

LIQUIDS WORKSHEET 1 EXAMPLE - ESTIMATING NUTRIENTS GENERATED PER CONFINEMENT PERIOD

Step 1. Nutrients Generated (As Excreted)																
Animal Type (See Table 1.1)	Number of Animals	x	Percent Waste as Liquid ^a	x	Average Weight (lbs)	÷	1,000	x	Confinement Period ^b (days/year)	=	Animal Unit Days	Table 1.1 Values	N	P ₂ O ₅	K ₂ O	
1.) Dairy Cows	50	x	50%	x	1,400	÷	1,000	x	180	=	6,300	N 0.45	=	2,835		
												P ₂ O ₅ 0.21	=	+	1,323	
												K ₂ O 0.35	=	+		2,205
												N 0.27	=	486	+	
2.) Dairy Heifers	20	x	50%	x	1,000	÷	1,000	x	180	=	1,800	P ₂ O ₅ 0.11	=	+	198	+
												K ₂ O 0.14	=	+		252
3.)		x		x		÷	1,000	x		=		N	=			+
												P ₂ O ₅	=			
												K ₂ O	=			
Step 1 Total												=	3,321	1,521	2,457	
												(lbs)				
Step 2. Manure Generated (As Excreted)																
Animal Unit Days (from Step 1)	x	Manure/A.U. (See Table 1.1)	x	Conversion	=	Volume of Manure										
1.) 6,300	x	1.4	x	7.5	=	66,150 gallons										
2.) 1,800	x	0.9	x	7.5	=	12,150 gallons										
3.)	x		x	7.5	=	gallons										
Step 2 Total						= 78,300 gallons										
						1 + 2 + 3										
Step 3. Water Added by Flushing, Wastage, or Cleaning																
Gallons/Day (See Table 1.1)	x	Number of Animals	x	Confinement Period (from Step 1)	=	Volume of Water										
1.) 5	x	50	x	180	=	45,000 gallons										
2.) 5	x	20	x	180	=	18,000 gallons										
3.)	x		x		=	gallons										
Step 3 Total						= 63,000 gallons										
						1 + 2 + 3										
Step 4. Water Added by Feedlot Runoff																
Width (feet)	x	Length (feet)	x	Frequency of Pump ^c	x	Conversion	=	Feedlot Runoff								
Paved Surface ^d		15	x	60	x	0.5 (days before pump ÷ 365)	x	18.75	=	8,438 gallons						
Unpaved Surface ^e			x		x	11.25 (days before pump ÷ 365)	=		gallons							
Step 4 Total									= 8,438 gallons							
									Paved + Unpaved							
Step 5. Water Added from Rainfall minus Evaporation on Storage Pond																
Width (feet)	x	Length (feet)	x	Frequency of Pump ^c	x	Conversion	=	Net Rainfall on Storage Pond								
Lagoon/Pond Surface Area		224	x	464	x	0.5 (days before pump ÷ 365)	x	11.25	=	584,640 gallons						
Step 5 Total									= 584,640 gallons							
Step 6. Total Volume of Manure Produced																
Step 2	+	Step 3	+	Step 4	+	Step 5	=									
78,300	+	63,000	+	8,438	+	584,640	=	Step 6 Total = 734,378 gallons								
Step 7. Weighted Nutrient Values Before Nutrient Losses																
Step 1	÷	Step 6 Total	x	Conversion	=											
N	÷	3,321	÷	734,378	x	1,000	=									
P ₂ O ₅	÷	1,521	÷	734,378	x	1,000	=									
K ₂ O	÷	2,457	÷	734,378	x	1,000	=									
Step 7 Total							=	4.5	2.1	3.3						
							(lbs/1,000 gallons)									

^a The percent of the manure that is handled as a liquid.

^b Confinement period should be adjusted for animals that are only in confinement for a portion of the day. For example, if animals spend 16 hours on pasture and 8 hours in confinement, then the confinement period would be 1/3 of a day or 122 days/year.

^c The number of days before the storage pond/lagoon is pumped for land application divided by 365. For example, if the pond is pumped twice a year, it would be .5 (180 ÷ 365 = .5).

^d Impervious surface areas such as concrete, asphalt, and roofs without gutters that contribute water to storage pond/lagoon.

^e Pervious surface areas such as gravel, dirt, or soil cement that contribute water to storage pond/lagoon.

EXAMPLE LIQUIDS WORKSHEET 2 - NUTRIENT BALANCE

Modified January 14, 2014

Tract	Field No.	Acres			
	1	28			
			Soil Test P Value (Mehlich 3) 401		
Step 1. Crop or Crop Sequence/Rotation			Corn silage (ton)		
See Table 2.1 Options					
Step 2. Realistic Yield (Average from 5-10 Years on a per acre basis)			20		
			N	P₂O₅	K₂O
Step 3. Plant Nutrients Needed or Allowed (lbs/ac)			194	72	160
N	$\frac{9.7}{\text{Table 2.1 Value for N}} \times \frac{20}{\text{Step 2}} =$	$\frac{194}{\text{Step 2}}$			
P	$\frac{3.6}{\text{Table 2.1 Value for P}} \times \frac{20}{\text{Step 2}} =$	$\frac{72}{\text{Step 2}}$			
K	$\frac{8}{\text{Table 2.1 Value for K}} \times \frac{20}{\text{Step 2}} =$	$\frac{160}{\text{Step 2}}$			
			P₂O₅		
Step 4. Adjusted P₂O₅ Application Rate According to Threshold			72		
P	$\frac{72}{\text{Step 3 P}_2\text{O}_5} \times \frac{1}{\text{Table 2.2 Value}} =$	$\frac{72}{\text{Table 2.2 Value}}$			
			N	P₂O₅	K₂O
Step 5. Fertilizer Credits (lbs/ac)			0	0	0
			N	P₂O₅	K₂O
Step 6. Plant Nutrients Needed Minus Credits (lbs/ac)			194	72	160
N	$\frac{194}{\text{Step 3 for N}} - \frac{0}{\text{Step 5 for N}} =$	$\frac{194}{\text{Step 5 for N}}$			
P	If Step 4 > 0: $\frac{72}{\text{Step 4 for P}} - \frac{0}{\text{Step 5 for P}} =$	$\frac{72}{\text{Step 5 for P}}$			
	If Step 4 = 0: $\frac{\text{Step 3 for P}}{\text{Step 3 for P}} - \frac{\text{Step 5 for P}}{\text{Step 5 for P}} =$	$\frac{\text{Step 3 for P}}{\text{Step 5 for P}}$			
K	$\frac{160}{\text{Step 3 for K}} - \frac{0}{\text{Step 5 for K}} =$	$\frac{160}{\text{Step 5 for K}}$			
			N	P₂O₅	K₂O
Step 7. Nutrients in Manure (lbs./1,000 gallons)			4.5	2.1	3.3
Step 4 Values from Liquids Worksheet 1 or use Lab Results					
			N	P₂O₅	K₂O
Step 8. Percent Nutrients Retained in System			35%	50%	65%
Enter Table 2.3 values or Enter zero if lab analysis is used			(Anaerobic lagoon or stored in waste storage pond diluted >50%)		
			N	P₂O₅	K₂O
Step 9. Net Retained Nutrients in Manure (lbs./1,000 gallons)			1.6	1.1	2.2
Enter zero if lab analysis is used					
N	$\frac{4.5}{\text{Step 7 for N}} \times \frac{0.35}{\text{Step 8 for N}} =$	$\frac{1.6}{\text{Step 8 for N}}$			
P	$\frac{2.1}{\text{Step 7 for P}} \times \frac{0.5}{\text{Step 8 for P}} =$	$\frac{1.1}{\text{Step 8 for P}}$			
K	$\frac{3.3}{\text{Step 7 for K}} \times \frac{0.65}{\text{Step 8 for K}} =$	$\frac{2.2}{\text{Step 8 for K}}$			
			N	P₂O₅	K₂O
Step 10. Percent of Available Nutrients			45%	80%	100%

Enter Table 2.4 Value for N

(Incorporation: 7 days or more)

	N	P ₂ O ₅	K ₂ O
Step 11 . Net Available Nutrients (lbs./1,000 gallons)	0.7	0.9	2.2

If Lab Results are used in Step 7:

N $\frac{\text{Step 7 for N}}{\text{Step 7 for N}} \times \frac{\text{Step 10 for N}}{\text{Step 10 for N}} = \underline{\hspace{2cm}}$

P $\frac{\text{Step 7 for P}}{\text{Step 7 for P}} \times \frac{\text{Step 10 for P}}{\text{Step 10 for P}} = \underline{\hspace{2cm}}$

K $\frac{\text{Step 7 for K}}{\text{Step 7 for K}} \times \frac{\text{Step 10 for K}}{\text{Step 10 for K}} = \underline{\hspace{2cm}}$

If Liquid Worksheet 1 Values are used in Step 8:

N $\frac{1.6}{\text{Step 9 for N}} \times \frac{0.45}{\text{Step 10 for N}} = \underline{0.7}$

P $\frac{1.1}{\text{Step 9 for P}} \times \frac{0.8}{\text{Step 10 for P}} = \underline{0.9}$

K $\frac{2.2}{\text{Step 9 for K}} \times \frac{1}{\text{Step 10 for K}} = \underline{2.2}$

	N	P ₂ O ₅	K ₂ O
Step 12 . Application Rate (1,000 gallons/ac)	277	80	73

N $\frac{194}{\text{Step 6 for N}} \div \frac{0.7}{\text{Step 11 for N}} = \underline{277}$

P $\frac{72}{\text{Step 6 for P}} \div \frac{0.9}{\text{Step 11 for P}} = \underline{80}$

K $\frac{160}{\text{Step 6 for K}} \div \frac{2.2}{\text{Step 11 for K}} = \underline{73}$

	N	P ₂ O ₅	K ₂ O
Step 13 . Net Application Amount for All Nutrients (1,000 gallons/ac)	9	12	29

N $\frac{0.7}{\text{Step 11 for N}} \times \frac{13}{\text{Application Rate}} = \underline{9}$

P $\frac{0.9}{\text{Step 11 for P}} \times \frac{13}{\text{Application Rate}} = \underline{12}$

K $\frac{2.2}{\text{Step 11 for K}} \times \frac{13}{\text{Application Rate}} = \underline{29}$

	N	P ₂ O ₅	K ₂ O
Step 14 . Nutrient Needs (negative) or Surpluses (positive) (1,000 gallons/ac)	-165	-60	-131

N $\frac{9}{\text{Step 13 for N}} - \frac{194}{\text{Step 6 for N}} = \underline{-165}$

P $\frac{12}{\text{Step 13 for P}} - \frac{72}{\text{Step 6 for P}} = \underline{-60}$

K $\frac{29}{\text{Step 13 for K}} - \frac{160}{\text{Step 6 for K}} = \underline{-131}$

Step 15 . Balance

Tons Available	<u>734,378</u>	-	Tons Applied in Field	<u>364,000</u>	=	Balance	<u>370,378</u>
	Step 6 from Liquids Worksheet 1 or Balance from Previous Worksheet 2			Application Rate x Field Acres x 1,000 or to deplete supply in one field: Gallons Available ÷ Num. of Acres = Uniform App. Rate (Be sure not to exceed 13,000 gallons/acre)			

EXAMPLE LIQUIDS WORKSHEET 3 - APPLICATION RATES AND LAND REQUIREMENTS ¹

Tract No.										
Field No.	Acres	Soil Test Phosphorus (STP)	Crop Rotation / Sequence	Planned Application Date or Timing	Planned Application Rate ² (1,000 gal/ac)	Liquid or Commercial Fertilizer (L or C)	Actual Application Date	Actual Application Rate ² (1,000 gal/ac)	Weather at Time of Application ³ (Cloudy, Raining, Sunny)	
									24 Hours Before	24 Hours After
									1	28

1. Where land application is occurring under long term lease or agreement with adjacent landowner, fields must be included in the above table.
2. Fields that have a "High" soil test phosphorus (>400) should implement Best Management Practices (BMPs) to reduce the risk of nutrient movement to sensitive waterbodies. BMPs may include, but not be limited to: installing conservation buffers, reducing P2O5 application rate, incorporating manure, adding chemical treatments to litter that tie up soluble P and keep it from moving over the landscape, and/or adjusting application timing.
3. It illegal to make land applications when the ground is frozen. It is recommended that land applications are not made within 48 hours of forecasted precipitation.