Ohio Phosphorus Rules
Introduction

Bruce MacLeod  
Technical Services Director  
Synagro Central  
(937) 361-0972  
bmacleod@synagro.com
• “Phosphorus index”
• -means the Ohio natural resources conservation service (NRCS) assessment technique for determining the relative risk of phosphorus movement from various landforms to waters of the state.

3745-40-01 (ZZZ)
• Ohio Biosolids Rules

• Ohio EPA

  http://epa.ohio.gov/dsw/rules/3745_40.aspx

  http://epa.ohio.gov/dsw/sludge/biosolid.aspx
Ohio Phosphorus Rules

Why Phosphorus Rules are Important

Ohio Biosolids Rules and How they Work

Impacts on Land Application

Future
Phosphorus is Back!

New Term - Dissolved Reactive Phosphorus (DRP)

From: Ohio Lake Erie Phosphorus Task Force II Final Report
October 2013,
What is causing the harmful algal blooms in Lake Erie?

- Climate change
- Commodity prices
- Cropping systems
- Crop nutrient efficiency
- Ethanol production
- Fertilizer placement
- Fertilizer rates
- Fertility recommendations
- Fertilizer sources
- Round-Up ready crops
- Increased soil pH
- Larger farm sizes
- Decrease sediment loading to water
- Manure
- Misconceptions by researchers about P
- Nitrogen
- No-Till
- Rental Agreements
- Products sold to increase fertilizer and Soil P availability
- Alterations to soil biology
- Soil testing and analysis
- Phosphorus stratification in soils
- Tile drainage
- Zebra mussels

From: Smith, Douglas; King, Kevin; Williams, Mark, What is causing harmful algal blooms in Lake Erie?
Submitted to Journal of Soil and Water Conservation 01/16/2015
http://www.ars.usda.gov/research/publications/publications.htm?SEQ_NO_115=312591
Phosphorus Runoff Risks

- Phosphorus Runoff
- Maintain low runoff (effluent concentration)
- Less than 1 mg/l

1. High Soil Test Phosphorus
2. Phosphorus Application

Figure 7-1. Relationship between offsite phosphorus transport and soil test phosphorus for sites where broadcast applications of phosphorus amendments were applied within 3 weeks and where no phosphorus amendments were applied for at least 6 months.

Adapted from: Ohio Lake Erie Phosphorus Task Force II Final Report October 2013,
• Ohio Biosolids Rules Addressing Phosphorus

Rules Adopted January 4, 2011
Effective July 1, 2011, and July 1, 2013

1. Biosolids Analysis
2. Soil Testing
3. Apply biosolids using agronomic application rates
4. No application on frozen or snow covered ground
5. No application before a predicted rain
6. Apply in contact with the soil avoid surface application on bare soil
7. Manage application on tile drained fields
This form is to assist compliance with the bulk sewage sludge (biosolids) notification requirements [40 CFR 503.12(f) and OAC 3745-40-05(A)]. This form can be used by a permittee to provide information to the initial person who receives biosolids.

Permittee Name: **Plant Y**

Address: **123 Biosolids Drive**

Telephone: **1-614-123-1234**

Ohio NPDES No.: **xxx-xx-xxxx**

Facility and Biosolids Type: **Anaerobically digested**

Monitoring Period: **From: 1-1-12** to **To: 6-30-12**

The material you are receiving is or contains biosolids that have been treated to meet the requirements in Chapter 3745-40 of the Administrative Code. The beneficial use, further treatment, storage, transfer or disposal of these biosolids shall be in accordance with Chapter 3745-40 of the Ohio Administrative Code.

A. Provide Concentrations

<table>
<thead>
<tr>
<th>Parameter Name</th>
<th>Concentration (mg/kg) Dry Weight Basis</th>
<th>Pollutant Concentrations (Table 3, 40 CFR 503.13) (Table D-3, OAC 3745-40-04(D)) (monthly average)</th>
<th>Ceiling Concentrations* (Table 1, 40 CFR 503.13) (Table D-1, OAC 3745-40-04(D)) (maximum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>6</td>
<td>41 mg/kg</td>
<td>75 mg/kg</td>
</tr>
<tr>
<td>Cadmium</td>
<td>5</td>
<td>39 mg/kg</td>
<td>85 mg/kg</td>
</tr>
<tr>
<td>Copper</td>
<td>530</td>
<td>1500 mg/kg</td>
<td>4300 mg/kg</td>
</tr>
<tr>
<td>Lead</td>
<td>80</td>
<td>300 mg/kg</td>
<td>840 mg/kg</td>
</tr>
<tr>
<td>Mercury</td>
<td>2</td>
<td>17 mg/kg</td>
<td>57 mg/kg</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>25</td>
<td>N/A**</td>
<td>75 mg/kg</td>
</tr>
<tr>
<td>Nickel</td>
<td>62</td>
<td>420 mg/kg</td>
<td>420 mg/kg</td>
</tr>
<tr>
<td>Selenium</td>
<td>8</td>
<td>100 mg/kg</td>
<td>100 mg/kg</td>
</tr>
<tr>
<td>Zinc</td>
<td>2200</td>
<td>2800 mg/kg</td>
<td>7500 mg/kg</td>
</tr>
<tr>
<td><strong>Total Kjehldahl Nitrogen</strong></td>
<td><strong>66000 mg/kg</strong></td>
<td><strong>N/A</strong></td>
<td><strong>N/A</strong></td>
</tr>
<tr>
<td><strong>Ammonia Nitrogen</strong></td>
<td><strong>28000 mg/kg</strong></td>
<td><strong>N/A</strong></td>
<td><strong>N/A</strong></td>
</tr>
<tr>
<td><strong>Total Phosphorus</strong></td>
<td><strong>23210 mg/kg</strong></td>
<td><strong>N/A</strong></td>
<td><strong>N/A</strong></td>
</tr>
<tr>
<td><strong>Total Potassium</strong></td>
<td><strong>3000 mg/kg</strong></td>
<td><strong>N/A</strong></td>
<td><strong>N/A</strong></td>
</tr>
</tbody>
</table>

B. Pathogen Reduction (40 CFR 503.32 and OAC 3745-40-05(B)) -- Please indicate the level achieved and the alternative met.
Biosolids phosphorus levels vary greatly between Wastewater plants - 30 WWTP biosolids sampled

**Total P**

- Maximum: 40,000 ppm
- Average: 18,218 ppm
- Minimum: 1380 ppm
- Std Dev: 9619

**Case Studies**

- High: 40,000 ppm
- Med: 20,000 ppm
- Low: 10,000 ppm
Soil Sampling

Runoff dissolved P concentration and load are strongly correlated to soil Test P

- Current Soil Samples
  - Less than 3 years old
- Representative
  - Soil type
  - Topography
  - Cropping
  - Max 20 acre area
### SOIL TEST REPORT

**Report Number:** F12336-0001  
**Account Number:** 86518

**To:** SYNAGRO  
**Grower Code:** FARMER  
**Grower:** JOE FARMER  
**Farm:** FARMER  
**Field:** DE-00-00  
**Date Reported:** 12/04/2012

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Lab Number</th>
<th>Organic Matter</th>
<th>Phosphorus</th>
<th>Potassium</th>
<th>Magnesium</th>
<th>Calcium</th>
<th>Sodium</th>
<th>pH Soil</th>
<th>pH Buffer</th>
<th>Cation Exchange Capacity (meq/100g)</th>
<th>Base Saturation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10111</td>
<td>2.5 L</td>
<td>28 M</td>
<td>186 H</td>
<td>222 M</td>
<td>2800 H</td>
<td></td>
<td>6.8</td>
<td>16.8</td>
<td>2.8 11.0 83.2 3.0</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>10112</td>
<td>2.8 M</td>
<td>50 VH</td>
<td>210 H</td>
<td>245 M</td>
<td>3200 H</td>
<td></td>
<td>6.7</td>
<td>19.8</td>
<td>2.7 10.3 80.9 6.1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>10113</td>
<td>2.2 L</td>
<td>112 VH</td>
<td>188 H</td>
<td>230 M</td>
<td>2400 M</td>
<td></td>
<td>6.4</td>
<td>16.8</td>
<td>2.9 11.4 71.4 14.3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>10114</td>
<td>3.6 M</td>
<td>152 VH</td>
<td>345 VH</td>
<td>220 L</td>
<td>3700 H</td>
<td></td>
<td>6.8</td>
<td>21.9</td>
<td>4.0 8.4 84.6 3.0</td>
<td></td>
</tr>
</tbody>
</table>
Agronomic Rates

- Ohio EPA Developed Worksheet
- Based on Phosphorus removal by crops
- Tri-State Fertilizer Recommendations
  - Michigan State University
  - The Ohio State University
  - Purdue University
- Example:
  - Corn crop removes 0.37 lb P₂O₅/Bushel
  - 200 Bushel Crop
  - 200 x 0.37 = 74 lbs P₂O₅ removed per acre
- (DRP loss average 1.5 lbs/acre)
Agronomic Rates

Biosolids Agronomic Rate - Based on Soil Analysis

150 ppm Bray P1
170 ppm Mehlich 3
100 ppm Bray P1
115 ppm Mehlich 3
40 ppm Bray P1
45 ppm Mehlich 3
Application Rates
Sample 1
28 ppm Bray P1

<40 ppm Bray P1
(45 ppm Mehlich 3)

<table>
<thead>
<tr>
<th>Limiting Rate (Lowest of)</th>
<th>Low P Biosolids</th>
<th>Med P Biosolids</th>
<th>High P Biosolids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen Agronomic Rate</td>
<td>4.53</td>
<td>4.53</td>
<td>4.53</td>
</tr>
<tr>
<td>0 – 250 Phosphate</td>
<td>5.46</td>
<td>3.03</td>
<td>1.36</td>
</tr>
<tr>
<td>256 - 500 phosphate*</td>
<td>10.92</td>
<td>6.07</td>
<td>2.73</td>
</tr>
</tbody>
</table>

* - 256-500  - If injected or incorporated within 24 hours or:
• Greater than 50% ground cover at the time of application
Application Rates
Sample 2
50 ppm Bray P1

>40 ppm Bray P1
(45 ppm Mehlich 3)
Up to 100 ppm Bray P1
(115 Mehlich 3)

<table>
<thead>
<tr>
<th>Limiting Rate (Lowest of)</th>
<th>Low P Biosolids</th>
<th>Med P Biosolids</th>
<th>High P Biosolids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen Agronomic Rate</td>
<td>4.53</td>
<td>4.53</td>
<td>4.53</td>
</tr>
<tr>
<td>Multi-year phosphate agronomic rate</td>
<td>7.69</td>
<td>4.27</td>
<td>1.92</td>
</tr>
</tbody>
</table>

* - 256-500 - If injected or incorporated within 24 hours or:
• Greater than 50% ground cover at the time of application
Application Rates – Dry Tons per acre

>100 ppm Bray P1
(115 ppm Mehlich 3)
Up to 150 ppm Bray P1
(170 Mehlich 3)

<table>
<thead>
<tr>
<th>Limiting Rate (Lowest of)</th>
<th>Low P Biosolids</th>
<th>Med P Biosolids</th>
<th>High P Biosolids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen Agronomic Rate</td>
<td>4.53</td>
<td>4.53</td>
<td>4.53</td>
</tr>
<tr>
<td>Single year phosphate agronomic rate</td>
<td>2.10</td>
<td>1.16</td>
<td>0.52</td>
</tr>
</tbody>
</table>

* - 256-500 - If injected or incorporated within 24 hours or:
  • Greater than 50% ground cover at the time of application
Application Rates – Dry Tons per acre

>150 ppm Bray P1
(170 ppm Mehlich 3)

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<th>Limiting Rate (Lowest of)</th>
<th>Low P Biosolids</th>
<th>Med P Biosolids</th>
<th>High P Biosolids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphorus Index Rate</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>
Agronomic Rates

Application Rate - Gallons Per Acre

<table>
<thead>
<tr>
<th></th>
<th>Soil Bray P1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>28</td>
</tr>
<tr>
<td>Biosolids High</td>
<td>12847</td>
</tr>
<tr>
<td>Phosphorus Med</td>
<td>21317</td>
</tr>
<tr>
<td>Phosphorus Low</td>
<td>21317</td>
</tr>
</tbody>
</table>
Agronomic Rates

**Acres Required - 1,000,000 Gallons**

<table>
<thead>
<tr>
<th>Soil Bray P1</th>
<th>Biosolids High</th>
<th>Phosphorus Med</th>
<th>Phosphorus Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>78</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>50</td>
<td>111</td>
<td>50</td>
<td>47</td>
</tr>
<tr>
<td>112</td>
<td>409</td>
<td>183</td>
<td>101</td>
</tr>
</tbody>
</table>
No Application on Frozen or Snow Covered Soil

- No surface application of bulk biosolids from December 15 to March 1
- Biosolids must be done using injection or same day incorporation during this period
- Ground that can be tilled to a depth of 4 inches is not frozen
No Application Before a Predicted Rain Event

- Surface Application
- Does not apply if injected or incorporated
- Use Forecast graph from NOAA (weather.gov)
- Stop application on a dry sunny day?
Soil Contact and Surface Application

- Ohio EPA allows a 50 percent credit on phosphorus application if the biosolids are injected or incorporated within 24 hours
- Encourages injection or incorporation
  - Public Relations
  - Soil contact
- Credit on phosphorus also justified based on water extractable phosphorus (solubility) of biosolids P compared to other forms of fertilizer
Soil Contact

**Source P Solubility**

From: Water Environment Federation Factsheet – Phosphorus in Biosolids May 2014
Soil Contact

P Runoff Comparison: Manure vs Biosolids

From: Water Environment Federation Factsheet – Phosphorus in Biosolids May 2014
Application on Tile Drained Fields

• For Liquid Application
• Visually monitor tile outlets
  – Methods to stop or capture flow shall be accessible
• Apply less than 0.5 inch (13,000 gallons per acre)
• Tillage or tool to disrupt or close preferential flow paths
• If injected, only deep enough to cover the biosolids and till at least 3 inches below the depth of injection
• If tillage is not an option
  – Plug tile outlets

Photo by Lynn Belts, USDA Natural Resources Conservation Service
Ohio Phosphorus Task Force

- **Final Report**
  - Published November 2013

- “Super 7 strategies”

- Soil Test
- Follow Tri-State recommendations
- No application on snow covered/frozen ground and do not apply before a rain event
- Fertilizer placement to ensure contact with soil and avoid surface application
- Develop soil health to increase infiltration and reduce runoff
- Manage tile drainage to minimize phosphorus transport
- Utilize trapping practices to slow down and retain water runoff

Ohio EPA Biosolids Rules
Adopted January 4, 2011

- Biosolids Analysis
- Soil Testing
- Apply biosolids using agronomic application rates
- No application on frozen or snow covered ground
- No application before a predicted rain
- Apply in contact with the soil avoid surface application on bare soil
- Manage application on tile drained fields
Other Rules

- **Ohio Senate Bill 1 (HB 61)**
  - Passed by Senate February 18, 2015
  - Fertilizer
  - Western Lake Erie watersheds
  - No application on frozen and snow covered ground
  - No application on saturated soils
  - No application before predicted rainfall

- **Ohio Fertilizer Applicator License**
  - Effective 2017
  - Application of fertilizer to greater than 50 acres will require a licensed applicator

- **4R Certification**
  - Voluntary – Fertilizer dealer
  - Using the Right Source of Nutrients at the Right Rate and Right Time in the Right Place

- **Other**
Synagro is the Nation’s largest and most experienced Residuals Management Firm.

Synagro Experience and Assets

- Over 600 municipal and industrial clients in 38 states
- Manage over 11 million tons of biosolids annually
- 6 Regional biosolids processing facilities
- 9 Class A drying/pelletizing single-customer facilities

- Over 70 permanent and mobile dewatering locations
- Permitted land base of over 900,000 acres
- Over $350 million in annual revenues
- $3 billion contract backlog
- Member of EQT Infrastructure Group
BROAD SERVICE OFFERINGS

Synagro offers all commercially viable residuals management options

- Heat Drying and Pelletization
- Composting
- Product Marketing
- Incineration
- Land Application
- Mobile and Stationary Dewatering
- Lagoon and Digester Clean-outs
- Stabilization Services
  - Alkaline Stabilization
  - Digestion
- Transportation and Disposal Services
- Gas Shale Services
THANK YOU