

Utah Animal Feeding Operation
Producer Self-directed CNMP Curriculum
January 2002

Foreward

On March 9, 1999 the United States Department of Agriculture (USDA) and Environmental Protection Agency (EPA) released the Unified National Strategy for Animal Feeding Operations.¹ The Strategy represents the USDA and EPA's plan for addressing water quality and public health concerns from animal feeding operations (AFOs). The cornerstone of the Strategy is the expectation that all AFOs will develop and implement a site-specific Comprehensive Nutrient Management Plan (CNMP).

In Utah, the USDA-NRCS has established that the following elements should be included in a CNMP:

1. Manure and wastewater production, collection, storage, treatment and transfer.
2. Evaluation and treatment of sites proposed for land application.
3. Land application of manure and wastewater.
4. Records of CNMP implementation.
5. Feed and animal mortality management.
6. Other manure utilization options.

Certified specialists and other qualified individuals are available to help AFO owners develop a CNMP. AFO owners have also been given the opportunity to voluntarily develop their own CNMP as long as it meets USDA and EPA requirements. By developing their own CNMP, AFO owners can ensure the plan is site-specific and tailored to their individual operation. Preparation of a CNMP by an AFO owner also ensures that the owner understands all elements and should expedite the implementation and maintenance of the plan.

This curriculum was prepared to assist Utah AFO owners in developing their own CNMP. The format of this self-directed CNMP workbook parallels the Utah publication *Comprehensive Nutrient Management Planning: A 12 Step Guide*. Most livestock producers in Utah have received a copy of the 12 Step Guide. If you have already studied the guide and completed the worksheets you are well on your way to completing your CNMP. We encourage you to complete as much of the CNMP as possible - if not all - on your own.

¹The complete Strategy can be viewed on the Internet at <http://www.epa.gov/owm/finafost.htm>

Step 1

Assessment and Information Gathering

Objectives:

After completing this section you should:

1. Have developed an environmental policy statement for your operation.
2. Have completed an assessment of your operation and developed a prioritized list of what improvements, if any, need to be made to be in environmental compliance and minimize negative environmental impacts.
3. Gathered the information required to complete the subsequent steps in developing a CNMP.

Documentation filed in this section:

1. Environmental policy statement.
2. Completed assessment forms (Farm*A*Syst, Utah AFO Strategy brochure assessment forms, and/or other assessments).
3. Prioritized list of improvements and target completion dates.
4. Completed survey of information for the remainder of the CNMP.

Developing an environmental policy statement

Assessing your operation

The first and perhaps most important step in nutrient management planning is to assess your operation and current manure management practices. Throughout the year are there any farm practices that result in discharges to surface or ground water sources? Some of these practices may be obvious while others may not. When assessing the operation be honest. Keep in mind that, according to federal law, no manure or contaminated wastewater can be discharged into any surface water sources, including ditches, that leave an operators property. Similarly, according to Utah State law contaminants cannot be discharged into ground waters such as through a leaking storage pond or lagoon liner. There is no minimum volume required for a release to be considered a discharge. All manure and contaminated wastewater from livestock facilities, manure storage sites, and land application areas must be contained.

When assessing your operation consider where manure, wastewater, and field runoff go during the year. Rainwater or melting snow that comes into contact with manure on a feedlot and then runs into an irrigation ditch may not appear to cause any problems. However, if the ditch leaves the owner's property or connects to any natural stream this could be considered a discharge. Similarly, storing contaminated wastewater in a structure without a proper lining to limit leaching is against the law. Even manure applied on fields can lead to a discharge if rainfall, snow melt, or irrigation tail water leaves the site and enters a surface water body.

Several resources are available to help farmers assess their operations. The Farm*A*Syst program includes a series of farm assessment guides and worksheets which lead individuals through a structured evaluation of farm activities and practices. The assessment provides a separate risk rating for individual activities. Recommendations are provided to improve the situation if the risk rating for any activity is high. These as well as other materials on farm assessment and nutrient management are available through your local Utah State University Extension or USDA-NRCS office, and on the Internet at: <http://www.extension.usu.edu>, <http://www.extension.usu.edu/coop/natres/wq/index.htm>, and <http://www.ut.nrcs.usda.gov>

It may be helpful to have an outside, nonregulatory assessment of your operation. Someone unfamiliar with the day-to-day activities of a facility may be able to identify problems not apparent to the owner or manager. Consider organizing an assessment team made up of local producers with similar interests. Have the team assess each member's facility and discuss recommendations for improvements.

Contact local employees of the Soil Conservation District, USDA-NRCS, Utah State University Extension, the Utah Farm Bureau Federation or the appropriate commodity group to obtain additional information on assessing livestock operations.

Additional notes

Step 2

Evaluating Storage Requirements

Objectives:

After completing this section, you should:

1. Have estimated the amount of manure and wastewater produced during critical storage periods.
2. Calculated your current manure and wastewater storage capacity.
3. Evaluated whether your current storage capabilities are adequate.

Documentation filed in this section:

1. Worksheets showing the estimated manure and wastewater volumes produced during the critical storage period, and/or documentation showing the actual volumes of manure and wastewater produced.
2. Calculations of the current manure and wastewater storage capacity.
3. Periodic monitoring and inspection records.

Estimating the volume of manure and wastewater produced

Estimating the volume of manure and wastewater produced is important to determine if storage facilities are adequate for critical periods. The critical storage period is the number of continuous days manure and wastewater cannot be land applied or otherwise used. This may occur during winter or during the growing season when applications cannot be made to crops. In Utah, the critical winter storage period may range from 45 to 150 days depending on location (see Table 1) and manure handling/treatment system. Storage requirements for wastewater may be longer than for solids depending on the type of wastewater application system. Contact your local NRCS office for assistance in estimating the number of days of storage needed for your area and situation.

Manure production estimates for various livestock types are presented in Table 2. Use Worksheet 1 to estimate the total cubic feet (ft³) of manure produced by livestock during the critical storage period. Wastewater production estimates include process water from milk houses and other handling facilities as well as lot runoff water coming into contact with manure. Also estimate the volume of wastewater produced during the critical storage period using Worksheet 2.

Worksheet 1. (A) Enter the number of animals for each type/class, the average animal weight, and the length of time manure must be stored on Worksheet 1. Obtain the appropriate manure production estimates from Table 2 and calculate the total volume of manure produced by each livestock type/class. Repeat the procedure for each livestock group and add the results together to determine the total volume produced for the storage period.

(B) Calculate the volume of manure storage currently available. Compare the cubic feet (ft³) of manure produced to the volume of storage available. ***Is the solid manure storage volume adequate for the critical period?*** If not, additional storage or alternative manure handling practices may be needed.

Worksheet 2. (A) Enter the number of gallons of wastewater produced per animal per day and the length of time wastewater must be stored on Worksheet 2. The number of gallons produced may be determined from water bills or through actual measurements of water use. Also calculate the number of gallons of contaminated lot runoff expected during the storage period. Determine lot runoff by estimating the amount of effective precipitation (in inches) received during the critical storage period and multiplying by the lot area (length × width). Note that facilities must be able to contain lot runoff up to and including a 25 year, 24 hour storm event. Therefore, the liquid storage structure must be able to contain runoff from this storm. For normal and 25 year, 24 hour storm precipitation data see the Internet

web pages: <http://www.wrcc.dri.edu/pcpnfreq/> and <http://www.wrcc.dri.edu/climsum.html>, or Table 1. Add the results together to estimate the total volume of wastewater and runoff produced during the storage period.

(B) Calculate the volume of wastewater storage available. Compare the volume of wastewater produced to the available storage volume. ***Is the wastewater storage volume adequate for the critical period?*** If not, additional storage or alternative handling practices may be needed.

Additional notes

Periodic Facility Monitoring and Inspection Checklist

Parameter	Inspection	Frequency	Initials/date
Lot	Runoff contained - has any runoff of manure occurred?	After heavy storms or snow melt	<hr/> <hr/> <hr/> <hr/> <hr/>
Structure freeboard	Is freeboard height maintained?	Monthly	<hr/> <hr/> <hr/> <hr/> <hr/>
Structural integrity	<p>Is concrete structure leaking?</p> <p>Are berms on liquid storage structures intact and not leaking?</p>	Monthly	<hr/> <hr/> <hr/> <hr/> <hr/>

Step 3

Estimating the Land Base Requirement

Objectives:

After completing this section you should:

1. Be able to estimate whether the land base is adequate for the number of animals on your farm.

Documentation filed in this section:

1. Calculation of the land base requirement.

Estimating the land base requirement

The land base requirement is an estimate of the number of acres needed to fully utilize the nutrients produced in manure over the crop rotation. Most manure, if applied according to crop needs for nitrogen (N), will oversupply crop needs for phosphorus (P_2O_5). Land base requirements in Utah are made on the basis of phosphorus needs for alfalfa. This generally represents the total number of acres needed to balance phosphorus needs over the entire crop rotation. In any given year, the number of acres that manure is actually applied to will be less than the land base requirement. Records should be kept to determine the number of acres manure is applied to on an annual basis, and the exact land base requirement for the farm.

Land base requirements are based on crop yield and can be refined by accounting for nutrient transformations such as mineralization, or for composting or offsite transport. Table 3 land base requirements are based on manure production estimates for various livestock types and mineralization rates for phosphorus with no composting or offsite transport. Use the information in Table 3 for general planning purposes. For further information on how composting or offsite transport may influence land base requirements contact NRCS or Utah State University Extension.

Additional notes

Step 4

Testing Soil and Manure

Objectives:

After completing this section you should:

1. Understand how and when to collect soil samples.
2. Understand how and when to collect manure samples.

Documentation filed in this section:

1. Soil test reports.
2. Manure test reports.

Testing soil

Soil testing is essential to determine the current nutrient status of soil and how much supplemental nitrogen, phosphorus, and other nutrients are needed to meet crop needs. **Soils should be tested annually when manure applications are made based on the nitrogen needs of crops, and at least once every three years when manure applications are made based on phosphorus.** Soil testing generally costs less than \$1.00 per acre and can save many times this amount by reducing fertilizer costs or improving crop yields.

For nitrogen-based applications, collect separate soil samples at depths of 0 to 12 and 12 to 24 inches. For phosphorus-based applications collect soil samples at a depth of 0 to 12 inches only. A soil probe is the most efficient way to collect samples. Probes are available on loan from County Extension Agents. Collect a composite sample by combining a minimum of 8-10 samples taken randomly throughout a field in a plastic bucket. Mix the samples and send at least one pint to the lab for analysis. More than one composite may be needed for large or highly variable fields.

Testing manure

Manure testing is necessary to accurately determine manure nutrient content. **Manure should be tested several times a year during common manure spreading times.** If manure nutrient contents are similar among several sample dates, average values can be used.

Since manure is a variable material, proper procedures must be followed to ensure a representative sample is collected. For liquids, sample directly from the storage structure, from the outlet pipe where liquid is removed, or from the field using catch

Manure samples or book values?

Recent research shows that western manure moisture and nitrogen contents are lower, and phosphorus contents higher, than book values. Whenever possible use recent manure sample data instead of book values to calculate manure application rates.

cans to collect samples applied through sprinklers. When sampling liquids, collect a minimum of six separate subsamples. Combine the subsamples in a clean bucket, mix well, and transfer approximately one pint of liquid to a clean bottle or other rigid container.

For solids, remove the surface six inch crust and use an auger or shovel to core into the pile. Take a minimum of six separate subsamples from around the pile and combine them in a clean bucket. Mix well and transfer approximately one quart to a clean plastic bag. Keep all samples cool until they can

be transported to a lab. The Utah State University Analytical Laboratory analyzes soil and manure samples. Contact your local County Extension Agent for information and sample submission forms, or see the Internet site: <http://www.tal.agsci.usu.edu/~tal/Soil.Science/usual>

Additional notes

Step 5

Calculating Manure Application Rates

After completing this section you should:

1. Be able to calculate manure application rates for individual fields and manure sources.
2. Have initiated the record keeping process with regard to manure applications.

Documentation filed in this section:

1. Manure application rate forms.
2. Records of the total amount of manure applied.

Calculating manure application rates

Calculating the correct rate of manure to apply is important to prevent the buildup of excess nitrogen or phosphorus in soil and the contamination of ground and surface waters. Various methods can be used to calculate manure application rates.

Worksheet 3 on page 12 describes one method for calculating application rates of manure based on nitrogen or phosphorus.

Using Worksheet 3

Reproduce several copies of this worksheet. Complete one worksheet per field each year manure is applied. Keep completed worksheets as a record of the manure applied to each field.

If soil test phosphorus levels are below 50 parts per million (ppm) calculate manure application rates based on nitrogen (N) or phosphorus (P_2O_5) recommendations, or N or P_2O_5 removal by the crop. Between 50 and 100 ppm soil test phosphorus, calculate application rates based on crop P_2O_5 removal. No further applications of manure are recommended when soil test phosphorus levels are above 100 ppm.

1. *Nutrients needed* are based on the crop to be grown and yield. Refer to soil test reports, fertilizer guides, your local Cooperative Extension or NRCS office, or the following plant nutrient uptake table for this information.
2. *Nutrients from other sources (credits)* may include residual nitrate-N from soil tests, supplemental fertilizers, N in irrigation water, previous legume crop credits, or nutrients from previous manure applications.
3. *Additional nutrients needed* is the amount of N or P_2O_5 to be supplied by manure.
4. *Total N and P_2O_5 in manure* (on a fresh weight or as-sampled basis) is based on a recent manure analysis or book estimate for your manure type. If you do not have a recent manure test contact your local Extension or NRCS office for more information.
5. Nutrients, particularly nitrogen, are released over time as manure decomposes in soil. The *nutrient availability factor* is the fraction of total N or P_2O_5 in manure available in the year of application. See Table 4 and Worksheet 3 for more information.
6. *Available nutrients in manure* is the amount of N or P_2O_5 available for plant use in the year of manure application.
7. *Manure Application Rate* is the rate of manure to apply to meet crop nutrient needs.

For planning it may be helpful to have an aerial photograph of your farm. Aerial photos can be obtained from your local NRCS office or through the Internet at:

<http://terraserver.microsoft.com>.

Plant food uptake by various crops.†

Crop	Yield unit	Pounds per yield unit		
		N	P2O5	K2O
Barley	bushel	1.45	0.55	1.45
Canola	bushel	3.0	1.5	2.4
Corn grain	bushel	0.9	0.37	0.87
Corn silage	ton	9.0	3.1	9.0
Safflower	lb	0.05	0.03	0.05
Wheat	bushel	1.7	0.7	2.0
Grass hay	ton	40	13	60
Alfalfa	ton	--	13	60
Wheat, barley and oats (hay/silage)	ton	11	5	9

†Taken from the Western Fertilizer Handbook, 8th edition (1995).

Additional notes _____

Supplemental N Needed

When soil test phosphorus (STP) levels are between 50 and 100 ppm and manure is applied on the basis of P_2O_5 removal by crops like small grains, corn, or grass hay and pasture, the amount of nitrogen supplied by manure is less than that required by the crop. In these situations, supplemental applications of inorganic nitrogen (N) fertilizer may be required for optimum yields. Worksheet 4 calculates the rate of supplemental N needed when manure applications are made based on crop P_2O_5 removal. Complete Worksheet 4 and attach it to the appropriate copy of Worksheet 3. Apply additional fertilizer nitrogen in the spring just before the seeding of annuals, or before the initiation of growth of perennial grasses.

Additional notes

Step 6

Determining How and When to Apply Manure

Objectives:

After completing this section you should:

1. Determine the most efficient method of manure application.
2. Determine the appropriate times for manure application on individual fields.

Documentation filed in this section:

1. Statement or description of manure application practices.
2. Assessment of manure application risk for individual fields.

Manure application options

The main factor governing the type of manure application method is moisture content (Table 5). Select an application method based on the manure storage system and moisture content of manure produced. Water is heavy and expensive to haul. Therefore, hauling semi-solid and slurry forms of manure long distances is not desirable. Some form of solid-liquid separation may be advantageous to allow solids to be transported and applied with a box spreader while liquids are applied through an irrigation system or water is evaporated.

Most manure applications are made in Spring before planting, or Fall after harvest.

Wastewater applications can be made during the cropping season through an irrigation system. Winter applications of manure should not be made unless measures are taken to ensure no field runoff occurs.

Table 5. Manure forms and application method.

Manure form	% Moisture	Method
Solid	less than 80	Box spreaders
Semi-solid	75-90	Flail spreaders
Slurries	88-98	Tank wagons
Liquid	93-99	Big guns or gated pipe
Ponds/lagoon	96-99	Sprinklers*, big guns, gated pipe

*may require screening or chopping.

The NRCS has developed a manure application risk index which should be used to identify field and cropping conditions when winter applications of manure on frozen

Winter Application of Manure

Producers should be aware that the practice of applying manure on frozen or snow-covered ground (during winter) is coming under increased scrutiny. Many Eastern U.S. states have already banned this practice. It is the responsibility of the producer to ensure that all field runoff is contained when manure is applied during winter. Winter applications should not be made on fields near any surface water source, including ditches that may carry runoff water to a stream or other water body.

and/or snow-covered ground are low risk. Regardless of when manure is applied, additional land management measures may be needed to ensure manure and runoff water do not leave a site after spreading. See Step 8 for more details.

Additional notes _____

Step 7

Calibrating Manure Spreaders

Objectives:

After completing this section you should:

1. Understand how to calibrate manure spreaders to achieve target application rates.
2. Understand when and how often to calibrate manure spreaders.

Documentation included in this section:

1. Completed manure spreader calibration forms and spreader calibration summary.

Spreader calibration

Equipment calibration is necessary to ensure manure and wastewater applications are made at desired rates. Equipment should be calibrated at least once a year or more often when the type of manure, amount of bedding, or consistency of manure changes.

Solid and slurry spreaders

Spreaders discharge at varying rates depending on ground and PTO speeds, equipment settings, and manure moisture content. To calibrate solid manure spreaders, first load and weigh the contents of the spreader. An alternative method is to weigh a 5 gallon bucket of manure and take the $\text{weight} \times 1.5 \times \text{length} \times \text{width} \times \text{height} \div 2000$ to estimate tons per load. To calibrate liquid/slurry spreaders, first determine the volume of material in gallons from manufacturer specifications, or by taking the $\text{length} \times \text{width} \times \text{height}$ of the spreader $\times 7.5$. For the volume in cylindrical tanks multiply $\text{length} \times \text{diameter} \times \text{diameter} \times 0.8 \times 7.5$.

Complete Worksheet 5 by estimating the distance in feet required to spread the entire load. Distance can be measured or estimated based on known field length or by counting fence posts along the length of the spread and multiplying by the average distance between posts. Also estimate the width of spread in feet, allowing for a 10-20% pass overlap to ensure uniform coverage. Multiply the length by the width and divide by 43,560 to convert to acres. Divide the weight or volume of manure in the spreader by the area covered to determine the application rate at this setting. If necessary re-adjust settings and calibrate for different rates.

Sprinkler systems

Design specifications for the sprinkler system may be used to estimate liquid application rates. An alternative method is to place straight-sided catch 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 application rates in inches per hour.

Spreader Calibration Summary Table

Use this sheet to summarize the results of several spreader calibration runs.

Calibration run #	Manure % Moisture	PTO Speed†	Tractor gear	Spreader settings	Application rate

†Note that most spreaders require a specific PTO speed for optimum function. Check the owners manual or specifications plate on the unit for more details.

Step 8

Land Management Practices to Reduce Nutrient Loss

Objectives:

After completing this section you should:

1. Understand and identify land management practices to reduce nutrient leaching and runoff.

Documentation included in this section:

1. Worksheets identifying which land management practices you will implement on your farm to reduce runoff and leaching.
2. Facility and field records of BMP implementation.

Best Management Practices

Minimizing surface runoff and leaching reduces the likelihood that contaminated water from fields will enter a surface or ground water source. Many conservation and land management practices have been proven to reduce leaching and runoff. These practices are referred to as Best Management Practices (BMPs). Voluntary adoption of these practices is encouraged by all livestock producers. It is not expected that all operations should adopt all of the practices listed. Rather, operators should evaluate these practices and adopt as many as they can that fit within their management system. BMPs should be adopted on sites where the risk of contaminating surface or ground water is high.

Review the conservation/best management practices described below. Indicate which practices are or will be implemented using the checklist and/or worksheet at the end of this section.

General BMPs

- Identify fields at high risk for leaching and/or runoff and don't apply manure there or apply at lower rates, and don't apply manure to these fields during winter.
- Consider grazing as an alternative to confinement to reduce the need for manure storage, handling, and spreading.
- Regularly sample manure and soils and calculate manure application rates based on realistic crop yields and procedures described in this publication.
- Reduce commercial fertilizer rates accordingly when manure is used as a nutrient source.
- Document all land management practices used to prevent surface runoff and leaching. Both photos and written documentation demonstrate awareness and implementation of BMPs.

Specific BMPs to reduce leaching

- Irrigation water management. Maintain irrigation systems and practice good water management during the growing season, especially on coarse textured soils.
- Don't apply manure, or apply manure at reduced rates (e.g., based on phosphorus), on fields with shallow water tables, coarse-textured soils, or other soil limitations.

Specific BMPs to reduce runoff

- Berm fields adjacent to surface water sources to contain runoff.
- Use application setbacks and/or vegetated filter strips where manure is applied to fields adjacent to a surface water source.
- Don't apply manure, or apply manure at reduced rates (e.g., based on phosphorus), to steeply sloped fields and/or fields near surface water sources.

- Apply manure to fields with as much vegetative or crop residue cover as possible, or incorporate manure immediately following application.

Additional notes

Checklist of Best Management Practices

Lot and storage areas

Instructions: Place a “✓” in each box indicating which conservation practices have been implemented or if the practice is not needed. If the practice will be implemented indicate the date of implementation.

Practice	Implemented	Date to be Implement	Not needed
<i>Lot and storage areas</i>	✓	_____	✓
Berm, ditch, gutter or otherwise divert all clean storm water away from the lot and manure stockpiles or bunkers	<input type="checkbox"/>	_____	<input type="checkbox"/>
Pipe or otherwise enclose ditches or small streams that run through or near the lot	<input type="checkbox"/>	_____	<input type="checkbox"/>
Locate manure stockpiles and lagoons above the flood plain and away from surface water sources and well heads	<input type="checkbox"/>	_____	<input type="checkbox"/>
Contain all runoff from manure stockpiles and lot areas	<input type="checkbox"/>	_____	<input type="checkbox"/>
When scraping soil-based lots do not disrupt the compacted surface layer that acts as a barrier to leaching	<input type="checkbox"/>	_____	<input type="checkbox"/>
Design manure bunkers and wastewater lagoons based on realistic storage periods for your location, field access, and manure, wastewater and runoff volumes generated	<input type="checkbox"/>	_____	<input type="checkbox"/>
Inspect lagoons and liquid manure storage ponds regularly to ensure seepage does not exceed state and local restrictions	<input type="checkbox"/>	_____	<input type="checkbox"/>

Checklist of Best Management Practices

Nutrient management

Instructions: Place a “✓” in each box indicating which conservation practices have been implemented or if the practice is not needed. If the practice will be implemented indicate the date of implementation.

Practice	Implemented	Date to be Implemented	Not needed
<i>Nutrient management</i>	✓	_____	✓
Develop a <u>nutrient management plan</u> including estimates of on-farm manure production, crop yield and nutrient uptake, soil/water/manure analysis, and calculated manure application rates	<input type="checkbox"/>	_____	<input type="checkbox"/>
Base manure application rates on phosphorus if soil test phosphorus is above 50 ppm, the field drains to a sensitive water body, or phosphorus movement is likely	<input type="checkbox"/>	_____	<input type="checkbox"/>
Apply supplemental commercial nitrogen and phosphorus to manured fields <u>only</u> when it has been determined that nutrients from manure will not satisfy crop needs	<input type="checkbox"/>	_____	<input type="checkbox"/>
Maintain nutrient management plans and actual manure and fertilizer management records on file for a minimum of three years or the duration of a crop rotation	<input type="checkbox"/>	_____	<input type="checkbox"/>
Scout fields for signs of nutrient deficiency or excess throughout the season in order to identify and correct problems that might limit crop yields	<input type="checkbox"/>	_____	<input type="checkbox"/>

Checklist of Best Management Practices

Manure application

Instructions: Place a “✓” in each box indicating which conservation practices have been implemented or if the practice is not needed. If the practice will be implemented indicate the date of implementation.

Practice	Implemented	Date to be Implemented	Not needed
<i>Manure application</i>	✓	_____	✓
Incorporate manure as soon as possible after application to minimize volatilization losses, reduce odor, and prevent runoff	<input type="checkbox"/>	_____	<input type="checkbox"/>
Apply manure uniformly with properly calibrated and operated equipment	<input type="checkbox"/>	_____	<input type="checkbox"/>
Time liquid manure applications to match crop nutrient uptake patterns to reduce the potential for nitrate leaching	<input type="checkbox"/>	_____	<input type="checkbox"/>
Limit solid manure applications on frozen or saturated ground to fields that are at low risk for runoff	<input type="checkbox"/>	_____	<input type="checkbox"/>
Create a buffer area away from surface water, irrigation return flow ditches, and well sources where no manure is applied to prevent the possibility of water contamination	<input type="checkbox"/>	_____	<input type="checkbox"/>
Apply manure on a rotational basis to fields that will be planted to high nitrogen use crops such as forages	<input type="checkbox"/>	_____	<input type="checkbox"/>

Step 9

Other Options for Utilizing Manure

Objectives:

After completing this section you should:

1. Understand the other options for utilizing manure.
2. Identify options other than land application to use the manure produced on your farm.

Some livestock operations may find that they do not have a sufficient land base to utilize all of the manure produced on the farm. Urban encroachment, increasing livestock numbers, or excessive phosphorus loading may necessitate the development of other options for using manure. If the land base is not adequate for the manure generated consider the following options and incorporate them into the CNMP as necessary.

Composting is one option for treating manure and converting it into a higher value product. Composted manure can be sold in urban markets, used for livestock bedding, and may be used as a feed source or supplement for some livestock. Equipment requirements, facility location, increased labor costs, and odors may limit the feasibility of composting. For more information about composting contact your local County Extension or NRCS office, or Compost Education Resources for Western Agriculture on the Internet: <http://www2.aste.usu.edu/compost/>. A copy of a fact sheet on composting is included at the end of this section.

Agreements with nearby landowners to use manure can reduce on-farm acreage requirements for manure spreading. If manure is being sold or given away, provide a recent manure test report to the recipient. Also, require that landowners receiving manure apply it according to proper guidelines such as those found in this publication. The amount of liability retained by the livestock owner when manure is sold or given away is a gray area. Therefore, document how much manure is sold or given away each year, to whom, and what information and instructions are provided with the manure. In addition, periodically check with landowners receiving manure to ensure it is being used properly.

Other, experimental options such as **power generation** and **aquatic plant or fish production** may, in the future, become available for using manure. Altering the **manure treatment** system may also reduce both the quantity and nutrient content of manure, thereby reducing the land base requirement.

Contact your local Utah State University Cooperative Extension or NRCS office for more information about options for using manure.

Step 10

Dealing with Mortalities

Objectives:

After completing this section you should:

1. Develop a plan for dealing with mortalities.

Documentation included in this section:

1. Plan for dealing with mortalities.

Between 1 and 5% of animals die on Utah farms each year. These mortalities must be disposed of in a manner acceptable to the producer and according to local, state, and federal regulations. Where available and economical, **rendering** is often the method of choice. On site **burial** was once a common method for mortality disposal and may still be acceptable if mortalities are buried at the proper depth in soils where a water table or other limitations do not exist. **Landfills** may also accept mortalities. **Incineration** is used by larger operations, particularly for smaller animals. Finally, **composting** is a relatively new option for mortality disposal. Check with local county and city officials for any guidelines or regulations regarding burial, landfilling, incineration, or composting of mortalities. Indicate the method of mortality disposal on the following sheet. A fact sheet describing cow mortality disposal is included at the end of this section.

Additional notes _____

√Disposal Method	Advantages	Disadvantages
<input type="checkbox"/> Rendering	<ol style="list-style-type: none"> 1) Conserves nutrients contained in the dead animals. 2) Minimal capital investment unless preservation is used. 3) Low maintenance. 	<ol style="list-style-type: none"> 1) Increases sanitary precautions to prevent disease transmission. 2) Storage of animals is required until pickup. 3) Fees charged for pickup. 4) Rendering service may not be available.
<input type="checkbox"/> Composting	<ol style="list-style-type: none"> 1) Conserves nutrients contained in the dead animals. 2) Low odor. 3) Environmentally safe. 4) No need to store dead animals. 	<ol style="list-style-type: none"> 1) High initial cost. 2) Labor intensive. 3) Regular monitoring and maintenance is required. 4) Cropland required for utilization of finished compost.
<input type="checkbox"/> Incineration	<ol style="list-style-type: none"> 1) Sanitary. 2) Final except for ashes. 	<ol style="list-style-type: none"> 1) Nutrients contained in the dead animals are wasted. 2) Initial cost. 3) Fuel costs. 4) Equipment operation and maintenance costs. 5) Potential air quality impairment.
<input type="checkbox"/> Sanitary landfills	<ol style="list-style-type: none"> 1) Simplicity. 2) No capital investment. 3) No maintenance. 	<ol style="list-style-type: none"> 1) Nutrients contained in the dead animals are wasted. 2) Few landfills accept dead animals. 3) Transportation costs. 4) Not permitted in many areas.
<input type="checkbox"/> Burial	<ol style="list-style-type: none"> 1) Capital limited to land and excavating equipment. 	<ol style="list-style-type: none"> 1) Nutrients contained in the dead animals are wasted. 2) Increases sanitary precautions to prevent disease transmission. 3) Storage of carcasses until burial may be necessary. Difficult if ground is frozen. 4) Land area becomes significant for large operations. 5) Siting requirements.
<input type="checkbox"/> Disposal pits	<ol style="list-style-type: none"> 1) Simplicity. 	<ol style="list-style-type: none"> 1) Nutrients contained in the dead animals are wasted. 2) Exacting soil and drainage conditions are required. 3) Satisfactory location may not be convenient to facilities. 4) Possibility of environmental hazards. 5) Not permitted in many areas.

Step 11

Managing Feeds to Reduce Nutrient Excretion

Objectives:

After completing this section you should:

1. Identify which feed management practices, if any, are used on farm.

Documentation included in this section:

1. Feed management practices used to reduce nutrient excretion on farm.

Recent advances in feed formulation, supplementation, and livestock monitoring indicate that feed management can be used to reduce nutrient excretion without affecting animal performance. For example, the milk urea nitrogen test can be used to determine whether dairy cows are being overfed protein in the ration. Recent evidence also suggests that many animals are fed more phosphorus than needed for optimum performance. Phosphorus monitoring in crops and supplements can lead to better dietary phosphorus balancing and reduced phosphorus excretion in the manure. Phytase, an enzyme supplement added to the feed of swine and poultry, enhances phosphorus absorption in the digestive track, thereby reducing phosphorus feeding requirements and excretion in manure. Feed management to reduce nutrient excretion is an emerging field and will likely become a more important management tool in the near future. Contact livestock nutritionists or performance monitoring programs such as the Dairy Herd Improvement Association (DHIA) for more information on feed management to reduce nutrient excretion.

Copies of feed management options and worksheets are included at the end of this section.

Additional notes

Dairy feeding practices to reduce nutrient excretion.

Feeding Practices	Reduces N Excretion	Reduces P Excretion	Reduces Purchased Feed Used	Is this option currently used on your operation?	Is this a viable option for the future adoption?
Group cattle by milk production or lactation stage and formulate multiple rations	x	x		Yes No	Yes No
Feed ration with % P of 0.49% for fresh cows		x		Yes No	Yes No
Feed ration with % P of 0.38%-0.42% for early to mid-lactation cows		x		Yes No	Yes No
Feed ration with 19% CP and 40% RUP for fresh cows	x			Yes No	Yes No
Feed ration with 16%-18% CP and 36%-38% RUP for early mid-lactation cows	x			Yes No	Yes No
Feed ration with 14% CP and 30% RUP for late lactation cows	x			Yes No	Yes No
Improve quality of home-grown feeds			x	Yes No	Yes No
Increase dry matter intake	x		x	Yes No	Yes No
Monitor MUN (should be between 12 and 18 mg/dl)	x			Yes No	Yes No
Blend legume and corn silage in ration to meet protein requirements	x			Yes No	Yes No
Test all forages and feed ingredients and adjust rations accordingly	x	x	x	Yes No	Yes No

Poultry feeding practices to reduce nutrient excretion.

Poultry Feeding Practices	Reduces N Content of manure	Reduces P Content of Manure	Reduces Air Quality Effects	Do you currently practice?	Will you consider for future?
Install feeders/feed systems designed to minimize feed waste	x	x		Yes No	Yes No
Adjust and clean feeders frequently	x	x		Yes No	Yes No
Use pelleted feeds	x	x	x	Yes No	Yes No
Formulate feeds based on digestible nutrients rather than totals	x	x	x	Yes No	Yes No
Select feed ingredients that have high digestibility	x	x	x	Yes No	Yes No
Grind coarse feed ingredients to a uniformly fine particle size	x	x		Yes No	Yes No
Add phytase to the feed		x		Yes No	Yes No
Add fiber-degrading enzymes to the feed	x		x	Yes No	Yes No
Select ingredients that are low in fiber (NDF and ADF)	x	x	x	Yes No	Yes No
Select ingredients that are low in trypsin inhibitors	x			Yes No	Yes No
Include disposal costs in economics of nutrition decisions	x	x	x	Yes No	Yes No
Implement phase feeding and split-sex feeding	x	x	x	Yes No	Yes No

Poultry Feeding Practices	Reduces N Content of manure	Reduces P Content of Manure	Reduces Air Quality Effects	Do you currently practice?	Will you consider for future?
Determine the nutritional value of each batch of an ingredient	x	x	x	Yes No	Yes No
Properly weigh and mix ingredients	x	x		Yes No	Yes No
Reduce protein in the diet by matching amino acid requirements	x		x	Yes No	Yes No
Add urine-acidifying compounds to the feed			x	Yes No	Yes No
Avoid excess sulfur-containing mineral sources			x	Yes No	Yes No
Use efficient water nipples, cup under drinkers, wet-dry or liquid feeders and fix water leaks immediately			x	Yes No	Yes No

Step 12

Review and Update the Plan

Developing a comprehensive nutrient management plan (CNMP) is not a one-time process, nor should the CNMP exist and operate separately from the overall farm management plan. As part of the farm management plan, the CNMP must be regularly reviewed and updated as conditions change. The Agriculture Environmental Management System (AEMS) model describes a cycle of continuous improvement through regular plan review, updating, implementation, and monitoring. This model is used extensively by manufacturing industries, but is adaptable to the livestock industry. Adaptation of the AEMS model can help facility owners and managers continuously improve environmental conditions, productivity, and profits. For more information about AEMS see the Internet at: <http://www.extention.usu.edu/aems/>

Here are some final suggestions for developing and implementing a CNMP:

- ! **Commit** to the planning process. Set aside a large block of time (40 hours or more) to initially develop a CNMP. Winter or other slack times may work well with fewer interruptions.
- ! **Develop the Plan.** Purchase a large (4-inch spine) 3-ring binder and tab system to organize the CNMP. A 12 tab system works well, using one tab divider for each part of the CNMP.
- ! **Implement** the plan. Refer to the plan regularly as the appropriate farm activities are conducted. Document activities, quantities, yields, soil test information, etc., and file all documentation in the appropriate place in the plan binder.
- ! **Check** the plan and organize documentation frequently.
- ! **Review** the CNMP at the end of the year and make necessary modifications in preparation for next year. Set new goals during the review. Also, at this time transfer any older documentation to an archive file such as a metal cabinet for long term storage.
- ! **Include** photographs where necessary to document improvements made over time.