Calculated Results

Analyte	Result (wet) mg/kg	RDL (Wet) mg/kg	Result (dry) mg/kg	RDL (dry) mg/kg	Qualifier	Dilution	Analysis date / time	Batch
Organic Nitrogen	248	5.00	41300	833		1	01/09/2019 14:13	WG1220476

Gravimetric Analysis by Method 160.4/2540G

Analyte	Result % of TS	Qualifier	Dilution	Analysis date / time	Batch
Volatile Solids	69.0		1	01/08/2019 16:59	WG1220384

Total Solids by Method 2540 G-2011

Analyte	Result %	Qualifier	Dilution	Analysis date / time	Batch
Total Solids	0.600		1	01/05/2019 12:29	WG1219564

Wet Chemistry by Method 350.1

Analyte	Result (wet) mg/kg	RDL (Wet) mg/kg	Result (dry) mg/kg	RDL (dry) mg/kg	Qualifier	Dilution	Analysis date / time	Batch
Ammonia Nitrogen	ND	5.00	ND	833		1	01/09/2019 14:13	WG1220476

Wet Chemistry by Method 4500NOrg C-2011

Analyte	Result (wet) mg/kg	RDL (Wet) mg/kg	Result (dry) mg/kg	RDL (dry) mg/kg	Qualifier	Dilution	Analysis date / time	Batch
Kjeldahl Nitrogen, TKN	248	20.0	41300	3330	J3 J5 J6	1	01/07/2019 12:33	WG1219884

Wet Chemistry by Method 9056A

Analyte	Result (wet) mg/kg	RDL (Wet) mg/kg	Result (dry) mg/kg	RDL (dry) mg/kg	Qualifier	Dilution	Analysis date / time	Batch
Nitrate	16.6	1.00	2770	167		1	01/09/2019 16:16	WG1220342
Nitrite	ND	1.00	ND	167		1	01/09/2019 16:16	WG1220342
Phosphate as P	17.4	1.00	2910	167		1	01/09/2019 16:16	WG1220342

Mercury by Method 7471A

Analyte	Result (wet) mg/kg	RDL (Wet) mg/kg	Result (dry) mg/kg	RDL (dry) mg/kg	Qualifier	Dilution	Analysis date / time	Batch
Mercury	ND	0.0200	ND	3.33		1	01/07/2019 08:53	WG1219876

Metals (ICP) by Method 6010B

Analyte	Result (wet) mg/kg	RDL (Wet) mg/kg	Result (dry) mg/kg	RDL (dry) mg/kg	Qualifier	Dilution	Analysis date / time	Batch
Arsenic	ND	0.200	ND	33.3		1	01/07/2019 15:41	WG1219804
Cadmium	ND	0.0500	ND	8.33		1	01/07/2019 15:41	WG1219804
Copper	2.19	0.200	365	33.3		1	01/07/2019 15:41	WG1219804
Lead	0.0944	0.0500	15.7	8.33		1	01/07/2019 15:41	WG1219804
Molybdenum	ND	0.0500	ND	8.33		1	01/07/2019 15:41	WG1219804
Nickel	ND	0.200	ND	33.3		1	01/07/2019 15:41	WG1219804
Selenium	ND	0.200	ND	33.3		1	01/07/2019 15:41	WG1219804
Zinc	5.22	0.500	870	83.3		1	01/07/2019 15:41	WG1219804

Biosolid Pathogen Worksheet

Class B Fecal Coliform
Liquid sample < 7% solids, for solid samples see p 138 of Whitehouse Manual 1999 edition
Membrane filter, SM 9222 D

Sample location Dig #1 Date 5-30-19 Sample Time 1304
Analyst TB Incubator Time IN 1332 OUT 1400 5-31-19

Dilution A: To 99 ml of sterile dilution water add 1ml of sample = 0.01 ml original sample / ml
Dilution B: To 99 ml of sterile dilution water add 1.0 ml of dilution A = 0.0001 ml original sample / ml
Dilution C: To 99 ml of sterile dilution water add 1.0 ml of dilution B = 0.000001 ml original sample / ml

Filter Number	Volume and Dilution	ml of original sample
Filter 1	1.0 ml dilution A	0.01
Filter 2	10 ml Dilution B	0.001
Filter 3	1.0 ml Dilution B	0.0001
Filter 4	10 ml Dilution C	0.00001

If needed adjust volumes and dilutions to produce 20-60 colonies per membrane filter
Use the same counting rules that apply to effluent Fecal Coliform

Calculations of total solids see SM 2540 G.

$$\text{CFU / gram} = \frac{\text{Colonies Counted}}{\text{ml of original sample} * \% \text{ total solids as decimal}}$$

Note: Test fails if CFU/gram >2,000,000

Filter 1 CFU / gram = $\frac{2}{0.01 \times (.0192} = 10,416.67$

Filter 2 CFU / gram = $\frac{ND}{0.001 \times (.0192}$

Filter 3 CFU / gram = $\frac{ND}{0.0001 \times (.0192}$

Filter 4 CFU / gram = $\frac{ND}{0.00001 \times (.0192}$

ND = NOT DETECTED

References: Standard Methods for the examination of Water and Wastewater
18 th Edition

Environmental Regulations and Technology, Control of pathogens and Vector attraction in Sewage Sludge. (Whitehouse Book) Page 103-104, 1992 edition, pp.138-138,1999 edition

Revised 3-01

Biosolid Pathogen Worksheet

Class B Fecal Coliform
Liquid sample < 7% solids, for solid samples see p 138 of Whitehouse Manual 1999 edition
Membrane filter, SM 9222 D

Sample location Dig #2 Date 5-30-19 Sample Time 1342
Analyst [illegible] Incubator Time IN 1412 OUT 1400 5-31-19

Dilution A: To 99 ml of sterile dilution water add 1ml of sample = 0.01 ml original sample / ml
Dilution B: To 99 ml of sterile dilution water add 1.0 ml of dilution A = 0.0001 ml original sample / ml
Dilution C: To 99 ml of sterile dilution water add 1.0 ml of dilution B = 0.000001 ml original sample / ml

Filter Number	Volume and Dilution	ml of original sample
Filter 1	1.0 ml dilution A	0.01
Filter 2	10 ml Dilution B	0.001
Filter 3	1.0 ml Dilution B	0.0001
Filter 4	10 ml Dilution C	0.00001

If needed adjust volumes and dilutions to produce 20-60 colonies per membrane filter
Use the same counting rules that apply to effluent Fecal Coliform

Calculations of total solids see SM 2540 G.

$$\text{CFU / gram} = \frac{\text{Colonies Counted}}{\text{ml of original sample} * \%\text{ total solids as decimal}}$$

Note: Test fails if CFU/gram >2,000,000

Filter 1 CFU / gram = $\frac{2}{0.01 \times (.0186} = 10,752.69$

Filter 2 CFU / gram = $\frac{ND}{0.001 \times (.0186}$

Filter 3 CFU / gram = $\frac{ND}{0.0001 \times (.0186}$

Filter 4 CFU / gram = $\frac{ND}{0.00001 \times (.0186}$

ND = NOT DETECTED

References: Standard Methods for the examination of Water and Wastewater
18 th Edition

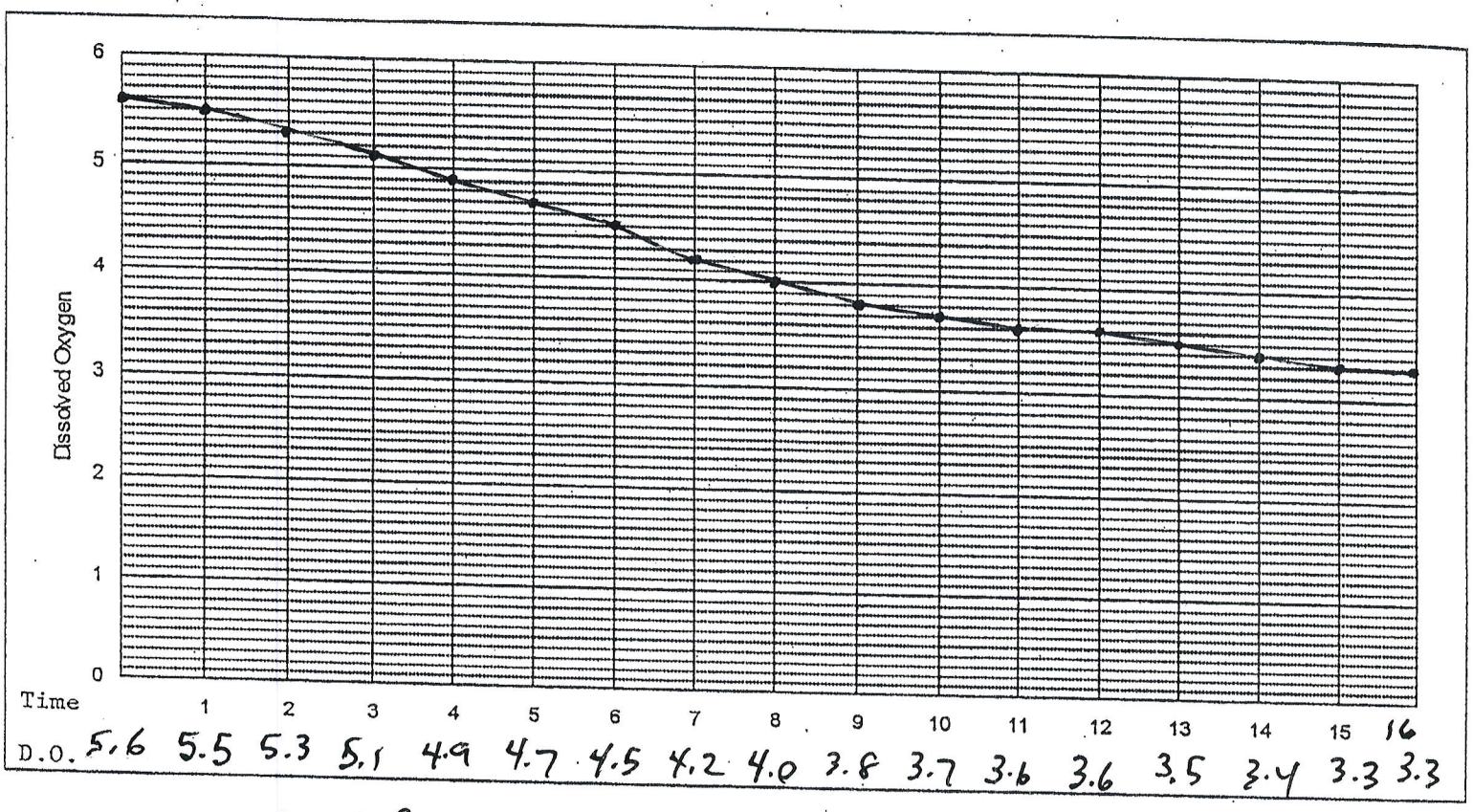
Environmental Regulations and Technology, Control of pathogens and Vector attraction in Sewage Sludge. (Whitehouse Book) Page 103-104, 1992 edition, pp.138-138,1999 edition

Revised 3-01

2019-1

Specific Oxygen Uptake Rate
SOUR

Date 5-30-19 Sample Location DIS #1 Temperature 25.15°C
Time 11:50 am



Begin Temp 24.8°C
TB 25.4°C

Average Temp 25.15°C

End Temp 24.9°C

Enter D.O. readings at each elapsed minute on the graph.
Graph the data and determine the time period where the slope is constant with a best fit line.
Use the first and last D.O. reading from this constant slope portion of the graph in the OUR formula.

Oxygen Uptake Rate (OUR) (S.M. 2710B)

$$\text{OUR mg } O_2\text{/L/hr} = \frac{\text{Begin Dissolved Oxygen - End Dissolved Oxygen}}{\text{Elapsed Time}} * 60$$

$$\text{OUR} = \frac{5.6 \text{ mg/L} - 3.3 \text{ mg/l}}{16 \text{ Minutes}} * 60 = 8.6 \text{ mg } O_2\text{/L/hr}$$

Specific Oxygen Uptake Rate (SOUR)

1. $$\text{SOUR mg } O_2\text{/hr/g} = \frac{\text{OUR mg } O_2\text{ /L/hr}}{\text{\% Total Solids} * 1000 \text{ g/L}}$$

Note: enter total solids as a decimal, see S.M. 2540 G

$$\text{SOUR} = \frac{8.6 \text{ mg } O_2\text{/L/hr}}{.0192 * 1000 \text{ g/L}} = .4479 \text{ mg } O_2\text{/hr/g}$$

Temperature Adjustment

SOUR @ Average Temp * Adjustment, or correction factor = SOUR @ 20° C

.4479 mg O_2/ hr/g @ 25.15 °C * .78 = .349 mg O_2/hr/g @ 20° C

Note: See adjustment formula and correction factors on the next page.

Brett Ward
Municipal Technical Advisory Service

Specific Oxygen Uptake Rate

Temperature Adjustment

SOUR is determined at the digester's ambient temperature and then adjusted as follows.

$$SOUR@20°C = SOUR @ \text{Ambient Temp.} * A^{(20-\text{Ambient temp.})}$$

Where A = 1.05 above 20°
= 1.07 below 20°
These factors are good between 10° C and 30° C

Simplified

SOUR @20° C = SOUR @ Ambient Temp. * Correction

$$\text{Correction} = A^{(20-\text{Ambient Temp})}$$

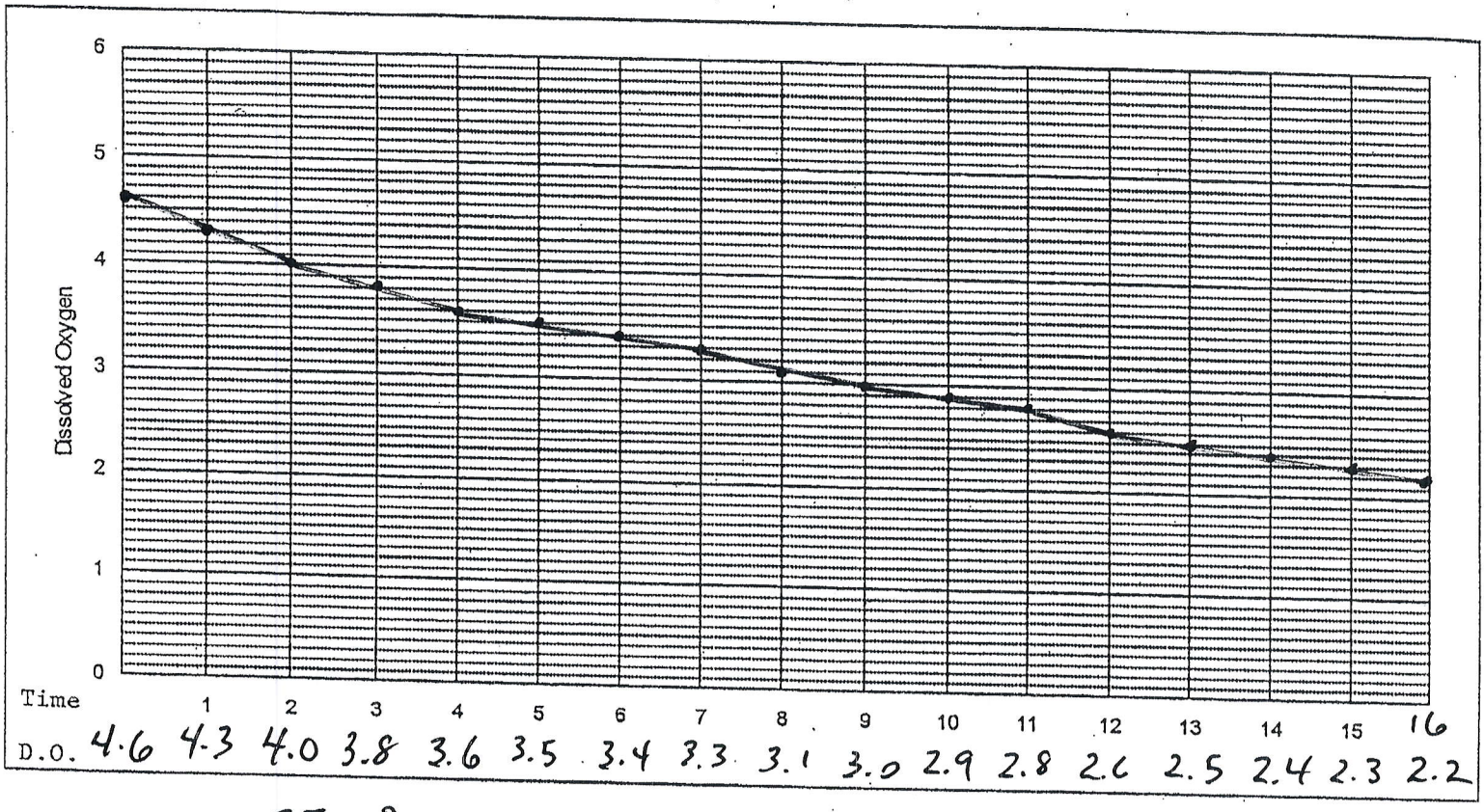
Temp° C	Correction
10	1.97
11	1.84
12	1.72
13	1.60
14	1.50
15	1.40
16	1.31
17	1.22
18	1.14
19	1.07
20	1.00
21	0.95
22	0.90
23	0.86
24	0.82
25	0.78
26	0.75
27	0.71
28	0.68
29	0.64
30	0.61

Municipal Technical Advisory Service
Brett Ward

2019-2

Specific Oxygen Uptake Rate
SOUR

Date 5-30-19 Sample Location Dig # 2 Temperature 25.2 °C
Time 12:45 pm



Begin Temp 25.1 °C Average Temp 25.2 °C End Temp 25.3 °C

Enter D.O. readings at each elapsed minute on the graph.
Graph the data and determine the time period where the slope is constant with a best fit line.
Use the first and last D.O. reading from this constant slope portion of the graph in the OUR formula.

Oxygen Uptake Rate (OUR) (S.M. 2710B)

$$\text{OUR mg } O_2\text{/L/hr} = \frac{\text{Begin Dissolved Oxygen - End Dissolved Oxygen}}{\text{Elapsed Time}} * 60$$

$$\text{OUR} = \frac{4.6 \text{ mg/L} - 2.2 \text{ mg/l}}{16 \text{ Minutes}} * 60 = 9.0 \text{ mg } O_2\text{/L/hr}$$

Specific Oxygen Uptake Rate (SOUR)

1. SOUR mg O_2/hr/g = $\frac{\text{OUR mg } O_2 \text{ /L/hr}}{\text{\% Total Solids} * 1000 \text{ g/L}}$

Note: enter total solids as a decimal, see S.M. 2540 G

SOUR = $\frac{9.0 \text{ mg } O_2\text{/L/hr}}{.0186 * 1000 \text{ g/L}} = .484 \text{ mg } O_2\text{/hr/g}$

Temperature Adjustment

SOUR @ Average Temp * Adjustment, or correction factor = SOUR @ 20° C

.484 mg O_2/ hr/g @ 25.2 °C * .78 = .378 mg O_2/hr/g @ 20° C

Note: See adjustment formula and correction factors on the next page.

Brett Ward
Municipal Technical Advisory Service

Specific Oxygen Uptake Rate

Temperature Adjustment

SOUR is determined at the digester's ambient temperature and then adjusted as follows.

$$SOUR@20°C = SOUR\ @\ Ambient\ Temp. * A^{(20-Ambient\ temp.)}$$

Where A = 1.05 above 20°
= 1.07 below 20°
These factors are good between 10° C and 30° C

Simplified

SOUR @20° C = SOUR @ Ambient Temp. * Correction

$$Correction = A^{(20-Ambient\ Temp)}$$

Temp° C	Correction
10	1.97
11	1.84
12	1.72
13	1.60
14	1.50
15	1.40
16	1.31
17	1.22
18	1.14
19	1.07
20	1.00
21	0.95
22	0.90
23	0.86
24	0.82
25	0.78
26	0.75
27	0.71
28	0.68
29	0.64
30	0.61

Municipal Technical Advisory Service
Brett Ward

Tennessee Department of Environment and Conservation - Division of Water Pollution Control

Exhibit B - Agronomic Application Rate Calculations Based on Nitrogen (N)

Revision 05/08/14

BACKGROUND INFORMATION/QUESTIONS	FILL IN BELOW
WWTP NAME	Baxter WWTP
WWTP NPDES PERMIT NUMBER	TN0021121
SITE NAME	Thomas Lee Young
COUNTY	PUTNAM
E.A.C.	
SITE TRACKING NUMBER	TNB021121
LABORATORY NAME	Nationwide Analytical Laboratories
DATE OF ANALYSIS	1/3/19

SLUDGE/BIOSOLID ANALYSIS LABORATORY RESULTS

(Attached a copy of the laboratory analysis used for these calculations to this report)

TOTAL KJELDAHL NITROGEN (TKN)	41,300	mg/kg
AMMONIUM NITROGEN (NH_4-N)		mg/kg
NITRATE + NITRITE NITROGEN (NO_3-N + NO_2-N)	2,770	mg/kg
NITROGEN FROM SUPPLEMENTAL FERTILIZERS (If Appropriate)	0	lbs/acre
NITROGEN FROM IRRIGATION WATER (If Appropriate)	0	lbs/acre
NITROGEN FROM PREVIOUS CROP (Unless 2 is based on soil testing)	0	lbs/acre
OTHER (If Appropriate) Specify _____	0	lbs/acre

SELECT CROP TYPE

(SELECT ONLY ONE)	YES
1 - CORN (GRAIN) EXPECT YIELD 100 - 125 BUSHELS	☐
2 - CORN (GRAIN) EXPECT YIELD 126 - 150 BUSHELS	☐
3 - CORN (SILAGE) EXPECT YIELD 20 TONS	☐
4 - SOYBEANS EXPECT YIELD 30 BUSHELS	☐
5 - SOYBEANS EXPECT YIELD 40 BUSHELS	☐
6- SOYBEANS EXPECT YIELD 50 BUSHELS	☐
7- WHEAT EXPECT YIELD 40 BUSHELS	☐
8 - SUMMER ANNUAL GRASS EXPECT YIELD 6 TONS (1 CUTTINGS)	☐
9 - HYBRID HAY EXPECT YIELD 8 TONS (4 CUTTINGS)	☐
10 - TALL FESCUE HAY EXPECT YIELD 3 TONS (2 CUTTINGS)	☑
11 - ORCHARD GRASS HAY EXPECT YIELD 4 TONS (2 CUTTINGS)	☐
12 - SORGHUM (GRAIN) EXPECT YIELD 60 BUSHELS	☐
13 - COTTON EXPECT YIELD 1 BALE / ACRE	☐
14 - COTTON EXPECT YIELD 1.5 BALE / ACRE	☐

CROP TYPE (LBS N/ACRE/YEAR)	120

VOLATILIZATION FACTORS K_V

(SELECT ONLY ONE)	YES
1 - ARE BIOSOLIDS LIQUID AND SURFACE APPLIED?	☑
2 - ARE BIOSOLIDS LIQUID AND INJECTED INTO SOIL?	☐
3 - ARE BIOSOLID DEWATERED AND APPLIED IN ANY MANNER?	☐

VOLATILIZATION FACTORS K_V = 0.5

MINERALIZATION RATE F_M

WHAT BIOSOLID PROCESS GENERATE THE FRACTION (F_M) OF ORGANIC NITROGEN? (SELECT ONLY ONE)

	SELECT PROCESS
NONE (Unstabilized)	☐
ALKALINE STABILIZATION	☐
AEROBIC DIGESTION	☑
ANAEROBIC DIGESTION	☐
COMPOSING	☐

SELECTION CHOICE: 1 SELECTED

MINERALIZATION RATE F_M = 0.3

AGRONOMIC LOADING RATE 3.6 tons/acre

Sludge Total and Volatile Solids
Total Solids see S.M. 2540 G

Date 5-30-19 Sample Location Dig #1 Sampler TB
Time 1150
Test Time 1207

Weight of Dish A = 84.2046

Weight of Dish and Wet Sludge B= 108.4380

Weight of Wet Sludge C= 24.2334

Weight after Drying D= 84.6696

Weight after Ignition E= NA

% Solids = (D-A) *100
(B-A)

%Total Solids = (84.6696 - 84.2046) = (.4650) = .0192*100 = 1.92%
(108.4380 - 84.2046) (24.2334)

% Volatile = (D-E) * 100
(C-A)

% Volatile = (-) = ( ) = *100
(-) ( )

Metric Tons = gallons * 8.34 * Total Solids as a decimal
2205

Sludge Total and Volatile Solids
Total Solids see S.M. 2540 G

Date 5-30-19 Sample Location Dig #2 Sampler TB
Time 1231
Test Time 1240

Weight of Dish A = 47.4373

Weight of Dish and **Wet** Sludge B= 71.9595

Weight of Wet Sludge C= 24.5222

Weight after Drying D= 47.8944

Weight after Ignition E= NA

% Solids = (D-A) *100
(B-A)

%Total Solids = (47.8944 - 47.4373) = (.4571) = .0186*100 = 1.86 %
(71.9595 - 47.4373) (24.5222)

% Volatile = (D-E) * 100
(C-A)

% Volatile = (-) = ( ) = * 100
(-) ( )

Metric Tons = gallons * 8.34 * Total Solids as a decimal
2205