

Appendix 3 Manure Group Information

Introduction

The purpose of Appendix 3 is to identify manure groups on the operation, inventory the amount of manure generated in each manure group, and summarize the required manure analysis results for each manure group.

There are two types of manure that are accounted for in the nutrient management plan. The first type is manure that is collected, stored and land applied. It is this manure that is allocated to specific fields in the nutrient management plan. The second type of manure is uncollected manure. Uncollected manure is deposited on pastures by grazing animals.

The regulatory requirements for this information are outlined in the Act 38 regulations in section 83.291.

Manure Group Identification

The starting point, regardless of manure inventory method, is the identification of the specific manure groups on the operation. Manure groups are the distinct portions of manure generated on the operation. Determination of manure groups is critical in the planning process, because manure will be allocated by manure group designation to specific crops and fields on the operation. Generally, it is differences in species, storage, and land application season that determine manure groups. Also, each manure group on an operation most likely will have a unique manure analysis.

The best way to identify manure groups is to ask two questions regarding all the manure generated on an operation.

1. Where are the specific locations on the operation where manure is stored and equipment is taken to load the manure? Different storage locations usually indicate different manure groups.
2. When is the manure loaded for land application at each storage location? Different application windows (seasons) usually indicate different manure groups.

Using this approach means that different animal groups may contribute to one manure group or the same animal group may contribute to multiple manure groups.

For planning purposes, each manure group must be labeled or named. This is the label that will be used to allocate manure to specific crops and fields. It is recommended that labels or names be used that the farmer understands. Some common designations of manure groups are:

- Spring Dairy
- Spring Liquid
- Fall Dairy

- Fall Liquid
- Bedded Pack
- Dairy Solid
- Storage 1 Spring
- Storage 2 Fall
- Broiler Manure
- Turkey Litter
- Finish House
- Pit Spring
- Lagoon Fall
- Animal Mortality Compost

In addition to manure generated on the operation, all imported organic sources of nutrients such as biosolids or manure imported from other operations should be treated as manure groups in the plan.

Multiple Manure Groups – Same Storage and Season

In most liquid manure storage systems, there is considerable variation in the proportion of liquids and solids throughout the storage profile. Likewise there is a corresponding variation in nutrient levels. Ideally, the manure should be agitated sufficiently during the emptying of the storage to obtain a homogenous product. If liquid manure is agitated sufficiently to achieve uniformity throughout the storage, one manure sample is adequate to determine the nutrient levels of that manure group.

If the storage is not adequately agitated and there are obvious changes, such as consistency, in the manure as the storage is being emptied, multiple samples will be required to represent the nutrient levels of the manure that is being land applied (See the section titled “Annual Manure Nutrient Generation Values”). This will require the identification of multiple manure groups and separate samples for each manure group. This can be done by noting when the manure consistency changes and estimating the percentage of manure volume in that portion.

Small Quantities of Manure

Livestock and poultry operations may have minor animal groups that produce a relatively small amount of manure. Examples include a horse for family recreation, animals for FFA or 4-H projects, or a small flock of laying hens. Animal groups of less than 5 AEUs do not need to be included in Appendix 3: Manure Group Information if the following two criteria are met:

1. Animals in the group represent less than 5 AEUs **and**
2. Five AEUs is less than 5% of the total AEUs in the nutrient management plan.

The animals in this group can be of multiple species, but only one miscellaneous grouping of animals is permitted in a nutrient management plan. Documentation of the animals in the miscellaneous animal group and how the manure produced by these animals is handled and utilized must be included the nutrient management plan according to the following requirements.

- The Operation Description section of Appendix 2: Operation Information must include a description of the animals in the miscellaneous animal group and how the manure will be handled and utilized. If manure will be applied to cropland, a statement indicating that the manure will be applied to cropland suitable to receive manure must be included.
- If manure from the miscellaneous animal group will be applied to cropland, a note for the crop management unit(s) receiving the manure must be included in the NMP Summary Notes.

Likewise, composting of animal mortalities may yield a small amount of manure. Small quantities of mortality compost of less than 5 tons of poultry mortality compost or 25 tons of non-poultry mortality compost do not need to be included in Appendix 3. Documentation of small quantities of mortality compost must be described in the Operation Description section of Appendix 2 and a note included in the NMP Summary Notes if applied to cropland.

Manure Production Inventory Method

There are two acceptable methods that can be used to inventory the manure generated on an operation.

- Estimating manure production by using book values to calculate manure amounts.
- Measuring manure production by using operation records.

After manure groups have been identified, the first decision that is required in completing Appendix 3 in the NMP Spreadsheet is to select the inventory method that will be used to determine manure production amounts.

The preferred, and most accurate, method is to measure the amount of manure generated on the operation. The Act 38 regulations state that, "If actual manure production records are available for the operation, these records shall be used for determining the manure produced on the operation." Field application records (number of loads, spreader capacity) and manure storage dimensions (total capacity and capacity at unloading) are common ways to measure the amount of manure produced.

For new operations, production records from similar operations can be used for planning purposes until the operation generates manure.

Manure Analysis Regulatory Requirements

Refer to "Section 83.291 – Determination of Available Nutrients" of the Act 38 regulations for the specific regulatory requirements regarding the analysis of manure. Manure analysis is required annually for each manure group. There are three exceptions to this requirement:

- Manure analysis is optional for manure groups associated with less than five AEU's.
- Some storages such as under-building swine manure storages, receive no rainwater and there is little variation in management such as feeding practices. Although the storage is emptied two or more times each year, the nutrient content in the multiple manure groups will be very constant. Therefore, only one annual manure sample is required for the storage rather one annual sample for each manure group associated with the storage.
- Manure analysis is optional for small quantities of mortality compost. Analysis is required for quantities exceeding 5 tons of poultry mortality compost or 25 tons of non-poultry mortality compost unless the material used to compost the mortalities is exclusively from a manure group generated on the operation, such as poultry litter. In those cases, that manure group analysis could be used for the mortality compost.
- Manure analysis is **not** to be obtained for uncollected manure deposited on pasture. Obtaining representative samples including both manure and urine deposited on pasture is extremely difficult. Therefore, manure sampling for nutrient content and PSC values for manure deposited on pasture will not be accepted for Act 38 nutrient management plans.

When manure sampling and analysis is not required by the regulations, the nutrient management specialist should use the nutrient content levels contained in the Penn State Agronomy Guide, Table 1.2-13 or other levels approved by the Commission. The source of these values should be noted in Appendix 10.

Appendix 3 must include manure analysis values for each manure group. Manure analysis reports used for Act 38 nutrient management plans must include the following results: total nitrogen, ammonium nitrogen, total phosphate, total potash, and percent solids. Manure analysis reports that do not contain these specific results cannot be used for Act 38 planning.

Several manure analysis reports may be used to determine an average analysis for a manure group. All manure reports used to report the manure nutrient values in Appendix 3 must be maintained on the operation or included in Appendix 10.

An optional manure analysis is the water extractable phosphorus (WEP) test. The water soluble phosphorus test result is converted by the laboratory to provide a Phosphorus Source Coefficient (PSC) value that can be used in the Pennsylvania Phosphorus Index. If the WEP test is not run, book values for the PSC are to be used. These values can be found in Appendix 5 or in the The Pennsylvania Phosphorus Index: Version 2 factsheet which is available at: http://panutrientmgmt.cas.psu.edu/pdf/phosphorus_index_factsheet.pdf.

Manure Sampling Procedures

It is imperative that the manure samples obtained for analysis represent the manure that is actually applied. Representative manure samples should be obtained using accepted manure sampling methods as outlined in Part 1, Section 2, "Manure Nutrient Content" in

the Penn State Agronomy Guide and Agronomy Facts 69: Manure Sampling for Nutrient Management Planning. This factsheet is available at: http://panutrientmgmt.cas.psu.edu/pdf/agronomy_facts_69.pdf. It is recommended that nutrient management specialists work with producers to develop site specific manure sampling procedures.

Manure nutrient levels obtained from a well-designed and diligently managed manure sampling program will be more representative of an operation's manure than book values. It is important to understand that manure analysis nutrient levels will most likely vary from book values.

Annual Manure Nutrient Generation Values

If analysis values are extremely different than book values, attention should be given to determining the cause of this variation. Commonly manure analysis values for liquid swine manure are found to be significantly less than book values. Often the nutrient concentration and manure generation figures are so low that it is neither logical nor scientifically possible that the animals are excreting such low amounts of nutrients over the year's time.

The results of an extensive swine manure production and analysis study generated estimated annual nutrient excretion levels for typical phases of swine production in Pennsylvania. The chart below provides the expected amount of nitrogen, phosphorus and potash to be generated per hog by various swine types over a given year.

Estimated annual nutrient excretion per hog by swine in various phases of production.

Phase of Production	Annual Nutrient Excretion Per Hog		
	N	P ₂ O ₅	K ₂ O
Farrow to wean (lb/sow)	33	33	20
Wean to finish (lb/pig)	11	7	6
Grow finish (lb/pig)	12	10	9
Nursery (lb/pig)	3.5	1.5	2.6

How To Use These Figures

Nutrient management plan writers and reviewers should use the nutrient excretion values to determine if the plan accounts for all of the nutrients expected to be generated by that particular type of swine facility.

To determine whether the nutrient generation figures included in a nutrient management plan are reasonable, the estimated annual mass nutrient excretion figures must be compared with the actual annual mass nutrient excretion figures included in the nutrient management plan. This is a three step process.

First, using the above table, calculate the expected annual mass nutrient generation for the farm operation. For example, a 3,000 hog grow-finish facility would be expected to generate approximately the following pounds of N, P₂O₅, and K₂O over the year:

- 3,000 hogs x 12 lbs N/hog/year = 36,000 lbs N
- 3,000 hogs x 10 lbs P₂O₅/hog/year = 30,000 lbs P₂O₅
- 3,000 hogs x 9 lbs K₂O/hog/year = 27,000 lbs K₂O

Second, using the on-farm manure production figures and the manure analysis results included in the nutrient management plan, calculate the actual annual mass nutrient generation as set forth in the plan. For this example 3,000 hog grow-finish facility, the on-farm records document an average of 1,766,223 gallons of hog manure generated a year and an average manure nutrient content of 19.82 lbs N, 10.75 lbs P₂O₅, and 16.67 lbs K₂O per 1,000 gallons. The annual mass nutrient production for the operation is:

- 1,766,223 gallons/year x 19.82 lbs N/1000 gallons = 35,000 lbs N/year
- 1,766,223 gallons/year x 10.75 lbs P₂O₅/1000 gallons = 18,987 lbs P₂O₅/year
- 1,766,223 gallons/year x 16.67 lbs K₂O /1000 gallons = 29,443 lbs K₂O/year

Third, compare the two sets of values for each nutrient. **The annual mass nutrient generation figures from the nutrient management plan must be at least 75% of expected annual mass nutrient figures in order to be considered reasonable for planning purposes.** In this example, the 35,000 lbs N/year and the 29,443 lbs K₂O/year are over 75% of the expected values. The 18,987 lbs P₂O₅/year in the plan is only 63% of the expected value and thus under 75% of the expected 30,000 lbs P₂O₅/year. To meet the 75% minimum for P₂O₅, the lbs/year (manure generated x the analysis) must be greater than or equal to 22,500 lbs P₂O₅/year.

A common cause for this type of discrepancy is the manure sampling procedure when only the top part of the manure storage is sampled. It is typical to have some separation in the storage resulting in a higher P analysis in the bottom of the storage. In the study used to develop these figures, separate samples were obtained from each third of the entire storage profile. Comparing the data from the different layers sampled in the storage shows how sampling procedure explains the discrepancies sometimes observed in the manure analysis results.

The average for all samples from all stages of production for all three storage layers was 18.3 lbs P₂O₅ /1000 gallons. This would be the best estimate of the average actual nutrient content in the manure storage. When only the top two-thirds of the manure was sampled the average analysis was 10.1 lbs P₂O₅/1000 gallons, which is about one-half of the true average. The results for the different phases of production were similar. The P analysis in the top two-thirds of the grow-finish manure was also about one-half and in the wean-finish manure it was about two-thirds of the actual average. The difference was much larger for farrow to wean where the P analysis in the top two-thirds was approximately one-fourth the average for the whole volume of manure. See the discussion on manure sampling early in this appendix.

Nutrient Management Plan Format

Act 38 regulations require that all nutrient management plans use a standard format for organizing and presenting the required plan elements. The Nutrient Management Program has developed a spreadsheet which includes all the required plan elements

and performs most of the necessary calculations using the data entered. All plans developed and submitted for approval must use the current version of the NMP spreadsheet.

The current version is the one posted on the Nutrient Management Program website: <http://panutrientmgmt.cas.psu.edu/>.

Completing NMP Spreadsheet: Appendix 3

The row titles from Appendix 3 in the Standard Format NMP Spreadsheet are used as the outline below to provide guidance for completing Appendix 3. The focus will be on the information entry points. The information entry points are identified in the NMP Spreadsheet with yellow shading. Most of the calculations are completed internally within the spreadsheet. Several of the rows are populated from these calculations. This will be noted below where applicable.

Manure Group Information

The spreadsheet can include up to 16 manure groups and 6 animal groups for each manure group. The manure groups from one to sixteen are organized horizontally, from left to right, in Appendix 3. The animal groups from one to six are organized vertically within each manure group.

Before entering any information for a manure group, the inventory method must be selected by clicking either “Calculated” or “Records” button. The inventory method will be recorded in the row titled “Inventory Method” below.

If the “Calculated” button is selected, a data entry screen will appear. The following information should be entered using this screen:

- Manure Group ID
- Manure Group Description
- Manure Analysis Results

If the manure group includes rainfall, click the “Rainfall/Runoff Worksheet” button. A new data entry screen will appear where the following information is entered or selected from pull down tabs:

- County
- No Evaporation or Evaporation
- Paved or Unpaved
- Beginning Month
- Ending Month
- Storage Surface Area
- Runoff Surface Area

If the manure group does not include rainfall, click the “OK” button.

If the “Records” button is selected, a data entry screen will appear. The following information should be entered using this screen:

- Manure Group ID
- Manure Group Description
- Manure Analysis Results
- Total Amount of Manure Collected

In each of these screens, when the information has been entered, click the “OK” button and the spreadsheet will perform the necessary calculations and enter the results in appropriate boxes in Appendix 3.

It is strongly recommended that when creating a manure group data be entered using the data entry screens. Once a manure group is created, information can be changed directly into any “yellow” highlighted box in Appendix 3.

Manure Group Identification

This information is entered into Appendix 3 of the NMP Spreadsheet using the data entry screen which is available after selecting either the “Calculated” or “Records” button. For guidance on determining manure groups see “Manure Group Identification” above.

Manure Report Date

This information is entered into Appendix 3 of the NMP Spreadsheet using the data entry screen which is available after selecting either the “Calculated” or “Records” button. If several reports are used to obtain an average, enter the date of the most recent report and note that several reports are being used. This can be done by entering “avg” after the date. If book values are used for Total Nitrogen, Phosphate and Potash manure nutrient content, enter “Book Values” in the Manure Report Date entry. Refer to the Manure Analysis Regulatory Requirements in this document for more information.

Laboratory Name

This information is entered into Appendix 3 of the NMP Spreadsheet using the data entry screen which is available after selecting either the “Calculated” or “Records” button. If several reports are used to obtain an average and are from different labs, enter the name of the laboratory of the most recent report. If book values are used for Total Nitrogen, Phosphate and Potash manure nutrient content, enter an indication of the book value information source in the Laboratory Name entry. For example, enter “PSU Agronomy Guide” for the Penn State Agronomy Guide. Refer to the Manure Analysis Regulatory Requirements in this document for more information.

Manure Type

This information is entered into Appendix 3 of the NMP Spreadsheet using the data entry screen which is available after selecting either the “Calculated” or “Records” button. The manure type is used by Appendix 4 to correctly identify Nitrogen Availability Factors. Therefore, a few general categories are provided and “Other”

should be used for manure types that do not fit specifically into the provided categories.

Manure Unit

This information is entered into Appendix 3 of the NMP Spreadsheet using the data entry screen which is available after selecting either the “Calculated” or “Records” button. The manure unit must be entered as lbs/ton or lbs/1000 gallons into Appendix 3. A few labs may report the manure analysis for liquid manure as lb /100 gal. To convert to lb/1000 gal multiply the manure analysis results by 10.

Total Nitrogen (N)

This information is entered into Appendix 3 of the NMP Spreadsheet using the data entry screen which is available after selecting either the “Calculated” or “Records” button. Enter the analysis results from the manure report(s).

Ammonium Nitrogen (NH₄-N)

This information is entered into Appendix 3 of the NMP Spreadsheet using the data entry screen which is available after selecting either the “Calculated” or “Records” button. Enter the analysis results from the manure report(s). If book values are used for Total Nitrogen, Phosphate and Potash manure nutrient content and no Ammonium Nitrogen value is available, leave the Ammonium Nitrogen entry blank.

Total Organic N

The spreadsheet version automatically calculates the amount of total organic nitrogen from the other nitrogen manure analysis values entered on the inventory method data entry screen. No data entry is required. If book values are being used for manure nutrient content and no Ammonium Nitrogen value is entered into Appendix 3, the Total Organic N entry will be blank.

Total Phosphate (P₂O₅)

This information is entered into Appendix 3 of the NMP Spreadsheet using the data entry screen which is available after selecting either the “Calculated” or “Records” button. Enter the analysis results from the manure report(s).

Total Potash (K₂O)

This information is entered into Appendix 3 of the NMP Spreadsheet using the data entry screen which is available after selecting either the “Calculated” or “Records” button. Enter the analysis results from the manure report(s).

Percent Solids

This information is entered into Appendix 3 of the NMP Spreadsheet using the data entry screen which is available after selecting either the “Calculated” or “Records” button. Enter the analysis results from the manure report(s).

PSC Value (if used in the P Index)

This information is entered into Appendix 3 of the NMP Spreadsheet using the data entry screen which is available after selecting either the “Calculated” or “Records” button. The default PSC Value is 1.0 and will automatically appear in the data entry screen. Use the default PSC Value or enter the analysis results from the manure report(s). If analysis values are not available, enter the appropriate book value from the Phosphorus Index Version 2.0 factsheet. As there is only one source of PSC Book Values, using a book value for the PSC Value does not need to be documented in the Manure Analysis Date or Laboratory Name as described above for Total Nitrogen, Phosphate and Potash book values.

Inventory Method

This will be completed when the inventory method button is selected when beginning the process of entering a manure group. See “Manure Group Information” above.

The inventory method can be modified or entered directly in the inventory method entry by using a drop down menu. The entry options are limited to “Calculated” or “Records”.

Manure Group Identification

The Manure Group information is also entered into Appendix 3 following the Inventory Method of the NMP Spreadsheet using the data entry screen which is available after selecting either the “Calculated” or “Records” button. .

Note: There are two columns in the NMP Spreadsheet for each manure group. The manure group name will appear in the left column. If there is uncollected manure associated with a manure group, the identification of the uncollected manure will be entered in the right column based on the manure group name. For example, Cow Spring – Uncollected”.

Description: Site & Season Applied

This information is entered into Appendix 3 of the NMP Spreadsheet using the data entry screen which is available after selecting either the “Calculated” or “Records” button.

Integral to manure group identification is the storage location and season of application. These two aspects of the manure group have already been determined in the process of determining the manure groups on the operation. The storage site/identification and specific manure application season need to be entered in this row for each manure group.

CALCULATED: Total Manure Collected Per Manure Group

If the “Calculated” inventory method was selected, the total amount of manure collected in the manure group is automatically calculated and entered in this row. The right column will record the amount of uncollected manure associated with this manure group. No data entry is required.

Unit

The units (lbs/ton or lbs/1000 gallons) for the manure group is from the Manure Unit entry of the inventory method data entry screen.

RECORDS: Total Manure Collected Per Manure Group

If the "Records" inventory method was selected, the amount of the total amount of collected manure will be entered from the inventory method data entry screen. Enter the total amount of manure from operation records for this manure group. Do not include units with the entry.

Unit

The units (lbs/ton or lbs/1000 gallons) for the manure group is from the Manure Unit entry of the inventory method data entry screen.

Manure Used On-Farm

As manure is allocated in Appendix 4, the spreadsheet calculates the total amount of manure, both collected and uncollected, from the manure group that has been allocated.

Unit

The units (lbs/ton or lbs/1000 gallons) for the manure group is from the Manure Unit entry of the inventory method data entry screen.

Manure Allocation Manure Balance

As manure is allocated in Appendix 4, the spreadsheet provides a running balance of manure, both collected and uncollected, that has not been allocated.

The amount of manure listed in the "Total Manure Collected Per Manure Group" row must be allocated to CMUs or fields on the operation or exported off of the operation.

The amount of unallocated manure must not exceed 5% of the total amount of manure collected in the manure group. This limit does not apply to manure groups with small quantities of collected manure:

- 5 tons of poultry manure
- 25 tons of non-poultry manure
- 10,000 of liquid manure

Over-allocation of a manure group is allowed, but a note should be included in the Nutrient Management Plan Summary to alert the operator that the total of planned acres exceeds the amount of manure available.

Unit

The units (lbs/ton or lbs/1000 gallons) for the manure group is from the Manure Unit entry of the inventory method data entry screen.

Manure Exported

If manure from a manure group is exported off the operation, list the amount of manure in each manure group that is exported off the operation.

Unit

The units (lbs/ton or lbs/1000 gallons) for the manure group is from the Manure Unit entry of the inventory method data entry screen.

Total Rainfall and Runoff

If the "Calculated" inventory method was selected, use the Rainfall/Runoff Worksheet data entry screen to determine the total amount of rainfall and runoff water added to the manure group. The amount of rainfall and runoff will be entered from the Rainfall/Runoff Worksheet data entry screen. The Rainfall/Runoff Worksheet information can be reviewed or modified directly by going to the Rainfall/Runoff Worksheet in the NMP Spreadsheet.

If the "Records" inventory method was selected, do not enter information in the Rainfall/Runoff entry cell.

Animal Group

The required information for each animal group that contributes to a manure group must be entered. The spreadsheet provides for up to six animal groups per manure group. Enter the name of the animal group.

Animal Type

Select the appropriate animal type from the pull down menu. This allows the spreadsheet to pull the appropriate numbers to be used in the internal calculations.

For livestock and poultry species not included in the Penn State Agronomy Guide, Table 1.2-13, contact Act 38 program staff contact program staff for guidance and technical assistance in entering this value.

Animal Number

In this row include the average number of animals in each animal group on a **typical production day** for the agricultural operation.

Animal Weight

In this row enter the average animal weight for this animal group taking into account weight variations during the production cycle. For mature animals (ex. dairy cows) this weight will not change significantly over the production cycle. For growing animals the average weight should account for weight variations during the production cycle (see comments under CAO Calculation Section of the manual). The average weight per animal should be the same weight used for the CAO calculation. If the weight used is different than those found in the table of standard animal weights, the method of determining the alternative weights should be explained in

Appendix 10 and supporting documentation is required to be maintained on-site and shall be furnished upon request.

Animal Group AUs

This value is calculated and entered automatically by the spreadsheet. It is used to calculate the amount of manure generated by this animal group.

Animal Group AEUs

This value is calculated and entered automatically by the spreadsheet. This value does not directly concern manure generation. It is used to calculate the total AEUs on the operation for the for the CAO calculation documented in Appendix 2.

Daily Manure Production Per AU

This information is entered automatically by the spreadsheet version using the information provided above. The number is obtained from the Penn State Agronomy Guide, Table 1.2-13.

For livestock and poultry species not included in the Penn State Agronomy Guide, Table 1.2-13, contact Act 38 program staff contact program staff for guidance and technical assistance in entering this value.

Total Days Manure Produced

The number of days that this animal group contributes manure to this manure group is entered in this row. Following are some typical examples:

- A broiler house, emptied yearly, runs six flocks a year at 50 days per flock; the total number of days for this manure group is 300 days.
- A liquid dairy storage is emptied every six months; the number of days for both manure groups is 180 days.

Total Manure Produced

This value is calculated and entered automatically by the spreadsheet. This is the amount of raw manure generated by the animal group before subtracting uncollected manure or adding any additions to the manure.

Days On Pasture

If the animals contributing to a particular manure group are on pasture during the time frame of that manure group, the number of days on pasture during that period is entered in this row.

Hours Per Day On Pasture

If the animals contributing to a particular manure group are on pasture during the time frame of that manure group, the average number of hours per day on pasture during that period is entered in this row.

For animals that have unrestricted access, 24 hours per day, to a pasture the following guidance should be followed to estimate hours per day on pasture. This

guidance is based on considering whether the animals are fed and/or watered at the barn. If the animals are both fed and watered at the barn use 12 hours per day on pasture instead of 24 hours. If animals are fed at the barn but water is provided in the pasture use 18 hours per day on pasture instead of 24 hours.

Total Bedding

The amount of bedding used for each animal group in the manure group is entered in this row. The amount of bedding used is obtained from operation records and information.

For some manure types the amount of bedding is included in Daily Manure Production values found in the Penn State Agronomy Guide, Table 1.2-13 (refer to comments column). If bedding is included in the Daily Manure Production values leave this row blank.

For solid manure, calculate the amount of bedding by using the following equation:

- Pounds of bedding used per period (day, week, month) x Number of periods (days, weeks, months) that manure is accumulated in this manure group ÷ 2,000 = Tons of Bedding

For liquid manure, calculate the amount of bedding by using the following equations:

- Pounds of bedding used per period (day, week, month) x Number of periods (days, weeks, months) that manure is accumulated in this manure group = Pounds of Bedding Per Manure Group Period
- Use the “Density of Bedding Materials” table in Supplement 6 to determine the density (pounds per cubic foot) of the type of bedding material used.
- Pounds of Bedding Per Manure Group Period ÷ Density (pounds per cubic foot) = Cubic Feet of Bedding Per Manure Group Period
- Cubic Feet of Bedding Per Manure Group Period ÷ 2 (bedding volume is reduced by one-half during use) x 7.48 gallons per cubic feet = Gallons of Bedding Per Manure Group Period (round to the nearest hundred gallons)

Calculations for bedding used are to be shown in Appendix 10 of the Nutrient Management Plan.

If the “Records” inventory method was selected, do not enter information in the Total Bedding entry cell.

Total Washwater

The amount of washwater or wastewater added to each manure group is entered in this row. Calculate the amount of washwater added by using the following equation:

- Gallons of washwater added per period (day, week) to the manure x Number of periods (days, weeks) in the manure group
- Note: Gallons can be converted to tons by dividing by 240 gallons/ton.

For some manure types the amount of washwater is included in Daily Manure Production values found in the Penn State Agronomy Guide, Table 1.2-13 (refer to comments column). If washwater is included in the Daily Manure Production values leave this row blank.

If the "Records" inventory method was selected, do not enter information in the Total Washwater entry cell.

CALCULATED - Total Uncollected Manure

This value is calculated and entered automatically by the spreadsheet.

Total Manure Collected Per Animal Group

This value is calculated and entered automatically by the spreadsheet.

Calculations Used By the Spreadsheet

Following are some of the calculations used internally by the spreadsheet:

Animal Group AUs

An Animal Unit (AU) is 1000 pounds of live animal weight. Calculate the number of AUs for each animal group by using the following equation:

- $\text{Animal Number} \times \text{Animal Weight} \div 1000 = \text{AUs}$

Total Manure Produced

Calculate the amount of raw manure produced by using the following equation:

- $\text{Number of AUs} \times \text{Daily Manure/Day /AU (pounds or gallons)} \times \text{Total Days Manure Produced} (\div 2000 \text{ for solid manure to convert to tons}) = \text{Total Manure Produced}$

Total Uncollected Manure

For solid manure groups, the amount of uncollected manure is calculated using the following equation:

- $\text{Manure Group AUs} \times \text{Daily Manure Production (pounds)} \times \text{Days On Pasture} \times \text{Hours Per Day On Pasture} \div 24 \div 2000 = \text{Tons of Uncollected Manure}$

For liquid manure groups, the amount of uncollected manure is calculated using the following equation:

- $\text{Manure Group AUs} \times \text{Daily Manure Production (gallons)} \times \text{Days On Pasture} \times \text{Hours Per Day On Pasture} \div 24 = \text{Gallons of Uncollected Manure}$
- For liquid manure groups the uncollected manure is calculated in gallons so that it can be subtracted from the total manure produced. However, this must be converted to tons to use the book analysis values as required for uncollected manure. To do this conversion use the actual manure density if known or use the conversion factor: 240 gallons of manure per ton of manure.

Total Manure Collected Per Animal Group

This amount is calculated using the following equation:

- Total Manure Produced + Total Bedding + Total Rainfall and Runoff + Total Washwater - Total Uncollected Manure = Total Manure Collected Per Animal Group

Total Rainfall and Runoff

The Rainfall Additions Worksheet should be used to calculate this addition to the manure group volume. Monthly rainfall values from Supplement 7, "Rainfall, Runoff and Evaporation Data for Pennsylvania Counties" should be used to complete the Rainfall Additions Worksheet. Follow the instructions provided on the cover page of Supplement 7 to determine which rainfall values to use for each manure group.