Comprehensive List of Leachate Parameters for Post Closure (PCC) Care Termination (3-27-12)

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KAR 28-29-104(i)(6)(A) states that "representative samples of leachate shall be collected annually from each unit and tested in accordance with paragraph (i)(6)(B) of this regulation at a frequency of once per year while the leachate management system is in operation." Paragraph (i)(6)(B) contains **a list of parameters which can be changed along with the frequency** by the Division of Environment Director (also, see paragraphs C and D).

The purpose of this document is to provide a comprehensive list of leachate parameters and the frequency of their measurement so that a more reliable set of data (or benchmarks) can be collected that will facilitate the determination of when PCC can cease. The annual sample and list of parameters would be maintained but three different quarterly samples will be required with the different list of parameters described herein. Also, leachate flow requirements will be made for all quarters of sampling. There are two sources which will be used to support these recommendations. They are a document and spreadsheet entitled, respectively: **A Simple, Overlooked Set of Parameters for Judging MSW Stabilization** (2-29-12) and **Adjusted Allen County Leachate for 7-1-01 to 10-14-11**.xls. The former document is a discussion about why it is useful to measure total and soluble BOD_5 and COD instead of total values. The spreadsheet is a comparison of Allen County leachate quality data for the designated period. This set of leachate data is different from many of the other Subtitle D data set submitted by other landfills in that seven of the eleven reporting years had quadruple sampling events.

An inspection of the Allen County BOD_5 and COD data show values which seem in error because they are much different than the other values (or average of the other values). The suggested BOD_5 outliers are 1,400, 260 and 210 mg/L versus an average without the outliers of 29.9. The suggested COD outliers are 20, 2,200, 1,600, 730 and 28 mg/L (which do not correspond to the BOD_5 outliers) versus an average without the outliers of 149 mg/L. The lone TSS outlier of 500 mg/L (which doesn't correspond to BOD_5 and COD) compares with an average without the outlier of 60 mg/L. Note the general downward trend of these values for a relatively short period of sampling (eleven years). The larger number of samples (29 versus 11) confirms this trend (as opposed to just using annual data). Finally, it should be noted that the samples analyzed for the three different parameters may have been different samples, e.g., the TSS sample may not have been taken from the sample container as that used to run the BOD_5 and COD samples although one would think that the same sample container was used to extract the aliquots used for all three parameters.

Another aspect of the Allen County data is the comparisons given below the sample results part of the spreadsheet. These include BOD (five day):COD, Anions:Cations as equivalences, Anions+Cations+Molecular:TDS as Mass, COD:TSS, BOD (five day):TSS, Soluble COD and % Soluble COD. The reported averages (right side of spreadsheet) include all outliers which likely distort the comparison values.

The leachate analyses for quarterly sampling, except for the annual sample, are summarized in the following table along with the reasons for selecting the value. Note that the currently required

annual sampling of leachate might be useful in some situations for some of the reasons given in the table, e.g, identifying the presence and amount of other potentially toxic inorganics and organics.

Comprehensive List of Leachate Parameters

Parameter	Reason for Selection
Temperature	Affects solubility of chemicals, an indicator of microbial activity and MSW mass thermal condition.
pH	Determines speciation of various chemicals, possible imbalance between acid and methane formers under anaerobic conditions; and conditions affection possible microbial activity.
Alkalinity	Measure of buffering capacity and approximate distribution of alkalinity species (carbonate, bicarbonate and hydroxide)
Total BOD_5	Measure of sample biodegradability.
Soluble BOD_5	Measure of soluble portion of sample's biodegradability.
Total COD	Measure of chemically oxidizable material.
Soluble COD	Measure of soluble portion of sample's chemically oxidizable material.
TOC	Measure of total carbon content.
Soluble TOC	Measures soluble carbon content.
Total Suspended Solids	Measure of insoluble solids which are comparable to insoluble BOD_5, COD and TOC.
Volatile Suspended Solids	Measure of volatile (or organic) insoluble solids which are comparable to insoluble BOD_5, COD and TOC.
Total Dissolved Solids	Measure of soluble solids and useful for mass balance calculation involving individual soluble species.
Calcium, Magnesium, Sodium, Potassium, Total and Ortho Phosphorus, Ammonium (or Ammonia)	Major cations affecting charge balance including major hardness cations; also, general distribution of phosphorus and nitrogen species.
Sulfate, Sulfite, Nitrate, Nitrite, Chloride	Major anions affecting charge balance including non-carbonate hardness anions and oxidations state of multivalent species.
Manganese, Aluminum, Tin, Iron, Chromium, Copper, Lead and Mercury	Possible minor metals affecting charge balance, but major affecting potential microbial toxicity; also, metals common to composition of MSW.
Kjeldahl Nitrogen	Measures organic and ammonium (or ammonia) nitrogen content.
Specific Conductance	Measure of ionic strength.

Quotes to conduct the above tests were received from a private laboratory. The estimated price was slightly over $1,200.