



DOMESTIC SEWAGE SLUDGE RE-USE  
AND  
DISPOSAL GUIDANCE  
FOR  
DESLUDGING LAGOONS

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YEAR

Land Application Forms  
for  
Kansas Domestic Wastewater Treatment Lagoon Facilities

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CITY

Rev. 6/12

## LAND APPLICATION - SPECIFIC INFORMATION AND INSTRUCTIONS

This packet contains the following forms:

<u>FORM</u>	<u>DESCRIPTION</u>
<b>LA-SD</b>	<b>Land Application - Site Descriptions</b>  The permittee shall complete this form showing all sites to which the permittee will be applying sludge.
<b>LA-MP</b>	<b>Land Application - Management Practices</b>  The permittee shall complete this form to assure the facility remains in compliance with the management practices at each land application site.
<b>LA-PR</b>	<b>Land Application - Class B Pathogen Reduction and Site Restrictions</b>  By agreement between EPA Region 7 and KDHE, sludge from lagoons that have not been desludged for 15 years has been sufficiently treated to meet Class B pathogen requirements. Therefore, the Class B pathogen reduction portion of this form has been removed. The permittee shall complete the site restrictions requirements on this form to assure the facility remains in compliance with the requirements.
<b>LA-VAR</b>	<b>Land Application - Vector Attraction Reduction – NOT APPLICABLE</b>  By agreement between EPA Region 7 and KDHE, lagoons which have not been desludged for 15 years, have sufficiently stabilized the sludge and therefore do not pose a vector attraction within the intent of the 503 sludge regulations. This form has been removed from the 503 sludge guidance packet for lagoon desludging.

**LA-ANR**      **Land Application - Agronomic Nitrogen Rate – Not required if the sludge application rate is 2 dry tons/acre or less.**

If required, the permittee shall complete this form to assure the facility remains in compliance with the requirements. This form is to be completed prior to application of sludge on the land application site. One form is to be completed for each site.

**LA-PMC**      **Land Application - Pollutant Metals Concentration**

The permittee shall enter the data on this form as soon as it is received. The permittee must meet the pollutant metals Ceiling Limits shown on the form to dispose of sludge by land application.

**LA-CPL**      **Land Application - Cumulative Pollutant Loading – NOT APPLICABLE FOR LAND APPLICATION SITES USED ONLY FOR A ONE TIME DESLUDGING ACTIVITY**

**LA-SHL**      **Land Application - Sludge Hauling Log**

Use is optional. The permittee may maintain any type of log which provides an accurate accounting of the date, time and amount of sludge being applied at each land application site.

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**FORM LA-SD**

**LAND APPLICATION - SITE DESCRIPTIONS**

**FACILITY:** \_\_\_\_\_ **CITY:** \_\_\_\_\_

**Provide a complete description of each land application site being used to dispose/re-use domestic sewage sludge as follows:**

**Name:** Provide name of owner of property and operator if different from owner.

**Legal:** Provide quarter section, section, township, range, county and state.

**Map:** Provide a Google or similar internet map showing the location of each site and the area on which sludge was applied.

**Other:** Provide directions from a town or other significant landmark which could be used by someone driving to the site.

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Site 1 Name: \_\_\_\_\_ Acres Used: \_\_\_\_\_

Legal Description: \_\_\_\_\_

Other Description: \_\_\_\_\_

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Site 2 Name: \_\_\_\_\_ Acres Used: \_\_\_\_\_

Legal Description: \_\_\_\_\_

Other Description: \_\_\_\_\_

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Site 3 Name: \_\_\_\_\_ Acres Used: \_\_\_\_\_

Legal Description: \_\_\_\_\_

Other Description: \_\_\_\_\_

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Site 4 Name: \_\_\_\_\_ Acres Used: \_\_\_\_\_

Legal Description: \_\_\_\_\_

Other Description: \_\_\_\_\_

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Site 5 Name: \_\_\_\_\_ Acres Used: \_\_\_\_\_

Legal Description: \_\_\_\_\_

Other Description: \_\_\_\_\_

**LAND APPLICATION - MANAGEMENT PRACTICES**

FACILITY: \_\_\_\_\_ CITY: \_\_\_\_\_

How are the land application management practice requirements met?

Site Identification:

Are the site identifications for this form the same as previously identified on the site description form?

\_\_\_ YES \_\_\_ NO If no, provide a correct site description form for each site and attach it to this form.

Indicate all sites on which sludge was applied during the year.

Site	All	1	2	3	4	5	6	7	8	9	10
No	___	___	___	___	___	___	___	___	___	___	___
Yes	___	___	___	___	___	___	___	___	___	___	___

1. Regulations provide that the land application of bulk sewage sludge must not cause adverse effects to a threatened or endangered species of plant, fish, or wildlife or their critical habitat. Was this criteria met?

Site	All	1	2	3	4	5	6	7	8	9	10
No	___	___	___	___	___	___	___	___	___	___	___
Yes	___	___	___	___	___	___	___	___	___	___	___

2. Was bulk sewage sludge land applied to flooded, frozen or snow-covered ground?

Site	All	1	2	3	4	5	6	7	8	9	10
No	___	___	___	___	___	___	___	___	___	___	___
Yes	___	___	___	___	___	___	___	___	___	___	___

If no to all sites, go to question 3.

If yes to any site, review the following and answer question 2A.

Bulk sewage sludge shall not be applied to a land application site that is flooded, frozen, or snow-covered such that the bulk sewage sludge enters a wetland or other waters of the United States.

2A. What measures were implemented to prevent bulk sewage sludge applied to a flooded, frozen, or snow-covered land application site from entering a wetland or other waters of the United States? From the choices A-G, provide the appropriate measures implemented for each site listed below.

MEASURES TAKEN

- A Application site is isolated from wetlands and waters of the United States.
- B Application site has less than 5% slope.
- C Application site has grass/crop residue cover.
- D Application site is terraced to prevent rapid runoff.
- E Application site is bermed to prevent runoff.
- F Application site has grass/tree filter strip at potential runoff points.
- G Other - Identify each site and provide description of measures taken.

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Site Number	1	2	3	4	5
Measures Taken	_____	_____	_____	_____	_____
Site Number	6	7	8	9	10
Measures Taken	_____	_____	_____	_____	_____

3. Was the bulk sewage sludge applied to a land application site kept at least 10 meters (32.8 feet) from waters of the United States?

Site	All	1	2	3	4	5	6	7	8	9	10
No	___	___	___	___	___	___	___	___	___	___	___
Yes	___	___	___	___	___	___	___	___	___	___	___

4. Was the sludge application rate equal to or less than the agronomic rate for the land application site?

Site	All	1	2	3	4	5	6	7	8	9	10
No	___	___	___	___	___	___	___	___	___	___	___
Yes	___	___	___	___	___	___	___	___	___	___	___

If yes to all sites, go to question 5.  
 If no to any site, go to question 4A.

4A. Were any of the sites, KDHE approved reclamation sites?

Site	All	1	2	3	4	5	6	7	8	9	10
No	___	___	___	___	___	___	___	___	___	___	___
Yes	___	___	___	___	___	___	___	___	___	___	___

If yes to any site, go to question 4B.  
 If no to all sites, go to question 5.

4B. What was the approved and actual loading rate in dry tons/acre for each reclamation site? Identify site and provide requested data.

Site Number	_____	_____	_____	_____
Approved Rate, tons/acre	_____	_____	_____	_____
Actual Rate, tons/acre	_____	_____	_____	_____
Site Number	_____	_____	_____	_____
Approved Rate, tons/acre	_____	_____	_____	_____
Actual Rate, tons/acre	_____	_____	_____	_____

5. If required, provide the calculations for the agronomic sludge application rate used at each site on the KDHE forms for the agronomic rate calculation - Form LA-ANR.

CERTIFICATION

I certify under penalty of law that the information as listed above is complete and accurate to the best of my knowledge. This determination has been made under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information used to determine the management practices have been met. I am aware that there are significant penalties for false certification, including the possibility of fine and imprisonment.

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Name and Official Title (type or print)

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Signature

Date Signed



**CLASS B PATHOGEN REDUCTION AND SITE RESTRICTIONS**

**By agreement between EPA Region 7 and KDHE, sludge from lagoons that have not been desludged for 15 years has been sufficiently treated to meet Class B pathogen requirements. Therefore, the Class B pathogen reduction portion of this form has been removed.**

**CLASS B SITE RESTRICTIONS**

Answer each question individually per site.

Site Identification:

Are the site identifications for this form the same as previously identified on the site description form?

YES  NO If no, provide a correct site description form for each site and attach it to this form.

Indicate all sites on which sludge was applied during the year.

Site	All	1	2	3	4	5	6	7	8	9	10
No	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Yes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

1. Sludge from lagoons is not allowed to be placed on land used for food crops without KDHE written approval. **(Food crops are human food normally eaten raw or with little processing such as tomatoes, potatoes, sweet corn.)**

2. Are animal feed (such as corn, milo, wheat, soybeans, grasses, hay, alfalfa, etc.) or fiber crops grown on the site receiving Class B sludge?

Site	All	1	2	3	4	5	6	7	8	9	10
No	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Yes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If no to all sites, go to question 4.

If yes to any site, read the following and answer question 3.

Feed crops and fiber crops shall not be harvested for 30 days after application of sewage sludge.

3A. Were harvest of feed and fiber crops prohibited for 30 days or more after the last sludge application?

Site	All	1	2	3	4	5	6	7	8	9	10
No	___	___	___	___	___	___	___	___	___	___	___
Yes	___	___	___	___	___	___	___	___	___	___	___

Go to question 4.

4. Are animals allowed to graze on the site receiving Class B sludge?

Site	All	1	2	3	4	5	6	7	8	9	10
No	___	___	___	___	___	___	___	___	___	___	___
Yes	___	___	___	___	___	___	___	___	___	___	___

If no to all sites, go to question 5.

If yes to any site, read the following and answer question 4A.

Animals shall not be allowed to graze on the land for 30 days after application of sewage sludge.

4A. Were animals prohibited from grazing on the land for 30 days after the last sludge application?

Site	All	1	2	3	4	5	6	7	8	9	10
No	___	___	___	___	___	___	___	___	___	___	___
Yes	___	___	___	___	___	___	___	___	___	___	___

Go to question 5.

5. Is turf grown on the site receiving Class B sludge?

Site	All	1	2	3	4	5	6	7	8	9	10
No	___	___	___	___	___	___	___	___	___	___	___
Yes	___	___	___	___	___	___	___	___	___	___	___

If no to all sites, go to question 6.

If yes to any site, read the following and answer question 5A.

Turf grown on land where sewage sludge is applied shall not be harvested for one year after application of the sewage sludge when the harvested turf is placed on either land with a high potential for public exposure or a lawn, unless otherwise specified by the permitting authority. A high potential for public exposure area is a private or public lawn, cemetery, ball field, playground, park, golf courses, etc.

5A. Was turf harvest prohibited for one year after the last sludge application date?

Site	All	1	2	3	4	5	6	7	8	9	10
No	___	___	___	___	___	___	___	___	___	___	___
Yes	___	___	___	___	___	___	___	___	___	___	___

Go to question 6.

6. Public access to land with a high potential for public exposure shall be restricted for one year after application of sewage sludge. (High potential means public parks, ball fields, cemeteries, school grounds and other areas where public access is readily available.)

Was this requirement met?

Site	All	1	2	3	4	5	6	7	8	9	10
No	___	___	___	___	___	___	___	___	___	___	___
Yes	___	___	___	___	___	___	___	___	___	___	___
N/A*	___	___	___	___	___	___	___	___	___	___	___

\* Not Applicable

Go to question 7.

7. Public access to land with a low potential for public exposure shall be restricted for 30 days after application of sewage sludge. (Low potential are private and public lands where public access is discouraged either by physical barriers (manmade or natural), trespassing laws or because of remoteness from population centers.)

Was this requirement met?

Site	All	1	2	3	4	5	6	7	8	9	10
No	___	___	___	___	___	___	___	___	___	___	___
Yes	___	___	___	___	___	___	___	___	___	___	___
N/A*	___	___	___	___	___	___	___	___	___	___	___

\* Not Applicable

Go to question 8.

8. Indicate the method of restricting public access.

CHECK ALL THAT APPLY.

- Informational Signs
  - Fenced
  - Rural Area / posted at entrances
  - Rural Remote
  - Other \_\_\_\_\_
- 

CERTIFICATION

I certify under penalty of law that the information as listed above is complete and accurate to the best of my knowledge. This determination has been made under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information used to determine the pathogen requirements and site restrictions have been met. I am aware that there are significant penalties for false certification, including the possibility of fine and imprisonment.

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Name and Official Title (type or print)

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Signature \_\_\_\_\_ Date Signed \_\_\_\_\_

## AGRONOMIC RATE CALCULATION FORMS

### SHORT FORM (DEFAULT) METHOD FORM LA.ANR/EZ

The short form option is used to determine the agronomic loading rate using the “default rate” method limiting application to a maximum of 2.0 dry tons of sludge per acre. The short form is best suited for permittees who do not wish to perform the calculations required by the long form, and who have a considerable amount of land available in relation to the amount of sludge that is land applied annually.

### LONG FORM METHOD FORM LA.ANR

The long form option should be used if the permittee desires to continue to calculate the maximum amount of sludge allowable per acre of land. The advantages of doing this are that it provides the maximum benefit to the farmer in terms of nutrients provided, and it utilizes the acreage available to the fullest extent possible. Many permittees will find that they can apply more gallons of sludge per acre by using the long calculation method than restricting themselves to the 2.0 dry tons per acre allowed with the short form.

**SHORT FORM**

**FORM LA-ANR/EZ  
CALCULATION WORKSHEET  
CALCULATING THE AGRONOMIC RATE FOR THE LAND APPLICATION OF SEWAGE SLUDGE  
DEFAULT RATE METHOD**

This Form LA-ANR-EZ may be substituted for Form LA-ANR, when the permittee desires to land apply sewage sludge at a default rate, without performing the lengthier agronomic rate calculations on form LA-ANR.

**PERMITTEES THAT DO NOT WISH TO CALCULATE THE AGRONOMIC NITROGEN RATE MAY INSTEAD CHOOSE TO LAND APPLY SLUDGE AT A RATE NOT TO EXCEED TWO (2) DRY TONS OF SLUDGE PER ACRE.**

For any site the permittee chooses to use the default rate, complete the following information instead of pages 20 through 25 (Form LA-ANR):

**CALCULATION OF DEFAULT LOADING RATE**

To determine the maximum default rate of 2.0 dry tons of sludge per acre, in terms of gallons per acre, use the following formula:

$$\text{Gallons/acre (liquid sludge)} = \frac{48,000}{\% \text{ solids in sludge}}$$

**CERTIFICATION**

I certify that to the best of my knowledge, the agronomic nitrogen loading rate was equal to or less than 2.0 tons of dry sludge per acre. This determination has been made under my direction or supervision in accordance with a system designed to assure that qualified personnel properly apply the sludge at or below the default limit of 2.0 tons per acre. I am aware that there are significant penalties for false certification, including the possibility of fine and imprisonment.

\_\_\_\_\_  
Name and Official Title (type or print)

Signature

Date Signed

## AGRONOMIC RATE CALCULATION FORMS

**USE OF THIS FORM IS REQUIRED ONLY IF THE PLANNED LAND APPLICATION RATE IS ABOVE 2.0 DRY TONS/ACRE.**

### LONG FORM METHOD FORM LA.ANR

The long form option should be used if the permittee desires to continue to calculate the maximum amount of sludge allowable per acre of land. The advantages of doing this are that it provides the maximum benefit to the farmer in terms of nutrients provided, and it utilizes the acreage available to the fullest extent possible. Many permittees will find that they can apply more gallons of sludge per acre by using the long calculation method than restricting themselves to the 2.0 dry tons per acre allowed with the short form.

## PROCEDURE FOR SOIL SAMPLING

### SOIL SAMPLING IS REQUIRED ONLY IF THE PLANNED LAND APPLICATION RATE IS ABOVE 2.0 DRY TONS/ACRE

A. Testing for available nitrogen (NO<sub>3</sub>), phosphorus (PO<sub>4</sub>), potassium (K<sub>2</sub>O) and pH. (required annually just prior to sludge application)

1. For uniform type soil,

Take at least ten - 6 inch\* deep core samples from each land application site and composite all cores from that site into one sample. From the same core holes, take a second sample (6 inch to 24 inch deep or as deep as you can go but not more than 24 inches) and composite these cores into one sample. Test the top core sample for nitrate-nitrogen, available phosphorus, exchangeable potassium and pH. Test the bottom core sample for nitrate-nitrogen.

2. For non-uniform soil type sites,

Divide the site into two or more areas with similar soil types in each area. Sample and test the soil from each area as noted in A.1 above keeping each composited sample separate.

\* If the sludge is injected into the soil, the top composited soil samples should be from cores the same depth as the sludge is injected plus 2 inches.



**CALCULATION WORKSHEET  
FOR CALCULATING THE AGRONOMIC RATE FOR THE LAND APPLICATION OF SEWAGE SLUDGE**

Site: \_\_\_\_\_ Facility: \_\_\_\_\_

**Procedure:** A procedure used to calculate the agronomic rate for application of sewage sludge at which the nitrogen supplied by the sludge and available to the plant does not exceed the requirement for nitrogen of the crop or vegetation. To calculate the agronomic rate, the available ammonium nitrogen ( $\text{NH}_4\text{!N}_{\text{avail}}$ ), nitrate nitrogen ( $\text{NO}_3\text{!N}_{\text{avail}}$ ), organic nitrogen ( $\text{Org!N}_{\text{avail}}$ ), must all be determined to calculate the total available nitrogen ( $\text{TN}_{\text{avail}}$ ) in the sludge. The nitrogen needed ( $\text{N}_{\text{needed}}$ ) by the crop is calculated basis the crop selected, expected yield, soil type, previous crop residual and nitrate nitrogen retained in the soil. Then the amount of nitrogen needed by the plant ( $\text{N}_{\text{needed}}$ ) is divided by the total nitrogen available ( $\text{TN}_{\text{avail}}$ ) to find the annual loading rate.

**Step 1: From analysis of the sewage sludge to be land applied, determine the amount of each nitrogen compound, based on dry weight, in pounds per ton (Lb/ton).**

Nitrogen Compound	Concentration of Nitrogen Compounds (mg/kg)	x.002 =	Current Amount of Nitrogen in Sludge (Lb/dry ton of sludge)
Total Kjeldahl Nitrogen (TKN!N)	_____	=	_____ Lb/ton TKN!N
Ammonium Nitrogen ( $\text{NH}_4\text{!N}$ )	_____	=	_____ Lb/ton $\text{NH}_4\text{!N}$
Nitrate Nitrogen ( $\text{NO}_3\text{!N}$ )	_____	=	_____ Lb/ton $\text{NO}_3\text{!N}$
Organic Nitrogen (ORG!N)	TKN!N - $\text{NH}_4\text{!N}$	=	_____ Lb/ton Org!N
Total Phosphorus (sludge) = _____ mg/kg or ppm			

**Step 2: Calculate the amount of ammonium-nitrogen available in the sewage sludge to be applied.** Assume that the available fraction ( $K_v$ ) is dependent upon operations at the site (see Table 1). Use the following equation:

$$\text{NH}_4\text{!N}_{\text{available}} = \text{NH}_4\text{!N} \times K_v$$

Where,

$\text{NH}_4\text{!N}$  is the amount of ammonium nitrogen in the sewage sludge to be land applied, Lb/ton.

$K_v$  is a volatilization factor for determining the availability of ammonium nitrogen based on how the sewage sludge is applied (see Table 1).

$$\text{NH}_4\text{!N}_{\text{available}} = \frac{\text{_____ Lb/ton}}{\text{From Step 1}} \times \frac{\text{_____}}{K_v} = \text{_____ Lb/ton}$$

Table 1. Factors for  $K_v$

If Sewage Sludge Is:	Factor $K_v$ Is:
Liquid and Surface Applied	.25
Liquid and Incorporated into the Soil	1.0
Dewatered and Applied in any Manner	1.0

**CALCULATION WORKSHEET**

**FOR CALCULATING THE AGRONOMIC RATE FOR THE LAND APPLICATION OF SEWAGE SLUDGE (Continued)**

**Step 3:** Calculate the amount of organic nitrogen available in the sewage sludge to be applied. The factor F, used for determining the amount of Org!N present due to mineralization, is provided below in Table 2. The value of F is dependent upon how the sludge is treated (i.e., aerobic digestion, composted, etc.).

**Step 3A: Current Available Organic Nitrogen, Current Org!N<sub>available</sub>.** Current available organic nitrogen from this year's sludge is determined by the following equation:

$$\text{Current Org!N}_{\text{available}} = \text{Org!N (from Step 1)} \times F$$

Where,

Current Org!N<sub>available</sub>=the nitrogen which will be available this year from this year's sludge.

Org!N=the organic nitrogen in the sewage sludge to be land applied, Lb/ton

F=is the mineralization rate from Table 2

$$\text{Current Org!N}_{\text{available}} = \frac{\text{Lb/ton}}{\text{From Step 1}} \times \frac{\text{Lb/ton}}{F} = \text{Lb/ton}$$

**Table 2. F Values**

Time After Sludge Application (Year)	Stabilized Primary and Waste Activated Sewage Sludges, Fraction of Org!N	Aerobically Digested Sewage Sludge, Fraction of Org!N	Anaerobically Digested Sewage Sludge Fraction of Org!N	Composted Sewage Sludge, Fraction of Org!N
0-1	0.40	0.30	0.20	0.10

**Step 4:**Total available nitrogen in the sludge is then determined by adding together the resulting totals from Steps 2 and 3 to the amount of NO<sub>3</sub>!N in Step 1 (Assuming 100% of NO<sub>3</sub>!N is available). The result is the following equation:

$$\text{Total Nitrogen Available (TN}_{\text{avail}}) = \text{NO}_3!N + \text{NH}_4!N_{\text{avail}} + \text{Current Org!N}_{\text{avail}}$$

$$\text{TN}_{\text{avail}} = \frac{\text{Lb/ton}}{\text{Step 1/NO}_3!N} + \frac{\text{Lb/ton}}{\text{Step 2/NH}_4!N_{\text{avail}}} + \frac{\text{Lb/ton}}{\text{Step 3/Current Org!N}_{\text{avail}}}$$

TN<sub>avail</sub> = \_\_\_\_\_ Lb/ton of dry sludge. This is the total available nitrogen in the sewage sludge and is used as the denominator in the equation in Step 8.

**CALCULATION WORKSHEET  
FOR CALCULATING THE AGRONOMIC RATE FOR THE LAND APPLICATION OF SEWAGE SLUDGE (Continued)**

**Step 5: Nitrogen Credits.** The available nitrogen credits from previous legume crops and existing residuals must be determined.

**Step 5A: Previous Legume Crop,  $N_{\text{previous crop}}$ .** If the crop for the previous year was a legume and was plowed under, there will be a previous crop nitrogen credit in the soil. Select the appropriate nitrogen credit based upon the data shown in Table 3.

$N_{\text{previous crop}} =$  \_\_\_\_\_ Lbs/Acre

<b>Table 3. Nitrogen Credits from Legumes in Rotations</b>	
<u>Legume Crop</u>	<u>Nitrogen Credit</u>
Alfalfa (1st year after)	
>80% stand	100-140 lbs/acre
60-80% stand	60-100 lbs/acre
<60% stand	0-60 lbs/acre
Alfalfa (2nd year after)	Half of 1st year credit
Sweet Clover	100-120 lbs/acre
Red Clover	40-80 lbs/acre
Soybeans*	30-60 lbs/acre
*(Allow 1 pound of N credit per bushel of yield. No credit for wheat double-cropped after soybean harvest.)	

**Step 5B: Existing Nitrate Content of Soil,  $N_{\text{residual}}$ .** The nitrogen credit for the existing nitrate level in the soil can be accounted for by using the soil test nitrate results in the following equations. (See soil testing procedures for soil sampling methods.)

(Use the data for the top (nominal 6 inch) soil composite sample.)

Depth of Sample= \_\_\_\_\_ inches

$\text{NO}_3 \text{! } N_{\text{soil}} =$  \_\_\_\_\_ mg/kg (or ppm)

$N_{\text{residual}} = \text{NO}_3 \text{! } N_{\text{soil}} \times \text{Density of Soil}^*$

$N_{\text{residual}} = \text{NO}_3 \text{! } N_{\text{soil}, \text{ mg/kg}} \times ( \underline{0.3 \text{ Lb}} \times \text{depth of sample, inches} )$   
acre-inch

$N_{\text{residual}} =$  \_\_\_\_\_  $\times .3 \times$  \_\_\_\_\_  
 $\text{NO}_3 \text{! } N_{\text{soil}} \text{depth of sample}$

$N_{\text{residual}} =$  \_\_\_\_\_ Lbs/Acre

\*300,000 Lb/acre-inch

**CALCULATION WORKSHEET**  
**FOR CALCULATING THE AGRONOMIC RATE FOR THE LAND APPLICATION OF SEWAGE SLUDGE (Continued)**

**Step 5C: Previous Sludge, Available Organic Nitrogen, Previous Org! N<sub>available</sub>.** Because the mineralization of organic nitrogen in sludge occurs over a long time, there will be a nitrogen credit for mineralization of previously applied sludge. This nitrogen credit is 0.5 of the previous year's calculated total available organic nitrogen.

A. Find the previous year's current organic nitrogen (Current Org! N<sub>available</sub> from Step 3 on last year's form).

Divide the previous year's sludge loading rate for this site in tons/acre. The previous year's Sludge Loading rate is calculated at:

Step 8 (last year) X gallons/acre actually applied last year

Step 9 (last year)

( \_\_\_\_\_ ) X  
 ( \_\_\_\_\_ )

Previous Year's Sludge Loading Rate = \_\_\_\_\_ tons dry sludge/acre

Previous Org! N<sub>available</sub> = 0.5 X Previous year's Current Org! N<sub>available</sub> X Previous Year's Sludge Loading Rate

Previous Org! N<sub>available</sub> = 0.5 X \_\_\_\_\_ Lb/ton X \_\_\_\_\_ tons/acre  
 tons/acre Step 3 (last year) previous year's sludge loading rate

Previous Org! N<sub>available</sub> = \_\_\_\_\_ Lb/acre

**Step 5D: Total Nitrogen Credits Summary**

Total Nitrogen Credits = Previous Crop Credit + Existing Nitrate Content of Soil +  
 Previous Organic Nitrogen

Total N<sub>credits</sub> = N<sub>previous crop</sub> + N<sub>residual</sub> + Previous Org. N<sub>available</sub>

Total N<sub>credits</sub> = \_\_\_\_\_ + \_\_\_\_\_ + \_\_\_\_\_ Lb/acre

Step 5A Step 5B Step 5C

Total N<sub>credits</sub> = \_\_\_\_\_ Lb/acre (Use this value in Step 7)

**CALCULATION WORKSHEET  
FOR CALCULATING THE AGRONOMIC RATE FOR THE LAND APPLICATION OF SEWAGE SLUDGE**

Step 6: **Crop Nitrogen requirement,  $N_{crop}$ .** Determine the crop nitrogen requirement. The equation is:

From Table 4, select the crop to be grown and its factor. From Table 5, select the soil factor.

Table 4.	
CROP	CROP FACTOR
Wheat	1.75 lbs N/bushel
Corn	1.35 lbs N/bushel
Oats	1.15 lbs N/bushel
Grain Sorghum/Milo	1.35 lbs N/bushel
Barley	1.50 lbs N/bushel
Soybeans	5.4 lbs N/bushel
Alfalfa	56 lbs N/ton
Orchard Grass	50 lbs N/ton
Brome Grass	33 lbs N/ton
Sunflowers	50 lbs N/1000 lbs seed
Tall Fescue	39 lbs N/ton
Forage Sorghum	9 lbs N/ton

Table 5. Soil Factor	
Type Soil	Factor
Sandy	1.1
All Other	1.0

Selected Crop is: \_\_\_\_\_

Crop Factor is: \_\_\_\_\_

Estimated Yield is: \_\_\_\_\_

Crop Nitrogen Requirement is:

$$N_{crop} = \text{Crop Factor} \times \text{Yield} \times \text{Soil Factor} = \text{_____} \times \text{_____} \times \text{_____} = \text{_____} \text{ Lb/acre}$$

crop factor          yield          soil factor

**Step 7: Nitrogen Needed,  $N_{needed}$ .** Based upon the previous calculations from Steps 5 and 6, the net amount of nitrogen needed for the land application site can be calculated from these equations:

$$N_{needed} = \text{Crop Nitrogen Requirement} - \text{Nitrogen Credits}$$

$$N_{needed} = N_{crop} - \text{Total } N_{credits}$$

$$N_{needed} = \text{_____} - \text{_____} = \text{_____} \text{ Lb/acre}$$

Step 6( $N_{crop}$ )          Step 5D(Total  $N_{credits}$ )

**Step 8: Determine the agronomic loading rate (ALR) for the sewage sludge.** This is determined by dividing the nitrogen needed by the plants ( $N_{needed}$ ) (from Step 7) by the total nitrogen available ( $TN_{avail}$ ) (from Step 4) in the following equation:

$$\text{ALR (ton/acre)} = \frac{\text{Nitrogen needed by crops or vegetation } (N_{needed}), \text{ Lb/acre}}{\text{Total Nitrogen Available } (TN_{avail}), \text{ Lb/ton}} = \frac{N_{needed}}{TN_{avail}} = \text{_____} \text{ ton/acre}$$

$$\text{ALR (ton/acre)} = \text{_____}$$

$$\text{Approved Loading Rate, APLR} = 1.2 \times \text{ALR} = 1.2 \times \text{_____} = \text{_____} \text{ tons dry sludge/acre}$$

ALR

**CALCULATION WORKSHEET  
FOR CALCULATING THE AGRONOMIC RATE FOR THE LAND APPLICATION OF SEWAGE SLUDGE**

**Step 9: To change tons of dry sludge/acre:**

A. For liquid application to gallons/acre:

$$\text{Approved Loading Rate (APLR)} = \frac{\text{Step 8}}{\text{acre}} \times \frac{(\text{tons dry sludge})}{\text{acre}} \times \frac{100}{\% \text{ Solids}} \times \frac{2000}{8.33}$$

Therefore,

$$\text{APLR} = \frac{\text{Step 8}}{\text{acre}} \times \frac{(\text{24009})}{(\% \text{ solids})} = \frac{\text{gallons}}{\text{acre}}$$

Before "dry" application to cubic feet/acre or cubic yards/acre:

$$\text{APLR} = \frac{\text{tons dry sludge}}{\text{acre}} \times \frac{2000 \text{ lb}}{\text{ton}} \times \frac{(\text{*})\text{Ft}^3}{\text{LB}} \times \frac{100}{\% \text{ Solids}} = \frac{\text{cubic feet}}{\text{acre}}$$

or,

$$\text{APLR} = \frac{\text{Ft}^3}{\text{acre}} \times \frac{1 \text{ yd}^3}{27 \text{ Ft}^3} = \frac{\text{cubic yards}}{\text{acre}}$$

\*Use  $\frac{1 \text{ Ft}^3}{60 \text{ Lb}}$  for sandbed dried or similar moisture content sludge.

**Step 10: From the soil analysis record the following parameters:**

0 - 6" depth sample

6 - 24" depth (profile) sample

Available

Phosphorus \_\_\_\_\_ ppm

Nitrate: \_\_\_\_\_ ppm

Exchangeable

Potassium: \_\_\_\_\_ ppm

pH: \_\_\_\_\_

Kansas State University, Cooperative Extension Service, Agronomy Program, currently recommends that pH be maintained between 6.5 and 7.0 for most field crops. Also, available phosphorus content of the soil should not be allowed to exceed 100 ppm to achieve maximum crop production. If high phosphorus contents are encountered, the disposal of sludge should be temporarily discontinued and an agronomist contacted to determine appropriate actions to be taken.

**LAND APPLICATION  
POLLUTANT METALS CONCENTRATIONS**

FACILITY NAME:			NPDES PERMIT NO:			YEAR:	
Pollutant	Ceiling Concentration	Time Period From: To:	Time Period From: To:	Time Period From: To:	Time Period From: To:	Time Period From: To:	Time Period From: To:
	mg/kg dry basis	Concentration in Sewage Sludge, mg/kg dry basis	Concentration in Sewage Sludge, mg/kg dry basis	Concentration in Sewage Sludge, mg/kg dry basis	Concentration in Sewage Sludge, mg/kg dry basis	Concentration in Sewage Sludge, mg/kg dry basis	Concentration in Sewage Sludge, mg/kg dry basis
% Solids							
Arsenic	75						
Cadmium	85						
Copper	4,300						
Lead	840						
Mercury	57						
Molybdenum	75						
Nickel	420						
Selenium	100						
Zinc	7,500						

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### SLUDGE HAULING LOG

DATE	TIME	SITE									
		1	2	3	4	5	6	7	8	9	10

FORM LA-SHL

REV. 6/93