



Energy and Environment | **Cabinet**

**DEPARTMENT FOR ENVIRONMENTAL PROTECTION
DIVISION OF WASTE MANAGEMENT**
300 Sower Boulevard, Second Floor
FRANKFORT, KENTUCKY 40601

ANNUAL LANDFARMING REVIEW
DEP 7048 (November 2016)

GENERAL INSTRUCTIONS

SUBMISSIONS

Complete all required information at the top of each log sheet.

Application records will be inspected by the Division of Waste Management's Regional Office Personnel during landfarming field inspections.

COVER LETTER

Annual Reviews must be submitted with a cover letter from the applicant including the applicant name, permit number, county, the year, proposed cropping plan, that this is an annual review, what is included (required information for subplot 1,2,3,...), anything that has been left out and is forthcoming or any other points that will help clarify the enclosed information. Cover letter should be signed by the ranking elected official, principal executive officer, or/and other authorized person per 401 KAR 45:030 Section 10.

SLUDGE ANALYSIS

Include originals or copies of the actual sludge analysis from the laboratory. Applicant should inform labs that sludge should be analyzed wet and analysis reported in mg/l. Conversions from mg/l to mg/kg should be calculated by dividing % solids into mg/l.

SURFACE AND GROUNDWATER ANALYSIS

Submit the original or copies of the original lab sheets for surface and groundwater analysis (if monitoring is required by your permit), clearly designating them as either surface and groundwater and the location as to correlate with what is shown in the original application.

ANNUAL LANDFARMING REVIEW

Complete this form using an average or your sludge analysis for the year (yearly, by-yearly, quarter or monthly) based on your sampling frequency required by your permit. You need only submit one copy of this form.

SLUDGE APPLICATION SUMMARY:

All Subplots which received sludge during the monitoring year should be listed along with the grand total sludge applied, the annual application rate per acre and the approved rate per acre.

LANDFARMING APPLICATION LOG:

Begin a log sheet for each subplot by waste generator source on the date the sludge sample is submitted for analysis at the beginning of the monitoring year. Record the date of application quantity, hauler's initials and date of corresponding sludge analysis.

On the date the next sludge sample is submitted for analysis, tally the grand total sludge applied and circle the total in red. Record the total application quantity and waste generator source on the metals historical sheet, and calculate the metals loading rate using Metals Concentration Conversion Sheet for each generator of sludge hauled during the monitoring period. Record the application quantity on the Nitrogen Utilization Sheet and calculate the nitrogen loading.

Continue to use the same log sheet(s) for the entire monitoring year. If more than one sheet is needed, label 1a, 1b, etc.

METALS CONCENTRATION CONVERSION SHEET:

Use the appropriate sheet (wet or dry sludge) based on the type sludge applied.

METALS HISTORICAL:

Record answers calculated per monitoring period and total at the bottom of sheet.

RESIDUAL NITROGEN WORKSHEET:

You will need to complete this form even if it is the first year's application. Use the residual nitrogen calculated, on the worksheet for calculating application rates, but not on the nitrogen balance sheet (if first year). If sludge has been applied in the past, transfer these numbers to the nitrogen balance sheet.

NITROGEN BALANCE SHEET:

See "Residual Nitrogen Worksheet" above.

WORKSHEETS FOR CALCULATING APPLICATION RATES:

Complete this form using yearly averages brought over from the Landfarming Review Sheet. This sheet is used to calculate average application rate for the upcoming year for each subplot/crop.

SOIL ANALYSIS:

The last page for each subplot should be the soil analysis. Submit an original or copy of the original lab sheet for the particular subplot.

Annual Landfarming Review

LANDFARMING SLUDGE DATA

Landfarming Permit # _____ KPDES # _____

Permittees Name _____

Sludge Source _____

Address _____

City _____ State _____ Zip Code _____

SLUDGE QUALITY

- 1. Current yearly average sludge analysis (mean value of sludge analysis based on sampling frequency):

Date (s) of Sampling _____

Type of Sample Grab Composite

pH _____

*Total Solid _____ %

*Volatile Solids _____ %

*Total Potassium _____ (ppm: _____)

*Total Phosphorus _____ (ppm: _____)

*Kjeldahl Nitrogen _____ (ppm: _____)

* Ammonium Nitrogen (NH₄-N) _____ (ppm: _____)

* Nitrate Nitrogen (NO₃-N) _____ (ppm: _____)

Cadmium (Cd) _____ mg/l _____ mg/kg

Copper (Cu) _____ mg/l _____ mg/kg

Lead (Pb) _____ mg/l _____ mg/kg

Nickel (Ni) _____ mg/l _____ mg/kg

Zinc (Zn) _____ mg/l _____ mg/kg

Chromium (Cr) _____ mg/l _____ mg/kg

Polychlorinated Biphenyls (PCBs) _____ mg/kg

(Submit a copy of the actual lab analysis sheets)

- 2. Total estimated quantity of sludge generated this year (gallons or dry tons) _____

3. Name of Testing Laboratory _____
Mailing Address _____
City _____ State _____ Zip Code _____
Phone (____) _____

(*Submit only 1 copy for entire package, however these numbers are used on pages 1,2,3 of "Worksheet for Calculating Application Rates" for each subplot.)

Metals Concentration Conversion
Liquid Sludge

Permit Number	Sub-Plot Number
Cd _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of CdApplied	
Cu _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of CuApplied	
Pb _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of PbApplied	
Ni _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of NiApplied	
Zn _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of ZnApplied	
Cd _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of CdApplied	
Cu _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of CuApplied	
Pb _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of PbApplied	
Ni _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of NiApplied	
Zn _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of ZnApplied	
Cd _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of CdApplied	
Cu _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of CuApplied	
Pb _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of PbApplied	
Ni _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of NiApplied	
Zn _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of ZnApplied	
Cd _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of CdApplied	
Cu _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of CuApplied	
Pb _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of PbApplied	
Ni _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of NiApplied	
Zn _____ mg./1x8.34x(_____ gal-1,000,000gal.)=_____ lbs.of ZnApplied	

****Lbs. of metal applied ÷ Subplot acreage = Lbs/. of metal/acre****

Metals Concentration Conversion

Permit Number _____ Sub-Plot Number _____

Dry Sludge

Cd _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Cd Applied

Cu _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Cu Applied

Pb _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Pb Applied

Ni _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Ni Applied

Zn _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Zn Applied

Cd _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Cd Applied

Cu _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Cu Applied

Pb _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Pb Applied

Ni _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Ni Applied

Zn _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Zn Applied

Cd _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Cd Applied

Cu _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Cu Applied

Pb _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Pb Applied

Ni _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Ni Applied

Zn _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Zn Applied

Cd _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Cd Applied

Cu _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Cu Applied

Pb _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Pb Applied

Ni _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Ni Applied

Zn _____ mg./kg x _____ tons sludge x.002= _____ lbs.of Zn Applied

lbs. of metal applied + subplot acreage = lbs. of metal/acre

RESIDUAL NITROGEN WORKSHEET
TABLE 1
Residual Nitrogen

<u>Years Since Last Application</u>	<u>Organic Nitrogen Content of Sludge</u>					
	2.0	2.5	3.0	3.5	4.0	4.5
<u>Lbs.N released per ton of sludge applied</u>						
1	1.0	1.2	1.4	1.7	1.9	2.2
2	0.9	1.2	1.4	1.6	1.8	2.1
3	0.9	1.1	1.3	1.5	1.7	2.0

Calculations should be done for each sub-plot which has received sludge

One year ago:

Lbs. of Nitrogen released per ton of sludge x tons of sludge applied = Residual N (one year)

$$\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \text{Residual N (one year)}$$

Two years ago:

Lbs. of Nitrogen released per ton of sludge x tons of sludge applied = Residual N (two years)

$$\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \text{Residual N (two years)}$$

Three years ago:

Lbs. of Nitrogen released per ton of sludge x tons of sludge applied = Residual N (three years)

$$\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \text{Residual N (three years)}$$

Total Residual Nitrogen:

Residual N (one year) + Residual N (two years) + Residual N (three years) = Total Residual Nitrogen

$$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}} = \text{Total Residual Nitrogen}$$

NOTE; TO CALCULATE RESIDUAL NITROGEN FOR YEAR 2 AND 3 YOU MUST FIND THE ORGANIC NITROGEN CONTENT OF SLUDGE FROM EACH YEAR. REFER TO YOUR PREVIOUS ANNUAL REVIEW.

WORKSHEET FOR CALCULATING APPLICATION RATES

SUBPLOT # _____ CROP _____

SLUDGE COMPOSITION (Parameter in ppm ÷ 10,000 = %)

Total Kjeldahl Nitrogen (TKN) _____ ÷ 10,000 = _____ %
 Ammonium Nitrogen (NH₄-N) _____ ÷ 10,000 = _____ %
 Nitrate Nitrogen (NO₃-N) _____ ÷ 10,000 = _____ %
 Total Phosphorus _____ ÷ 10,000 = _____ %
 Total Potassium _____ ÷ 10,000 = _____ %

1. Percent Available Organic Nitrogen = (%TKN) - (%NH₄-N) - (%NO₃-N)
 _____ = (_____) - (_____) - (_____)

2. Available Nitrogen in waste:

(a) Incorporation:

(%NH₄Nx20) + (%NO₃Nx20) + (%available organic N x 4) = lbs. available N/ton

(_____ x20) + (_____ x20) + (_____ x4) = _____ lbs. available N/ton

(b) Surface Application:

(%NH₄Nx10) + (%NO₃Nx20) + (%available organic N x 4) = lbs. available N/ton

(_____ x20) + (_____ x4) = _____ lbs. = _____ lbs. available N/ton

3. Residual Nitrogen (N) : _____

(Calculated Residual N by utilizing the formulas found on the Residual N worksheet)

4. Annual Application Rate:

(a) (Crop N requirement - Residual N)/Acre ÷ lbs. available N/ton = Dry Tons/acre

_____ - _____) ÷ _____ = _____ Dry Tons/acre

(B) 0.44 lbs. of available Cd/acre ÷ (mg./kg of Cd in sample X 0.002) = Dry Tons/acre

_____ + (_____ x 0.002) = _____ Dry Tons/acre

Annual Application Rate: (LOWER of (a) or (b).)

Annual Application Rate = _____.

5. Conversion Formula: Dry Tons to Wet Gallons

(Tons of sludge x 2000) ÷ (8.34x% solids in the sludge/100) = wet gallons/acre

(_____ x 2000) ÷ (8.34x _____) = _____ wet gallons/acre.

6. Additional Phosphorous and Potassium needed:

(a) Phosphorus (P₂O₅) in waste:

Tons waste/acre (from 4a or 4b) x % P in waste x 45.8 = lbs. P₂O₅ added/acre

_____ x _____ x 45.8 = _____ lbs. P₂O₅ added/acre

(b) Additional P₂O₅ fertilizer needed:

Total phosphorous (P₂O₅) needed/acre - P₂O₅ added from sludge = lbs. P₂O₅/acre

_____ - _____ = _____ lbs. of additional P₂O₅ needed/acre

* A negative answer means no additional P₂O₅ fertilizer is needed.

(c) Potassium (K₂O) in waste:

Tons waste (from 4a or 4b)/acre x % K in waste x 24 = lbs. K₂O added/acre

_____ x _____ x 24 = _____ lbs. K₂O added/acre

(d) Additional K_2O fertilizer needed:

$$\text{Total } K_2O \text{ needed/acre} - K_2O \text{ added from sludge} = \text{lbs. } K_2O/\text{acre}$$
$$\underline{\hspace{2cm}} - \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \text{ lbs. of additional } K_2O \text{ needed/acre}$$

*A negative answer means no additional K_2O fertilizer is needed.

**Nitrogen Required - (lbs. available N/ton X maximum tons waste to be applied/acre) = lbs of additional fertilizer nitrogen applied. (additional nitrogen may be needed by fertilization if the annual application rate is limited by cadmium.

7. Maximum Amount of Waste Allowable per Acre:

Obtain maximum amount of Pb, Cd, Cu, Ni, and Zn allowed based on the Cation Exchange Capacity of the soil from 401 KAR 45:100 Section 10(23). If sludge has previously been applied, calculate the remaining lifetime limits by subtracting the total amount of each metal applied from the maximum allowed found in 401 KAR 45:100 Section 10 (23).

Cadmium (Cd):

$$\text{Maximum Cd allowable/acre} + (\text{dry mg/kg of Cd in sample} \times 0.002) = \text{tons waste/acre}$$
$$\underline{\hspace{2cm}} + (\underline{\hspace{2cm}} \times 0.002) = \underline{\hspace{2cm}} \text{ tons waste/acre}$$

Copper (Cu):

$$\text{Maximum Cu allowable/acre} \div (\text{dry mg/kg of Cu in sample} \times 0.002) = \text{tons waste/acre}$$
$$\underline{\hspace{2cm}} \div (\underline{\hspace{2cm}} \times 0.002) = \underline{\hspace{2cm}} \text{ tons waste/acre}$$

Lead (Pb):

$$\text{Maximum Pb allowable/acre} + (\text{dry mg/kg of Pb in sample} \times 0.002) = \text{tons waste/acre}$$
$$\underline{\hspace{2cm}} + (\underline{\hspace{2cm}} \times 0.002) = \underline{\hspace{2cm}} \text{ tons waste/acre}$$

Nickel (Ni):

$$\text{Maximum Ni allowable/acre} + (\text{dry mg/kg of Ni in sample} \times 0.002) = \text{tons waste/acre}$$
$$\underline{\hspace{2cm}} + (\underline{\hspace{2cm}} \times 0.002) = \underline{\hspace{2cm}} \text{ tons waste/acre}$$

Zinc (Zn):

$$\text{Maximum Zn allowable/acre} \div (\text{dry mg/kg of Zn in sample} \times 0.002) = \text{tons waste/acre}$$
$$\underline{\hspace{2cm}} \div (\underline{\hspace{2cm}} \times 0.002) = \underline{\hspace{2cm}} \text{ tons waste/acre}$$

Life in Number of Years = Lowest amount from Item 7 in
tons/acre ÷ tons waste applied/acre/year

_____ ÷ _____ = _____ years

8. Number of years that waste can be applied: _____

CERTIFICATION

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure tht qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for such violations."

Signature of Authorized Agent _____ Date _____

Name of Authorized Agent _____

Title _____