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STATEMENT OF BASIS

GROUND WATER DISCHARGE PERMIT UGW010012

Circle Four Farms
Milford, Utah

June 2015

Purpose

Groundwater discharge permit No.UGW010012 for the operation of the Smithfield BioEnergy (SBE) Plant is being renewed for a five year permit term. The BioEnergy Plant and a Collection System are located approximately ten miles west of Minersville, Utah, in the SW ¼ of the SE ¼ of Section 4, Township 30 South, Range 11 West, Salt Lake Base & Meridian. Circle Four Farms (CFF) monitors the BioEnergy Plants and operates the swine production facilities in Beaver County 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 the farm sites consist of one primary lagoon and one containment basin for evaporation. The Smithfield BioEnergy Plant is no longer in operation, but the Collection System for twenty-three existing finisher farm sites is being used to transfer manure to the Blue Mountain gas plant. Hog waste can collected from all of the finisher farms and conveyed through the Collection System to either the BioEnergy Plant or diverted to a different facility (Blue Mountain Biogas Plant). To increase biogas production at the Plants, supplemental organic feedstock can be added to the digesters. The additional steam requirement for heating the supplemental feedstock combined with the associated utilities for steam production can result in a significant amount of additional wastewater. To address this need for additional evaporative capacity, CFF constructed a containment basin located directly east of the plant.

Table 1 provides a summary of the Farm and BioEnergy Plant Collection System.

Table 1: Summary of BioEnergy Plant Collection System

	Layout	*Farm Sites*
Phase I	East Skyline Layout	41311 through 41314
	Central Skyline Layout	41306 through 41308 41315 & 41322
Phase II	West Skyline Layout	41316 through 41321
	North Skyline Layout	41301 through 41305

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

Ground Water Class and Protection Based on ground water quality data from site-specific monitoring wells, the ground water quality beneath the SBE Plant is Class 1A, Pristine Ground Water. Protection levels have been established by monitoring wells installed upgradient of the anaerobic digesters and containment basin, and by existing monitoring wells at nearby farm sites. Protection Levels for plant storage basins are summarized in Appendix I of Permit UGW010012.

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.

Compliance Monitoring Program

A ground water monitoring well system has been installed at each of the digester and basin systems for the purpose of establishing the ground water gradient at each farm site and to monitor the ground water quality both upgradient and downgradient 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. Compliance with the requirements for use of best available technology (BAT) is demonstrated by construction, maintenance and operation of the collection and the digester systems according to the construction permits issued for this permit.

The containment basin capacity design is based on evaporating approximately 33,000 gallons of liquid input into the basin each day. To minimize basin leakage, a 40-mil high-density polyethylene (HDPE) flexible membrane liner is constructed over an 8-inch compacted subgrade. Compaction of the subgrade is to 90% of standard proctor maximum density. Construction quality assurance and quality control testing consisted of compaction testing to obtain proper compaction density. Atterburg limits and sieve analysis tests were performed to assure subgrade and compaction quality. A Construction Permit was issued on March 8, 2006. Authorization to place the containment basin in service was issued on November 2, 2006.

Farm sites each have at least one primary lagoon and a containment basin for evaporation. Primary lagoons and containment basins will be 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). 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.

Construction permits require that lagoon systems and the SBE Plant 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 for 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.

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.

Major Permit Changes

The BioEnergy Plant facility is in idle status and is not currently operating. The permit is being maintained for possible future Plant use and/or business opportunities. Ground water compliance monitoring requirements for the digesters and wastewater evaporation basins are still in effect.

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.

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.