Manure Management
Milk Shake Dairy
Ken Johnson
Cache County, Utah

Purpose: To provide the site specifications necessary to properly utilize manure generated on the Milk Shake Diary owned and operated by Ken Johnson, and to prevent the degradation of soil, water, air, plant, and animal resources. To meet the objectives of the dairy, get the most value from their manure, and to stay in compliance with current state and national regulations.

Current Situation: Ken has 400 lactating and 100 dry dairy cows. There is currently a storage facility for the solid manure that is produced but the milk house water is flowing into a depression in the land to the northwest of the milking parlor. Liquid and solid manure has gotten into the O'Berry canal in the past. The manure that is produced is stacked in the corrals and in the solid manure structure until after crops are harvested. The storage facility is not large enough to store all of the manure that is produced. Runoff water comes onto the dairy operation from a depression to the east of the facility. Manure is applied to approximately 97 acres of land.

Objectives: Ken would like to:

1) Add storage capacity onto the existing solid pit to increase it to 90-120 day storage
2) Add a liquid storage facility to accommodate the liquids from the milk house and a planned milk processing plant.
3) Build new corrals on site to adequately house the animals and remove them from the dry lot area and build a berm and pipe system to keep clean storm water from running onto the facility.
4) Add a composting facility to the northwest of the liquid storage structure. This will reduce the amount of solids that have to be handled and some of the liquids can be utilized to keep the compost at the desired operating temperature.
5) Irrigate with water from the liquid storage ponds through existing surface ditches. Furrow irrigation will be used to spread the liquids on the field west of the dairy. He will have enough furrow length to ensure that the liquids are not applied on the same spot every time. He plans to put in a gated pipe system sometime in the future. See attached Irrigation Water Management Plan.

Production: This plan is based on manure quantity and nutrient content estimates generated from NRCS guidelines for the animal type, waste production values, and number of animals. These estimated values account for typical storage, volatilization, denitrification, and mineralization losses based on the proposed methods of handling the manure. A total of 10,265 tons of fresh manure will be produced on the operation. With

the addition of 41 tons of straw bedding and the use of the composting facility the expected moisture content of the compost should be 40%. With reductions in moisture and bulk density, it is expected that the compost facility will produce 1,718 tons of compost yearly (See attached Animal Manure Nutrient Balance Worksheet for additional information).

Collection/Transfer: The manure will be scraped daily from the corrals and walkways into the solid waste structure. The liquid from the manure will drain through a series of weep boards into a pipe that flows into a liquid storage pond. The solid manure also contains straw bedding material that is used in the corrals. The solid manure will be hauled from the storage structure to the compost site for composting three to four times yearly. A front-end loader will be used to transfer the manure.

The milk house will be washed after every milking to clean up the facility. The flush water and liquid manure as well as water from the milk processing and bottling plant will be piped into the liquid storage pond. Only those chemicals used for cleaning and disinfection will be allowed to enter the storage pond.

The water that falls onto the roofs of the housing buildings will be collected with rain gutters, ditches, and pipelines and moved off site to reduce the amount of liquids handled. This water will not come in contact with manure. Water that runs onto the east side of the lot will be routed to the north and into the canal through a berm and pipe system to keep clean run-on water from becoming polluted.

Storage: The solid manure from the corrals will be stored in a solid concrete structure that is 110’ wide, 190’ long and 8’ deep. The structure is designed to hold 120 days storage.

The water and manure from the milk house and processing plant will be stored in an earthen liquid storage structure that is 255’ wide 250’ long and 9’ deep with a 1’ free board on the surface. The soils in the pond have a permeability of 1 X 10-7 cm/sec at a compaction of 95%. The designed structures will store liquid manure for 120-days.

Solid manure is moved from the solid structure to the composting site, which is 2 acres in size to accommodate the composting piles, as well as the curing and storage piles. Some of the liquid from the liquid storage pond will be used to make sure that the compost has enough moisture to cure properly. The composting site will have a 50-foot buffer strip of grass and trees to reduce possible odors carried by the wind. A 1-2 foot berm will be built to keep manure from running off from the compost site.

Treatment: Wash and flush water will be piped into the pond at which time the solids will settle out and some of the liquids will evaporate as it is filled. The liquids from the storage pond will be pumped onto the fields through a surface irrigation system. After the liquids are pumped out any and all solids that are left in the pond will be added to the compost piles or into the solids structure to allow for liquids to be drained off and used to fertigate at a later date.

The fresh manure will be composted to reduce the quantity of manure and improve the quality of the product that will be hauled to neighboring land or sold. Ken will find alternate markets for the compost so that it does not have to be applied on the land that is high in phosphorus.

Utilization: Solid manure will be composted and hauled off site until soil test levels are less than 100 ppm Soil Test Phosphorus (STP). Compost may then be applied based on crop phosphorus needs. Commercial nitrogen fertilizer may need to be used to maximize crop production and to facilitate crop removal of phosphorus. Nitrogen additions will be based on soil test recommendations as outlined in the Utah Fertilizer Guide. About 245 acres of alfalfa is needed to properly utilize all of the phosphorus from the solid manure produced on this facility.

Liquid manure will be applied based on soil and manure testing and nutrient guidelines as outlined in the NRCS Animal Waste Management Field Handbook. Liquid manure will be applied on fields 2 and 3 owned and operated by Ken Johnson. It will be applied based on the IWM plan that is attached. About 80 acres of alfalfa is needed to properly utilize all the phosphorus from the liquid manure produced on this facility.

Soil Testing: As a minimum, soil tests will be taken once every three years. Test will be taken at 0 to 12" depth. Soil tests will be used to monitor phosphorus levels. Utah State University soil-testing procedures will be followed (Refer to the attached USU soil testing guidelines). Soil tests may be sent to Utah State University or other approved private testing facilities (see NRCS for a list of approved testing facilities). If soil test phosphorus levels fall below 50 ppm, and manure is applied based on crop nitrogen needs, then soil tests will be taken annually.

Manure Testing: Manure tests will be taken at least yearly for a minimum of 5 years so that average manure test values can be obtained. Utah State University procedures will be followed (Refer to the attached manure testing guidelines). Composted manure from the dairy animals and liquid manure from the dairy will be tested separately. The manure test values will be used to determine actual moisture and nutrient content of the manure. Adjustments will be made in application rates based on actual soil and manure tests.

Actual test values will be provided to those receiving the compost along with general application guidelines.

Current Soil Test Levels: Soil tests taken in 2000 for all fields associated with the Johnson dairy are currently above the 100 ppm standard.

Current Soil Test Results	Field A	Field B
Nitrate-Nitrogen ppm	87.3	60.3
Phosphorus ppm	153	153
Potassium ppm	> 400	> 400

Application Rates: The liquid storage structure will hold 184,000 cubic feet of liquid. The amount of water in the liquid storage structure is 5-acre feet or when applied to the field, 1.5 inches over 40 ac. Ken will move each irrigation setting for liquid manure application in order to avoid applying too much in one location (Refer to the attached IWM plan for proper application rates).

Solid manure applications will not be made until it has been proven by soil tests that the phosphorous levels are below 100 ppm. Until the phosphorous levels are reduced Ken will compost and use the compost as bedding for his cows. This way he will not have to apply the manure until the levels are reduced and will not have to purchase bedding materials. In addition Ken will find a market for the rest of the compost produced on the dairy.

Spreader Calibration: Several methods are available for spreader calibration. To calibrate the solid manure spreader, first load and weigh the contents of the spreader or weigh a 5-gallon bucket of manure and multiply the weight x 1.5 x length x width x height of the spreader. This will give you tons per load of manure. To calibrate liquid/slurry spreaders, first determine the volume of material in gallons from manufacturer specifications or multiply the length x width x height of the spreader x 7.5. For volume in cylindrical tanks multiply length x width x height of the spreader x 0.8 x 7.5.

Next determine the distance in feet that it takes to spread the entire load. Distance can be estimated or determined based on known field length or by counting fence posts along the length of the spread and multiplying by the average distance between posts. Then estimate the width of the spread in feet, allowing for a 10-20% pass overlap to ensure uniform coverage. Calculate the area covered and divide by 43,560 to convert to acres. Divide the weight or volume of manure in the spreader by the acres covered to determine the application rate for the given spreader setting (length x width of spread / acres covered = application rate in tons or gallons). Adjust the spreader settings and redo the calculations until the desired application rate is achieved.

Application rates in inches being applied through liquid irrigation systems can be determined by using the formula, inches applied = (cfs X hrs) / ac. In the formula, cfs is the cubic feet per second, hrs. is the hours that the water has run, and ac. is the acres covered. If the water is measured in gpm, it can be converted to cfs by dividing gpm by 450. The acres can be calculated by multiplying the width and length of the set, and then dividing by 43,560 (length x width / 43,560).

Where sprinkler systems are used, application rates can be estimated by placing six straight-sided cans at various locations under the sprinkler system. Measure the depth of liquid in inches accumulated in the cans over a period of time (e.g., 1 hour). Calculate the average depth of liquid in the cans and divide by the time interval to

determine the application rate in inches per hour. Contact NRCS or USU if additional assistance is needed in calibrating your spreader.

Crop Rotation: Crops grown on the Ken Johnson dairy include alfalfa and corn. The crop rotation is 4 to 5 years of alfalfa and 2 to 4 years of corn. The corn is always cut for silage and the alfalfa is baled and used for feed. Caution should be used when feeding the hay to young stock as it may be high in potassium because of the high levels of potassium in the soil.

Special Precautions and Provisions:

1) Manure cannot be applied at anytime within 30 feet of irrigation return flow ditches or upstream from the canal.
2) Liquid wastes will not be applied on frozen or snow covered ground.

Spreading: (Only when STP levels drop below 100 ppm)

1) When spreading on fields that are close to housing consider spreading at different times to minimize odor problems. Spread when the wind is not blowing and in the morning when the air is rising rather than in the afternoon.
2) Avoid spreading on wet soils to eliminate the potential for compaction.
3) When cleaning application equipment, keep at least 100 from the drinking well or canal to reduce pollution potential from runoff or leaching.

Dead Animal Management: All dead animals will generally be taken to the local processing plant, but may also be taken to the county landfill.

Irrigation Water Management: Proper management of irrigation water has a large impact on the leaching and/or runoff of coliform, nitrogen, phosphorus, and other nutrients. When applying liquid manure, irrigation applications must not exceed the soils available water holding capacity. Irrigation water management will be carried out in accordance with the attached IWM plan and IWM Supplement.

Record Keeping: Records will be kept yearly and are the responsibility of the landowner. Records will include:

1) Soil and manure test results
2) Crops grown, management , and yields for each field
3) The amount of compost sold by weight and who sold to
4) Dates and rates of liquid manure applied to each field
5) Field and weather conditions when liquid manure is applied
6) Maintenance checks on solid and liquid structures

Plan Review: This plan will be reviewed and updated at least once every five years. This is to assure that the operation is still running correctly, is being managed such that the correct amounts of animal manure are being applied and that the plan is working

properly. Updated plans must meet NRCS standards and specifications. The plan must also be revised when the STP levels drop below the 100 ppm level or when significant changes (>10%) are made in animal numbers or in the manner in which the manure is handled.

Signatures: This manure management plan is based on my current and planned system and objectives. I have reviewed this plan and understand what is required. My decisions for installation, operation, maintenance, and safety are accurately represented by this plan. I agree to operate according to this plan for the life of the contract and beyond to ensure that all objectives are met. I understand that it is my responsibility to obtain all permits required to implement this plan. If I plan to alter my operation I will contact NRCS to determine if a revised plan is needed.

Ken Johnson	**Date**
NRCS Planner	**Date**
SCD Board	**Date**
Reviewed & Approved by	**Date**