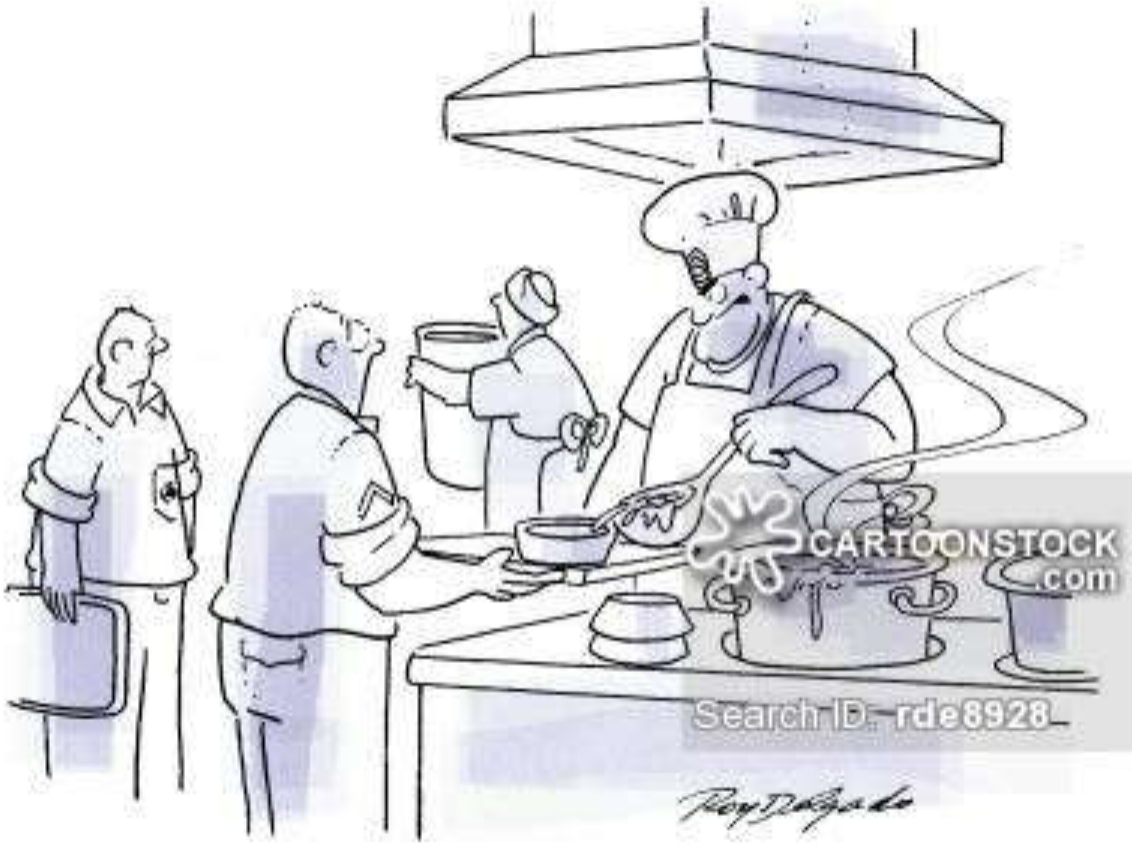
SCIENTIFIC MANAGEMENT OF NUTRIENTS IN BIOSOLIDS APPLICATIONS

THE LAND APPLICATION OF BIOSOLIDS TO FARM FIELDS

1) Determine the fit
   a) Do the biosolids meet Table 1 of the 503's?
   b) What is the timeframe for biosolids application?
   c) What type of farm will fit with this timeframe?
2) Find a farmer cooperator.
   a) Does he/she believe in the value of biosolids?
   b) Are they willing to pay for the product?
   c) Is your prospective farmer a "quality" farmer?
   d) Does their timing need for nutrients fit with your supply timing?

KNOW WHAT IS IN YOUR BIOSOLIDS



" I can't tell you what's in the stew because it's ***classified.*** "

WHAT IS IN BIOSOLIDS?

Report Number:

Page: 1 of 1

Midwest Laboratories, Inc.
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Date Sampled: 11/0

SOME WASTE WATER
TREATMENT FACILITY
BIOSOLIDS ANALYSIS

Second Copy: (15480) PARKER AG

Analysis Performed	As Received	Dry Weight Basis	Units	Detection Limit	Method	Analyst Date	Verifier Date
Lab number: 1647886 Sample ID: DEWATERED LOAD 1							
Calculated Potash K2O	762	7546	mg/Kg		CALC	cmw/11-10	lm/11-10
Calculated Phosphate P2O5	6050	59,903	mg/Kg		CALC	cmw/11-10	lm/11-10
Organic nitrogen	6603	65,376	mg/Kg		CALC	cmw/11-10	lm/11-10
Percent volatile solids		78.29	%	0.01	SM 2540 G	jsa/11-12	cmw/11-17
Kjeldahl nitrogen	7318	72,455	mg/kg	12.5	EPA 351.3	lkd/11-13	cmw/11-17
Phosphorus (total)	2642	26,158	mg/kg	10	EPA 6010	rrd/11-12	bab/11-12
Potassium (total)	633	6269	mg/kg	10	EPA 6010	rrd/11-12	bab/11-12
Sulfur (total)	897	8882	mg/kg	25	EPA 6010	rrd/11-12	bab/11-12
Calcium (total)	1353	13,396	mg/kg	1	EPA 6010	rrd/11-12	bab/11-12
Magnesium (total)	397	3935	mg/kg	1	EPA 6010	rrd/11-12	bab/11-12
Sodium (total)	120	1189	mg/kg	1	EPA 6010	rrd/11-12	bab/11-12
Iron (total)	1065	10,545	mg/kg	5	EPA 6010	rrd/11-12	bab/11-12
Manganese (total)	43.9	435	mg/kg	1	EPA 6010	rrd/11-12	bab/11-12
Copper (total)	32.7	323	mg/kg	1	EPA 6010	rrd/11-12	bab/11-12
Zinc (total)	73.5	727	mg/kg	1	EPA 6010	rrd/11-12	bab/11-12
Ammoniacal nitrogen	715	7079	mg/kg	5	EPA 350.2	lkd/11-12	cmw/11-17
Nitrate/Nitrite Nitrogen	0.2	2.4	mg/kg	0.2	EPA 353.2	jd/11-13	cmw/11-17
Arsenic (total)	n.d.	n.d.	mg/kg	0.5	EPA 6020	akj/11-12	bab/11-12
Barium (total)	22.0	218	mg/kg	0.5	EPA 6010	rrd/11-12	bab/11-12
Cadmium (total)	n.d.	n.d.	mg/kg	0.5	EPA 6010	rrd/11-12	bab/11-12
Chromium (total)	1.8	18.1	mg/kg	1	EPA 6010	rrd/11-12	bab/11-12
Lead (total)	n.d.	n.d.	mg/kg	5	EPA 6010	rrd/11-12	bab/11-12
Mercury (total)	0.07	0.72	mg/kg	0.05	EPA 7471	mlm/11-12	bab/11-12
Molybdenum (total)	n.d.	n.d.	mg/kg	1	EPA 6010	rrd/11-12	bab/11-12
Nickel (total)	1.3	13.2	mg/kg	1	EPA 6010	rrd/11-12	bab/11-12
Selenium (total)	0.58	5.72	mg/kg	0.5	EPA 6020	akj/11-12	bab/11-12
Silver (total)	4.7	47	mg/kg	1	EPA 6010	rrd/11-12	bab/11-12
Percent solids	10.10		%	0.01	SM 2540 G	jsa/11-12	cmw/11-17
pH	6.6		S.U.		EPA 9045	jdb/11-10	cmw/11-17

For questions contact

John McManis
Client Service Representative
jmcmanis@midwestlabs.com (402)829-9887

DOES IT MEET THE REQUIREMENTS?

Pollutant Limits

Pollutant limits for land application are listed in the following table:

Land Application Pollutant Limits
(all limits are on dry weight basis)

Table in 503 Rule	Table #1	Table #2	Table #3	Table #4
Pollutant	Ceiling Concentration Limits* (mg/kg)	Cumulative Pollutant Loading Rates (kg/ha)	"High Quality" Pollutant Concentration Limits** (mg/kg)	Annual Pollutant Loading Rates (kg/ha/yr)
Arsenic	75	41	41	2.0
Cadmium	85	39	39	1.9
Copper	4,300	1,500	1,500	75
Lead	840	300	300	15
Mercury	57	17	17	0.85
Molybdenum	75	C	C	C
Nickel	420	420	420	21
Selenium	100	100	100	5.0
Zinc	7,500	2,800	2,800	140

* absolute values
** monthly averages

To be land applied, bulk sewage sludge must meet the pollutant Ceiling Concentrations and Cumulative Pollutant Loading Rates or Pollutant Concentration limits. Bulk sewage sludge applied to lawns and home gardens must meet the Pollutant Concentration limits. Sewage sludge sold or given away in bags or other containers must meet the Pollutant Concentration limits or meet the Ceiling Concentrations and be applied at an annual sewage sludge product application rate that is based on the Annual Pollutant Loading Rates.

WHAT MAKES A FARMER A GOOD FIT FOR BIOSOLIDS

- One who believes in the environmental, agronomic and financial benefits of the program.
- One whose crop and farming practices match the product.
- One who wants to be a good neighbor

- **A FARMER WHO BELIEVES IN THE ENVIRONMENTAL, AGRONOMIC AND FINANCIAL BENEFITS OF THE PROGRAM.**

- Sequesters large quantities of carbon that contributes to the reduction of greenhouse gases and the mitigation of global warming, reduces the chance that nitrates will end up in groundwater, etc.
- An organic amendment that in contrast to manures has been treated for pathogens, does not contain weed seeds, and may contain low levels of heavy metals that can be plant nutrients, etc.
- Significant cost savings to the farmer.

A FARMER WHOSE CROP AND FARMING PRACTICES MATCH THE PRODUCT.

- When are the fields available for spreading? When do your biosolids need to be spread?
- Is it cost effective to haul the product long distances? (ie liquid verses cake)
- Does the farmer have manure that he must use on his fields?
- Do they manage their soil nutrients responsibly? (ie soil sample)
- Is he/she a good steward of the land and a conscientious farmer?

3) Permit the land by sending an application to ORDEQ.
   a) Receive approval from ORDEQ.
   b) Read the approval letter thoroughly to make sure that you can meet any conditions of the approval.
4) Determine who can/should fulfill the hauling and application requirements.
   a) What is the correct equipment for the job - loaders, spreaders, tractors, tankers, sprayers etc?
   b) What is the most cost effective?
   c) If is an outside company - Are they familiar with the rules concerning the application of biosolids?

ORDEQ REQUIREMENTS

Biosolids Land Application Site Authorization Request Documentation Checklist

DEQ requests the following information be submitted with the biosolids land application site authorization request.

DEQ
State of Oregon Department of Environmental Quality

SITE INFORMATION

- ☐ Vicinity map (e.g., USGS, tax lot, county assessor) indicating location of proposed land application site and acreage, including gross and net (any area or buffer areas not available for biosolids application) acreage.
- ☐ Site location including street address (if not available, then state directions to site), tax reference number, section, township, range, and county.
- ☐ Site owner name, address, and phone number. Site renter name, if applicable.
- ☐ Detailed map showing property boundaries, and setbacks from roadways, occupied buildings, other manmade features, surface waters, and domestic water source or wells. (*Recommended: plot on aerial photograph.*)
- ☐ Distance (in feet) from biosolids land application site boundary to nearest residence(s), other publicly occupied building(s) (e.g., retail store, school, apartment building), and public use areas such as parks or hiking trails.
- ☐ Site management agreement between the biosolids generating source and the site owner(s) of record and/or authorized representative operator.
- ☐ Site Zoning.
- ☐ Description of adjacent land uses.

SOIL INFORMATION

- ☐ USDA Natural Resources Conservation Service (NRCS) soil survey map.
- ☐ Copy of the soil survey map description for each soil series indicated on a NRCS map at the proposed land application site.
- ☐ *Not required for all sites but if available*, the most recent soil analysis (of organic matter, NO_3-N, total N, Bray or Olsen P, pH, buffer pH, trace metals from biosolids list).

AGRICULTURAL AND CROP MANAGEMENT INFORMATION

- ☐ Crop to be grown at the site and intended market (e.g., barley for seed, feed, brewing, food, or commodity sale).
- ☐ Crop assimilative capacity (nitrogen).
- ☐ Crop sequences and the time(s) of year biosolids will be land applied to the crop site.
- ☐ Crop harvest method (e.g., silage vs. pasture) and tilling practices.
- ☐ Irrigation practices and fertilizer use.
- ☐ *Not required but if* available, typical harvest information (e.g., quantity, protein content) from site.

BIOSOLIDS AND LAND APPLICATION INFORMATION

- ☐ Biosolids characteristics from the most recent biosolids analyses, including data on:
  - Total kjeldahl nitrogen, nitrate nitrogen, ammonium nitrogen, total phosphorus, potassium, total solids, volatile solids (expressed as percent dry weight), pH; and
  - Arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, and if required, silver and chromium (expressed as mg/kg dry weight).
- ☐ Forecast of first year biosolids application rate (gallons or dry tons/acre/year).
- ☐ Nutrient and metal loadings based on biosolids analyses and total acreage land applied for the year.
- ☐ Calculations used for forecasting annual biosolids application rate.
- ☐ Site life calculations (if applicable).
- ☐ Field staging and/or storage practices (if applicable).

PUBLIC PARTICIPATION INFORMATION

- ☐ Documentation on Public Notification, including:
  - Copy of any written notification materials
  - Who received notification (including name, address, and telephone number, if known)
  - How notification was made (e.g., information flyer left at the door, mail, conversation with occupant, etc.)
  - Date and, for direct contacts, time of notification
  - Summary of any responses to notification and how they were addressed

EQUIPMENT

5) Soil sample the field(s) to determine the need.
   a) Sample for nutrients and metals before any application.
   b) “Report card” soil sample. Western WA uses a report card.
   c) Requirements verses BMP for biosolids.
6) Calibrate spreading equipment or insure that it has been accurately done by contractor.
7) Finish up –
   a) Invoice farmer cooperator for services, and determine job satisfaction.
   b) Deliver farmer completion report detailing nutrients supplied.
   c) Prepare annual report for state.

SOIL TESTING

REPORT NUMBER

ACCOUNT

Midwest Laboratories Inc.®
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www.midwestlabs.com

IDENTIFICATION

ONEILL SUSTAINABLE AG CNSLTING
DENNIS ONEILL
4804 NW BETHANY BLVD/I2-118
PORTLAND OR 97229

Joe Farmer
SHERMAN COUNTY

SOIL ANALYSIS REPORT

INFO SHEET: 656083

LAB NUMBER *270*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P, (WEAK BRAY) 1:7 ppm	RATE	P, (STRONG BRAY) 1:7 ppm	RATE	OLSEN (BICARBONATE) P ppm	RATE	POTASSIUM (NEUTRAL AMMONIUM ACETATE/DTPA EXTRACTABLE) K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
66496	4MF17-WR	1.2	VL	35	VH	85	VH			312	VH	285	VH	1384	H			6.7		10.1	7.9	23.5	68.6	0.0	
66499	4MF23-SE	1.2	VL	31	VH	83	VH			274	VH	330	VH	1519	M			5.8	6.7	13.6	5.2	20.2	55.8	18.8	
66502	MMR07-HE	1.2	VL	31	VH	77	VH			223	VH	332	VH	1507	M			5.8	6.7	13.5	4.2	20.5	55.8	19.5	

LAB NUMBER *270*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B BORO. DTPA ppm	RATE	EXCESS LIME RATE	SOLUBLE SALTS 1:1 mmhos/cm	RATE
66496	3	11	0-12	1	4	12-24	1	4	24-36	19	22	H													
66499	2	7	0-12	1	4	12-24	1	4	24-36	15	18	M													
66502	2	7	0-12	1	4	12-24	1	4	24-36	15	13	M													

REV 12/03

The above analytical results apply only to the sample(s) submitted. Samples are retained a maximum of 30 days.

Report Number:

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Analysis Performed	As Received	Dry Weight Basis	Units	Detection Limit	Method	Analyst Date	Verifier Date
Lab number: 2332161 Sample ID: 4MF17-WR							
Percent solids	100.0		%	0.01	SM 2540 G	bjs/10-27	mjs/10-28
Arsenic (total)	10.5	10.5	mg/kg	10	EPA 6010	ras/10-24	kkh/10-24
Cadmium (total)	1.33	1.33	mg/kg	0.5	EPA 6010	ras/10-24	kkh/10-24
Copper (total)	15.6	15.6	mg/kg	1	EPA 6010	ras/10-24	kkh/10-24
Chromium (total)	21.7	21.7	mg/kg	1	EPA 6010	ras/10-24	kkh/10-24
Lead (total)	8.6	8.6	mg/kg	5	EPA 6010	ras/10-24	kkh/10-24
Mercury (total)	n.d.	n.d.	mg/kg	0.05	EPA 7471	ccm/10-24	kkh/10-24
Molybdenum (total)	n.d.	n.d.	mg/kg	1	EPA 6010	ras/10-24	kkh/10-24
Nickel (total)	16.2	16.2	mg/kg	1	EPA 6010	ras/10-24	kkh/10-24
Selenium (total)	n.d.	n.d.	mg/kg	10	EPA 6010	ras/10-24	kkh/10-24
Zinc (total)	49.5	49.5	mg/kg	1	EPA 6010	ras/10-24	kkh/10-24
Lab number: 2332162 Sample ID: 4MF23-SE							
Percent solids	100.0		%	0.01	SM 2540 G	bjs/10-27	mjs/10-28
Arsenic (total)	n.d.	n.d.	mg/kg	10	EPA 6010	ras/10-24	kkh/10-24
Cadmium (total)	1.26	1.26	mg/kg	0.5	EPA 6010	ras/10-24	kkh/10-24
Copper (total)	15.4	15.4	mg/kg	1	EPA 6010	ras/10-24	kkh/10-24
Chromium (total)	22.9	22.9	mg/kg	1	EPA 6010	ras/10-24	kkh/10-24
Lead (total)	7.6	7.6	mg/kg	5	EPA 6010	ras/10-24	kkh/10-24
Mercury (total)	n.d.	n.d.	mg/kg	0.05	EPA 7471	ccm/10-24	kkh/10-24
Molybdenum (total)	n.d.	n.d.	mg/kg	1	EPA 6010	ras/10-24	kkh/10-24
Nickel (total)	16.7	16.7	mg/kg	1	EPA 6010	ras/10-24	kkh/10-24
Selenium (total)	n.d.	n.d.	mg/kg	10	EPA 6010	ras/10-24	kkh/10-24
Zinc (total)	50.3	50.3	mg/kg	1	EPA 6010	ras/10-24	kkh/10-24

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SOIL ANALYSIS REPORT

INFO SHEET: 478016

LAB NUMBER *240*	SAMPLE IDENTIFICATION	ORGANIC MATTER L.O.I. percent	RATE	PHOSPHORUS P1 (MEHLICH / BRAY I) 1:7 ppm	RATE	P2 (STRONG / BRAY) 1:7 ppm	RATE	OLSEN (BICARBONATE P) ppm	RATE	NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE) POTASSIUM K ppm	RATE	MAGNESIUM Mg ppm	RATE	CALCIUM Ca ppm	RATE	SODIUM Na ppm	RATE	pH SOIL pH 1:1	BUFFER INDEX	CATION EXCHANGE CAPACITY C.E.C. meq/100g	PERCENT BASE SATURATION (COMPUTED) % K	% Mg	% Ca	% H	% Na
64541	KDJ07-12	3.0	M	38	VH	54	H			121	M	313	VH	1911	M			5.6	6.6	16.3	1.9	16.0	58.6	23.5	

LAB NUMBER *240*	NITRATE-N (FIA) SURFACE ppm	SURFACE lbs/A	SURFACE depth (in)	SUBSOIL 1 ppm	SUBSOIL 1 lbs/A	SUBSOIL 1 depth (in)	SUBSOIL 2 ppm	SUBSOIL 2 lbs/A	SUBSOIL 2 depth (in)	Total lbs/A	SULFUR S ICAP ppm	RATE	ZINC Zn DTPA ppm	RATE	MANGANESE Mn DTPA ppm	RATE	IRON Fe DTPA ppm	RATE	COPPER Cu DTPA ppm	RATE	BORON B BOBB. DTPA ppm	RATE	EC(1:1) mmhos/cm	SOLUBLE SALTS 1:1 mmhos/cm	RATE
64541	6	22	0-12	8	29	12-24	4	14	24-36	65	20	H													

REV 12-03

The above analytical results apply only to the sample(s) submitted. Samples are retained a maximum of 30 days.

Nutrient Management Decisions

1. pH – Below 6.0 in high rainfall areas verses arid regions.
2. Nitrogen needs for each crop. OSU guidelines. https://catalog.extension.oregonstate.edu/topic/agriculture/fertilizer-guides
3. Phosphorus concerns.

QUESTIONS:

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