Standard Methods for Sewage Sludge
(...or what has changed)

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BACKGROUND

- Federal Register/Vol. 77, No. 97/ Friday, May 18, 2012/ Rules and Regulations
- EPA methods 1680, 1681 and 1682 were included as new methods.
- Changes to NR 219 approved by NRB 10-23-2019
- Governor’s approval 12/5/2019

After a lot of muddlement in 2020 (Legislature opting to adjourn until 2021 on 2/21/20, COVID pandemic)

Rule change finally published in the July Administrative Register, making it effective August 1, 2020

Register July 2020 No. 775
3 Main changes involved

APPROVED METHODS
HOLDING TIME
USE OF GEOMEAN
### TABLE IA—LIST OF APPROVED BIOLOGICAL METHODS FOR WASTEWATER AND SEWAGE SLUDGE

<table>
<thead>
<tr>
<th>Parameter and units</th>
<th>Method</th>
<th>EPA</th>
<th>Standard methods</th>
<th>AOAC, ASTM, USGS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bacteria:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Coliform (fecal), number per 100 mL or number per gram dry weight</td>
<td>Most Probable Number (MPN), 5 tube, 3 dilution, or Membrane filter (MF), single step</td>
<td>p. 132³</td>
<td>9221 C E–2006.</td>
<td>1680¹¹,¹⁵,¹⁶⁸¹¹¹,²⁰.</td>
</tr>
</tbody>
</table>

*Added 3 new EPA methods, 2 for Fecals, 1 for Salmonella*
NR 219...prior to this rule change

Wait...so if these methods were already in NR 219, why are these considered “new” changes?

<table>
<thead>
<tr>
<th>Parameter and units</th>
<th>Analytical Technology 1</th>
<th>EPA</th>
<th>Standard Methods 27</th>
<th>AOAC, ASTM, USGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacteria:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Coliform (fecal), number per 100 mL or</td>
<td>Most Probable Number</td>
<td>p. 132 3</td>
<td>9221 C–2006</td>
<td></td>
</tr>
<tr>
<td>number per gram dry weight</td>
<td>(MPN), 5 tube, 3 dilution, or</td>
<td>1680 11,15</td>
<td>9221 E–2006</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Membrane filter (MF) 2,</td>
<td>p. 124 3</td>
<td>9222 D–1997</td>
<td>B–0050–85 4</td>
</tr>
<tr>
<td></td>
<td>single step</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Salmonella, number per gram dry weight</td>
<td>MPN multiple tube</td>
<td>1682 23</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NR 219 Previous BioSolids Methods

The problem is a disconnect between Table A and Table EM

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Analytical Technology</th>
<th>Sample Preparation</th>
<th>Determinative Method</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fecal Coliform</td>
<td>Most Probable Number</td>
<td>SW–8461</td>
<td>SW–846 (^1)</td>
<td>9221 E [18,19, 20,21], 9221 E–99, 9222 D, 9222 D–97</td>
</tr>
<tr>
<td></td>
<td>Membrane Filter</td>
<td>EPA</td>
<td>EPA 2,3</td>
<td>Appendix F(^{10})</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Standard Methods [ed.] 8,9</td>
<td></td>
</tr>
<tr>
<td>Salmonella</td>
<td>Most Probable Number</td>
<td></td>
<td></td>
<td>9260 D.1(^{8})</td>
</tr>
<tr>
<td></td>
<td>Selective Media Culture</td>
<td></td>
<td></td>
<td>Appendix G(^{10})</td>
</tr>
</tbody>
</table>

Did anyone catch the difference in Std Methods approved editions between Tables A and EM?
## Table EM
List of Approved Analytical Methods for Sludge

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sample Preparation</th>
<th>Determinative Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coliform (fecal), number per gram dry weight</td>
<td>Most Probable Number (MPN), 5 tube, 3 dilution, or</td>
<td>p. 132&lt;sup&gt;16&lt;/sup&gt; 1680&lt;sup&gt;11,17&lt;/sup&gt; 1681&lt;sup&gt;11,18&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Membrane filter (MF)&lt;sup&gt;21,22&lt;/sup&gt; single step</td>
<td>p. 124&lt;sup&gt;16&lt;/sup&gt;</td>
</tr>
<tr>
<td>Salmonella number per gram dry weight&lt;sup&gt;11&lt;/sup&gt;</td>
<td>MPN multiple tube</td>
<td>1682&lt;sup&gt;20&lt;/sup&gt;</td>
</tr>
</tbody>
</table>
It gets confusing!
NR 219 v. 40 CFR Part 136

• In 40 CFR Part 136, Table IA is for wastewater AND sludge
• In NR 219, Table A says it’s for wastewater AND sludge, BUT... there is a Table EM that addresses approved methods for sludge
• There is no Table EM in 40 CFR Part 136
Confusion resolved: REVISED NR 219 rules

Now the approved methods (SM editions) in the two tables will agree!
HOLDING TIMES

This is a tricky part to navigate, since NR 219 is not structured perfectly parallel to Federal Code
There is no Holding Time Table parallel in 40 CFR (federal rules) for Biosolids... ...AND... you have to look at the footnotes!

### NR 219 Table F – Holding Time

Holding Time changes from 6 hrs to 8 hrs

<table>
<thead>
<tr>
<th>Parameter Number/Name</th>
<th>Container</th>
<th>Preservation</th>
<th>Maximum Holding Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5. Coliform, total, fecal and E. coli</td>
<td>PA, G</td>
<td>Cool, &lt;10°C, 0.0008%, Na₂S₂O₃⁵</td>
<td>8 hours</td>
</tr>
<tr>
<td>8. Salmonella</td>
<td>PA, G</td>
<td>Cool, &lt;10°C, 0.0008%, Na₂S₂O₃⁵</td>
<td>8 hours</td>
</tr>
</tbody>
</table>
Sample analysis should begin as soon as possible after receipt; sample incubation must be started no later than 8 hours from time of collection.

For fecal coliform samples for sewage sludge (biosolids) only, the holding time is extended to 24 hours for the following sample types using either EPA Method 1680 (LTB–EC) or 1681 (A–1):

Class A composted,
Class B aerobically digested,
Class B anaerobically digested

Class A, B refers to the quality of the biosolids with respect to pathogens.
8 v. 24 hr Hold Time

So....for Fecal Coliforms only...

**IF**

- You use EPA Methods 1680 or 1681 (*i.e. not Std Methods*)

**AND** you are analyzing any of the following biosolids:

- Class A composted,
- Class B aerobically digested, or
- Class B anaerobically digested.

**THEN**...

- The Holding Time can be extended to 24 hrs
What the Methods Say

Standard Methods 9221E (MFT) and 9222D (MPN) direct the user to Standard Methods 9060A,B for Holding Time requirements:

9060 B. Preservation and Storage
1. c. Nonpotable water for compliance purposes:
   For bacterial samples in wastewater sludge (fecal coliforms and Salmonella sp.) the regulatory holding time is 24 h.

Statutes ➔ Administrative Code (NR xxx) ➔ Methods
QUESTIONS ON USE OF GEOMEAN
(but what else to do?)
NR 204.07(6)(a) is **incorrect** with respect to federal code:
- **a geometric mean cannot be used for Class A samples.**

NR 204.07(6)(a). The sludge shall have a fecal coliform density \( \leq 1,000 \text{ (MPN) / g} \) of total solids on a dry weight basis. **Compliance shall be demonstrated by calculating the geometric mean of at least 7 separate samples;**

**Federal Code (40 CFR Part 503) 503.32 Pathogens.**

(a) *Sewage sludge—Class A.* (1) The requirement in §503.32(a)(2) and the requirements in either §503.32(a)(3), (a)(4), (a)(5), (a)(6), (a)(7), or (a)(8) shall be met for a sewage sludge to be classified Class A with respect to pathogens.

(b) *Sewage sludge—Class B.* (1)(i) The requirements in either §503.32(b)(2), (b)(3), or (b)(4) shall be met for a sewage sludge to be classified Class B with respect to pathogens.

(a) Sewage sludge—Class A.

503.32 (a)(3) Class A—Alternative 1. (i) Either the density of fecal coliform in the sewage sludge shall be <1000 MPN/g of total solids (dry weight basis), or the density of Salmonella sp. bacteria shall be < 3 MPN/4g of total solids (dry weight basis) at the time the sewage sludge is used or disposed;

(b) Sewage sludge—Class B.

(2) Class B—Alternative 1.

(i) 7 representative samples of the sewage sludge used/disposed shall be collected.

(ii) The geometric mean of the density of fecal coliform in the samples ... shall be less than either 2,000,000 MPN/ g of total solids (dry weight) or 2,000,000 CFU/g of total solids (dry weight basis).
If you can’t perform a geomean, what is the alternative?

A single (hopefully representative) sample?

Does that even make sense?

Wouldn’t we WANT good data (i.e., based on multiple samples)?

Just because federal code doesn’t mention doing a geomean on 7 samples, does that mean it’s precluded?

And...if it’s an error in NR 219 to allow it, and NR 219 is state law, isn’t it therefore allowed? Who wants to go before an ALJ and argue against this position?

Just sayin’....
Collecting samples for pathogen testing

- Class B cake storage (geomean)...fairly simple...collect from several different locations

- Class A liquid storage...again simple...representative sampling (refer to Steve Warrner’s presentation)

- Lagoon Sampling...consider one lagoon, two lagoons, etc.
Retesting for re-growth

- If distribution or land application does not occur **soon after testing**, (think bagging, storage, etc.) RETESTING for pathogens is required prior to distribution, bagging, land application.

- Sludge storage implications... *(vector attraction)*

- Have a backup plan
Vector Attraction Reduction
(Class A & B biosolids landspreading requires some measure of VAR)
Vector attraction: FLIES!!!
Vector attraction: BIRDS!!!
Vector attraction: and of course....RATS!!!
Vector attraction: and more RATS!!!
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