40 CFR 503

DOMESTIC SEWAGE SLUDGE RE-USE AND DISPOSAL REGULATIONS

_____

YEAR

Land Application Forms for Kansas Domestic Wastewater Treatment Facilities

_____

CITY

Rev. 4/01

LAND APPLICATION - SPECIFIC INFORMATION AND INSTRUCTIONS

This packet contains the following forms:

FORM	DESCRIPTION

LA-SD **Land Application - Site Descriptions**

40 CFR 503 regulations require the sludge applier to notify the regulatory agency of site locations where domestic sludge is being land applied prior to sludge application at the site. The permittee should complete this form showing all new sites the permittee will be applying sludge to for the year. The permittee must make a copy of the LA-SD form and send the copy to KDHE. A second (updated if necessary) site description submittal is to be submitted to KDHE as part of the annual sludge report due February 28 of each year. The permittee must notify KDHE of new land application sites by adding the information to this form and sending a copy to KDHE prior to sludge application. If all the sites being used this year were identified to KDHE in previous years, no additional notification is required.

LA-MP **Land Application - Management Practices**

The permittee should review this form to assure the facility remains in compliance with the requirements. Up to 10 sites can be reported on this form. The form is to be completed at the end of the calendar year and submitted to KDHE as part of the annual sludge report due February 28 of each year.

LA-PR **Land Application - Class B Pathogen Reduction and Site Restrictions**

The permittee should review this form to assure the facility remains in compliance with the requirements. Up to 10 sites can be reported on this form. The form is to be completed at the end of the calendar year and submitted to KDHE as part of the annual sludge report due February 28 of each year.

LA-VAR **Land Application - Vector Attraction Reduction**

The permittee should review this form to assure the facility remains in compliance with the requirements. Up to 10 sites can be reported on this form. The form is to be completed at the end of the calendar year and submitted to KDHE as part of the annual sludge report due February 28 of each year.

LA-ANR Land Application - Agronomic Nitrogen Rate

The permittee should review 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. The completed forms are to be submitted to KDHE as part of the annual sludge report due February 28 of each year.

LA-PMC Land Application - Pollutant Metals Concentration

The permittee should enter the data on this form as soon as it is received. For those facilities required to test only once per year, testing should be performed late in the year (when the sludge is being land applied) and those results used during the next year's land application season. The permittee must meet the pollutant metals Ceiling Limits shown on the form to continue disposal by land application. The form is to be submitted to KDHE as part of the annual sludge report due February 28 of each year.

LA-CPL Land Application - Cumulative Pollutant Loading

The pollutant cumulative loading rate is to be calculated at the end of each testing period for those facilities who test more often than once per year or at the end of each calendar year for those facilities who test only once per year. One form is to be completed for each site. The completed forms are to be submitted to KDHE as part of the annual sludge report due February 28 of each year.

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 site. This information along with the pollutant metals concentration data (Form LA-PMC) will be used to calculate the cumulative pollutant loading rate (Form LA-CPL). The information on the sludge hauling log is not sent to the regulatory agency but must be made available upon request.

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 USGS map (7.5 minute) showing the location of each site.**

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

Site 1	Name:	_____	Acres:_____
	Legal Description:	_____	
	Other Description:	_____	
Site 2	Name:	_____	Acres:_____
	Legal Description:	_____	
	Other Description:	_____	
Site 3	Name:	_____	Acres:_____
	Legal Description:	_____	
	Other Description:	_____	
Site 4	Name:	_____	Acres:_____
	Legal Description:	_____	
	Other Description:	_____	

Site 5	Name:		Acres:
	Legal Description:		
	Other Description:		
Site 6	Name:		Acres:
	Legal Description:		
	Other Description:		
Site 7	Name:		Acres:
	Legal Description:		
	Other Description:		
Site 8	Name:		Acres:
	Legal Description:		
	Other Description:		
Site 9	Name:		Acres:
	Legal Description:		
	Other Description:		
Site 10	Name:		Acres:
	Legal Description:		
	Other Description:		

FORM LA-MP

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 so 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.

_____

_____

_____

_____

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 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 statement 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 statement 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. 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.

_____

Name and Official Title (type or print)

_____

Signature Date Signed

REV. 4/01

CLASS B PATHOGEN REDUCTION AND SITE RESTRICTIONS

How were the class B pathogen reduction and site restriction 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.

CHECK ALL THAT APPLY:

1. ___ The geometric mean of the density of fecal coliform in the samples is less than 2,000,000 Most Probable Number/Colony Forming Units per gram of total solids (dry weight basis).

   Fecal Coliform geometric mean was _____ MPN/CFU per dry gram total solids for the reporting period.

   Go to Question 4.

2. ___ A Process to Significantly Reduce Pathogens was used to meet Class B pathogen reduction.

   CHECK ALL PROCESSES TO SIGNIFICANTLY REDUCE PATHOGENS (PSRP) USED TO MEET THE CLASS B PATHOGEN REDUCTION REQUIREMENT.

   ___ Aerobic digestion

   Aerobic conditions were maintained for a mean cell residence time and temperature between 40 days at 20 C (68 F) or 60 days at 15 C (59 F).

   ___ Air drying

   Sewage sludge was dried on sand beds or on paved basins. The sewage sludge dried for a minimum of three months. During two of the three months, the ambient average daily temperature was above 0 C (32 F).

   ___ Anaerobic digestion

   Sewage sludge was treated in the absence of air for a specific mean residence time and temperature between 15 days at 35 to 55 C (95 to 131 F) or 60 days at 20 C (68 F).

   ___ Composting

   Using either the within-vessel, static aerated pile, or windrow composting methods, the temperature of the sewage sludge was raised to 40 C (104 F) or higher and remained at 40 C (104 F) or higher for five days. For four hours during the five days, the temperature in the compost pile exceeded 55 C (131 F).

___ Lime stabilization

Sufficient lime was added to the sewage sludge to raise the pH of the sewage sludge to 12 after two hours of contact.

3. ___ An Equivalent Process to Significantly Reduce Pathogens was used to meet Class B pathogen reduction.

___ EPA Equivalency Statement is included.

___ EPA Equivalency Statement was provided previously.

CLASS B SITE RESTRICTIONS

Answer each question individually per site.

4. Are food crops grown on the site receiving Class B sludge?
(Food crops are human food normally eaten raw or with little processing.)

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

If no to all sites, go to question 6.

Yes	___	___	___	___	___	___	___	___	___	___	___

If yes to any site, go to question 4A.

4A. Do harvested parts above the surface of the land touch the soil/sludge mixture?

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

If no to all sites, go to question 4C.
If yes to any site, read the following and answer question 4B.

Food crops with harvested parts that touch the sewage sludge/soil mixture and are totally above the land surface shall not be harvested for 14 months after application of sewage sludge.

4B. Is food harvest prohibited for 14 months or more after the last sludge application?

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

4C. Are harvested parts below the surface of the land?

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 4D.

Food crops with harvested parts below the surface of the land shall not be harvested for 20 months after application of sewage sludge when the sewage sludge remains on the land surface for four months or longer prior to incorporation into the soil.

4D. Does the sewage sludge remain on the land surface for four months or longer prior to incorporation into the soil?

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

If no to all sites, go to question 4F.
If yes to any site, answer question 4E.

4E. Is food harvest prohibited for 20 months or more after the last sludge application?

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

Go to question 5.

4F. Food crops with harvested parts below the surface of the land shall not be harvested for 38 months after application of sewage sludge when the sewage sludge remains on the land surface for less than four months prior to incorporation into the soil.

Is food harvest prohibited for 38 months or more after the last sludge application?

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

Go to question 5.

5. Food crops shall not be harvested for 30 days after application of sewage sludge.

Is all food crop harvesting 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 6.

6. 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	___	___	___	___	___	___	___	___	___	___	___
Yes	___	___	___	___	___	___	___	___	___	___	___

If no to all sites, go to question 7.
If yes to any site, read the following and answer question 6A.

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

6A. Are 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 7.

7. 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 8.
If yes to any site, read the following and answer question 7A.

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

7A. Are 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 8.

8. 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 9.
If yes to any site, read the following and answer question 8A.

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.

8A. 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 9.

9. Public access to land with a high potential for public exposure shall be restricted for one year after application of sewage sludge.

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 10.

10. Public access to land with a low potential for public exposure shall be restricted for 30 days after application of sewage sludge.

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 11.

11. 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.

_____
Name and Official Title (type or print)

_____
Signature Date Signed

LAND APPLICATION - VECTOR ATTRACTION REDUCTION

FACILITY:_____ CITY:_____

How were the vector attraction reduction 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.

CHECK ALL THAT APPLY.

NOTE: ONLY ONE OF VECTOR ATTRACTION REDUCTION REQUIREMENTS MUST BE MET.

1. ___ The mass of volatile solids in the sewage sludge was reduced by a minimum of 38 percent.

   $$\text{Volatile Solids Reduction} = \frac{\text{VS in - VS out}}{\text{VS in - (VS in X VS out)}} \times 100$$

   Volatile Solids Reduction = _____ %

   VS in and VS out in decimal, eg. 50% = 0.50

2. ___ When the 38 percent volatile solids reduction requirement could not be met for an anaerobically digested sewage sludge, vector attraction reduction was demonstrated by digesting a portion of the previously digested sewage sludge anaerobically in the laboratory in a bench-scale unit for 40 additional days at a temperature between 30 and 37 C (90 to 99 F). At the end of the 40 days, the volatile solids in the sewage sludge at the beginning of that period was reduced by less than 17 percent.

   Volatile Solids Reduction = _____ %

3. ___ When the 38 percent volatile solids reduction requirement could not be met for an aerobically digested sewage sludge, vector attraction reduction was demonstrated by digesting a portion of the previously digested sewage sludge that has a percent solids of two percent or less aerobically in the laboratory in a bench-scale unit for 30 additional days at 20 C (68 F). At the end of the 30 days, the volatile solids in the sewage sludge at the beginning of that period was reduced by less than 15 percent.

   Volatile Solids Reduction = _____ %

4. ___ The specific oxygen uptake rate (SOUR) for sewage sludge treated in an aerobic process was equal to or less than 1.5 milligrams of oxygen per hour per gram of total solids (dry weight basis) at a temperature of 20 C (68 F).

Specific Oxygen Uptake Rate = _____ mg/hr/gram

5. ___ Sewage sludge was treated in an aerobic process for 14 days or longer. During that time, the temperature of the sewage sludge was higher than 40 C (104 F) and the average temperature of the sewage sludge was higher than 45 C (113 F).

6. ___ The pH of sewage sludge was raised to 12 or higher by alkali addition and, without the addition of more alkali, remained at 12 or higher for two hours and then at 11.5 or higher for an additional 22 hours.

Indicate the individual sites that receive alkali/lime treated sludge.

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

7. ___ The percent solids of sewage sludge that does not contain unstabilized solids generated in a primary wastewater treatment process was equal to or greater than 75 percent based on the moisture content and total solids prior to mixing with other materials.

8. ___ The percent solids of sewage sludge that contains unstabilized solids generated in a primary wastewater treatment process was equal to or greater than 90 percent based on the moisture content and total solids prior to mixing with other materials.

9. ___ Sewage sludge was injected below the surface of the land.
No significant amount of the sewage sludge was present on the land surface within one hour after the sewage sludge was injected.

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

10. ___ Sewage sludge applied to the land surface was incorporated into the soil within six hours after application to the land.

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

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 that the vector attraction reduction requirements have been met. 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

PROCEDURE FOR SOIL SAMPLING

A. Testing for available nitrogen (NO3), phosphorus (PO4), potassium (K20) 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 no 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 types,

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.**

REV. 1/95

AGRONOMIC RATE CALCULATION FORMS

LONG FORM METHOD
FORM LA.ANR
PAGES 20-25

SHORT FORM (DEFAULT) METHOD
FORM LA.ANR/EZ
PAGE 25A

NOTE: ONE OF THE TWO ABOVE METHODS MUST BE UTILIZED TO CALCULATE THE AGRONOMIC LOADING RATE.

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. Soil tests must be performed and the results indicated on the form. The nutrients in the sludge do not need to be tested, although all other applicable 503 tests must continue to be performed. 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.

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.

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 (NH_4●N_{avail}), nitrate nitrogen (NO_3●N_{avail}), organic nitrogen (Org●N_{avail}), must all be determined to calculate the total available nitrogen (TN_{avail}) in the sludge. The nitrogen needed (N_{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 (N_{needed}) is divided by the total nitrogen available (TN_{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)			Current Amount of Nitrogen in Sludge (Lb/dry ton of sludge)
Total Kjeldahl Nitrogen (TKN●N)	_____	x.002	=	_____Lb/ton TKN●N
Ammonium Nitrogen (NH_4●N)	_____	x.002	=	_____Lb/ton NH_4●N
Nitrate Nitrogen (NO_3●N)	_____	x.002	=	_____Lb/ton NO_3●N
Organic Nitrogen (ORG●N)	TKN●N - NH_4●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:

$$NH_4\bullet N_{available} = NH_4\bullet N \times K_v$$

Where,

NH_4●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).

$NH_4\bullet N_{available}$ = _____ Lb/ton (From Step 1) X _____ (K_v) = _____ 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●$N_{available}$. Current available organic nitrogen from this year's sludge is determined by the following equation:

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

Where,

Current Org●$N_{available}$=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

Current Org●$N_{available}$ = _____ Lb/ton X _____ = _____ Lb/ton
From Step 1 F

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_3●N in Step 1 (Assuming 100% of NO_3●N is available). The result is the following equation:

Total Nitrogen Available (TN_{avail}) = NO_3●N + NH_4●N_{avail} + Current Org●N_{avail}

TN_{avail} = _____ Lb/ton + _____ Lb/ton + _____ Lb/ton
Step 1/NO_3●N Step 2/NH_4●N_{avail} Step 3/Current Org●N_{avail}

TN_{avail} = _____ 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, $N_{previous\ crop}$. 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.

$N_{previous\ crop}$ = _____ Lbs/Acre

Table 3. Nitrogen Credits from Legumes in Rotations

Legume Crop	Nitrogen Credit
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, $N_{residual}$. 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

$NO_3 \bullet N_{soil}$=_____ mg/kg (or ppm)

$N_{residual}=NO_3 \bullet N_{soil}$ X Density of Soil*

$N_{residual}=NO_3 \bullet N_{soil}$, mg/kg X $\left(\frac{0.3\ Lb}{\text{acre-inch}}\right.$ X depth of sample, inches$\left.\right)$

$N_{residual}$=_____ X .3 X _____
$NO_3 \bullet N_{soil}$ depth of sample

$N_{residual}$=_____ 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●$N_{available}$. 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●$N_{available}$ from Step 3 on last year's form).

B.Find 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

C.Previous Org●$N_{available}$= 0.5 X Previous year's Current Org●$N_{available}$ X Previous Year's Sludge Loading Rate

Previous Org●$N_{available}$= 0.5 X _____ Lb/ton X -_____ tons/acre
tons/acre Step 3 (last year) previous year's sludge loading rate

Previous Org●$N_{available}$= _____ Lb/acre

Step 5D: Total Nitrogen Credits Summary

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

Total $N_{credits}$= $N_{previous\ crop}$ + $N_{residual}$ + Previous Org. $N_{available}$

Total $N_{credits}$= _____ + _____ + _____ Lb/acre
Step 5AStep 5BStep 5C

Total $N_{credits}$= _____ 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} = Crop Factor X Yield X Soil Factor = _____ X _____ X _____ = _____ 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}= Crop Nitrogen Requirement - Nitrogen Credits

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

N_{needed}= _____ - _____ = _____ 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:

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

ALR (ton/acre)= _____

Approved Loading Rate, APLR = 1.2 X ALR = 1.2 X _____ / ALR = _____ tons dry sludge/acre

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:

Approved Loading Rate (APLR) = _____ (tons dry sludge/acre) X (100/% Solids) X (2000/8.33)
Step 8

Therefore,

APLR = _____ tons/acre X (24009/(% solids)) = _____ gallons/acre

B.For "dry" application to cubic feet/acre or cubic yards/acre:

APLR= _____ tons dry sludge/acre X 2000 lb/ton X (*)Ft^3/LB X (100/% Solids) = cubic feet/acre

or,

APLR= _____ FT^3/acre X (1 yd^3/27 Ft^3) = _____ cubic yards/acre

*Use 1 FT^3/60 Lb for sandbed dried or similar moisture content sludge.

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

0 - 6" depth sample

Available
Phosphorus _____ ppm

Exchangeable
Potassium:_____ ppm

pH:_____

6 - 24" depth (profile) sample

Nitrate:_____ppm

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.

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 (pages 20-25), 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.

Permittees that wish to apply sludge to a site at the maximum rate allowable must instead continue to determine the agronomic rate using Form LA-ANR.

Permittees that choose to apply at the default rate of two tons dry sludge per acre or less no longer need to test the sludge for nutrients, but still must perform annual soil testing on each site used for sludge application during the reporting year. The requirements for soil testing will be the same for both methods, as outlined on page 19; PROCEDURE FOR SOIL SAMPLING.

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

SITE ID: _____

From the soil analysis, record the following parameters:

0 - 6" depth sample	6 - 24" depth sample
Nitrate Nitrogen _____ ppm	Nitrate Nitrogen _____ppm

Available Phosphorus _____ ppm

Exchangeable Potassium _____ ppm

pH _____

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**

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						

Form LA-PMC
Rev. 1/96

CALCULATION WORKSHEET

FOR TRACKING THE CUMULATIVE POLLUTANT LOADING RATES ON LAND APPLICATION SITES

1. Site Name & Location:	2. Application Time Period:	3. Amount of Sludge Applied:
Facility: _____	From: _____	4. Acres on Which Sludge Applied:
	Through:	

Pollutant	Maximum Cumulative Pollutant Loading Rates, CPLR, Lb/acre	CALCULATION FOR DETERMINING CUMULATIVE LOADING				
	100%	COLUMN 1 Concentration in Sewage Sludge	COLUMN 2 Amount of Sludge Applied/Acre	COLUMN 3 Conversion Factor CF*	COLUMN 4 Amount Applied in Past, Lb/acre	COLUMN 5 Total Amount Applied to Date, Lb/acre
Arsenic	36	_____ X	_____ X	CF +	_____ =	_____
Cadmium	34	_____ X	_____ X	CF +	_____ =	_____
Copper	1,320	_____ X	_____ X	CF +	_____ =	_____
Lead	264	_____ X	_____ X	CF +	_____ =	_____
Mercury	15	_____ X	_____ X	CF +	_____ =	_____
Molybdenum	16	_____ X	_____ X	CF +	_____ =	_____
Nickel	370	_____ X	_____ X	CF +	_____ =	_____
Selenium	88	_____ X	_____ X	CF +	_____ =	_____
Zinc	2,464	_____ X	_____ X	CF +	_____ =	_____

*See Conversation Factors on Next Page

(Rev. 5/94)

Form LA-CPL

LAND APPLICATION

CUMULATIVE LOADING RATE CALCULATION

CONVERSION FACTORS, CF

Although EPA 40 CFR Part 503 regulations provide limits on a dry sludge basis, it will generally be easier for most facilities to calculate cumulative loading rates on a wet (as-sampled/as-received) basis. If the laboratory has supplied the pollutant metals concentration data on a dry basis, the facility can convert the concentrations to a wet basis as follows:

$$\_\_\_\_\_ \text{ mg/kg (dry)} \times \frac{\text{\% total solids}}{100} = \_\_\_\_\_ \text{ mg/kg (wet)}$$

Then calculate the cumulative loading rate using the information provided below:

If the pollutant metals concentration units in Column 1 are	and amount of sludge applied is in units of	to obtain lbs/acre, the conversion factor, CF is
mg/l or mg/kg (wet)	gallons/acre	8.33×10^{-6} or 0.00000833
mg/kg (wet)	lbs/acre (wet)	1×10^{-6} or 0.000001

Rev. 6/93

SLUDGE HAULING LOG

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

FORM LA-SHL

REV. 6/93