintenance of these facilities may require more effort than is outlined in the Natural Resources Conservation Service (NRCS) standards for maintenance of anaerobic lagoons found in the NRCS's *Agricultural Waste Management Field Handbook.* Additional guidance in the proper maintenance of anaerobic lagoons is available from the Utah State University Extension Service, the American National Standards Institute/ American Society of Agricultural Engineers (ANSI/ASAE) Engineering Practice EP403.3 (July 1999) entitled *Design of Anaerobic Lagoons for Animal Waste Management*, and ANSI/ASAE Standard EP379.2 November 1997 entitled *Control of Manure Odors*. If the guidance in these references is not followed, Circle Four will provide credible documentation supporting any deviation from the guidance contained in the above references.

The lagoon system is sized to accept up to 1.8 cubic feet of volume per live animal weight (LAW) in the primary lagoon for sow and finisher farms (2.3 cubic feet for nursery farms) and provide enough surface area for evaporation of water in the containment basin. The primary lagoons at each farm site are designed to operate as anaerobic waste treatment lagoons in which liquid and solid swine waste flushed from the pits under the animal containment barns is digested primarily by anaerobic bacteria in the treatment volume of the lagoon and sludge accumulates in the underlying sludge volume. These design specifications require the establishment and maintenance of a properly balanced bacterial population, which is realized through the proper operation, and management of the anaerobic lagoons. Proper operation and management of anaerobic lagoons will also optimize volatile solids digestion and prevent excessive sludge build up extending the effective life of the lagoon before sludge removal is required. Only wastes from the hog-raising operations may be treated in the lagoons. The design, operational, and contingency requirements detailed above represent Best Available Technology since the implementation of these requirements is expected to be protective of current and future beneficial uses of water resources in the area surrounding the facility.

Currently Circle Four Farms has 13 farm sites in operation for this permit, and each site has a primary lagoon where manure solids are collected. It is necessary to remove accumulated solids from the bottom of each primary lagoon at the farm sites. Circle Four Farm has implemented a program to remove the solids from the lagoons and dry the manure on a drying pad constructed near the lagoon. The manure is a nutrient source and the drying of the manure will allow the nutrients to be sold and applied to local cropland at agronomic rates. Pad construction will follow the engineering design approved by the Utah Division of Water Quality.

Potential Impacts to Ground Water

Leakage from liners can cause degradation of the ground water at the permitted sites. Potential impacts to ground water can be minimized by employing best available technology and discharge minimization technology for the lagoons. BAT performance monitoring, treatment technology, and compliance monitoring wells will ensure that the facility is operated in accordance with design specifications and will also ensure that any early indications of facility problems will be detected.

Assessment and Corrective Action to restore the beneficial uses of the ground water were ordered by the Director during the previous permit term for Farms 42101, 42103-04, and 42201. Leak detection surveys were conducted to search for holes in liners, and repairs were made when found. Repairs have been effective based on stabilized trends of chloride and N+N in monitoring wells. Because of the slow velocity of groundwater, some down-gradient wells still exceed compliance limits for that farm. However, the elevated parameter levels should dissipate with time. If further degradation of ground water from probable failure of BAT is observed, additional source assessment or corrective action may be required.

Major Permit Changes

The requirement for collection and analysis of ground water samples for ammonia nitrogen for routine samples is being discontinued. Collection and analysis of ammonia in ground water samples will continue for probable non-compliance, non-compliance sampling, and lagoon samples. Routine sampling for ammonia in ground water has been demonstrated to be of limited use. While ammonia is quite high in lagoon wastewater, it does not appear in ground water at leakage sites. Ammonia is transformed in the unsaturated and vadose zone prior to entering ground water. In warm, well-drained soil, ammonium transforms rapidly to nitrate (NO_3^-). It leaches easily, since it is a negatively charged ion (anion) and is not attracted to soil clay. Several thousand ammonia analyses of ground water have been collected, and ammonia is detected in less than 1% of the samples, even at known non-compliant sites. Division of Water Quality sample splits confirm this fact. Chloride and Nitrate + nitrite in groundwater are better indicators of lagoon wastewater contamination than ammonia at this site.

Permit Application Documents

Applicable Circle Four Farms Operations Documents for this permit include but are not limited to:

Circle Four Farms Sampling and Analysis Plan

Anaerobic Lagoon Systems Operation and Maintenance Manual

Spill Prevention and Response Manual

Sludge Disposal and Farm Closure Plan

Nutrient Management Plan for Land Application

Manure Drying Program Plan

Reference:

[1] Van der Hoven, S.J. 2001. Determination of Groundwater Transport Rates, Annual Recharge, and Sources of Microbial Contamination in the Milford Basin, Utah. Department of Geography-Geology, Illinois State University

[2] Haxo, H.E., and Lahey, T.P., 1988. Transport of Dissolved Organics from Dilute Aqueous Solutions Through Flexible Membrane Liners, Hazardous Waste and Hazardous Materials, 1988, 5, 275-294.

Dwq-2014-001262