

How To Calculate Sludge Loading Rates

1. You need lab analyses of the sludge, including the following: % solids, % total N, % NH₄-N, % organic N, % P, % K, ppm Cu, ppm Zn, ppm Pb, ppm Cr, ppm Ni, ppm Cd, pH; and CEC (cation exchange capacity) of the soil.
2. You need fertilizer recommendations based on soil test and crop so that you can gear sludge rate to soil levels and crop needs.

3. Nitrogen (N)

Add all of inorganic N to 20% of the organic N to get the total N available to the crop in the year of application.

Divide (crop need) by (N in sludge) to get application rate.

Phosphorus (P)

Divide (crop needs) by (P₂O₅ in sludge) to get application rate.

Note: Since P in sludge is often high, the sludge application rate is often determined by this nutrient, rather than by N. In that case you will add sludge to take care of P needs and add fertilizer to cover N and K deficiency.

Potassium (K)

Divide (crop needs) by (K₂O in sludge) to get application rate.

Note: Sludges are low in K so you will need to supply the rest of the K needed by applying K-carrier fertilizer.

4. Cadmium (Cd)

First heavy metal to consider because of its potential toxicity.

Divide (maximum annual application rate = 1.8 lb/A)

Cd in sludge (lb/ton)

↳ determine how much sludge can be applied per year.

5. Other Heavy Metals

Compare the application rates calculated for N, P and Cd and see which is the lowest figure. That will be the desired application rate per year. For that rate calculate how much of each heavy metal is applied in the sludge as follows: (ppm of metal in sludge) x 0.002 = lb. of metal/ton of sludge. (ton/A application rate) x (lb. of metal/ton) = lb. of metal/acre.

6. Lifetime Loading

Now you need to calculate how many years it will take to reach the maximum loading level for each metal. EPA has set maximum limits of metal to be applied per acre, as follows:

Metal	Max. Level (lb/A)	Years to Reach Max. Level
Cd	10	10 : (lb. of Cd per application) = _____
Cr	60	60 : (lb. of Cr per application) = _____
Ni	100	100 : (lb. of Ni per application) = _____
Cu	250	250 : (lb. of Cu per application) = _____
Zn	500	500 : (lb. of Zn per application) = _____
Pb	1000	1000 : (lb. of Pb per application) = _____

The smallest number on the right sets the limit of the number of years this sludge can be applied at the recommended application rate.

7. Now calculate how much short you are in either N, P or K to find how much additional fertilizer is needed for that crop.

100

8. Remember: wet tons/acre = (dry tons/acre) x (% solids in sludge)

gallons/acre = (wet tons/acre) x 240