OVERVIEW OF MUNICIPAL AND INDUSTRIAL LAND APPLICATION RULES

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WE LIVE IN A WASTEFUL SOCIETY

- **LAND APPLICATION**
  - Regulated by DNR, EPA
  - Beneficial re-use
  - Value to the generator and farmer

- **LANDFILLING**
  - Loss of nutrients and organic matter
  - Methane generation
  - Future issues??

- **INCINERATION**
  - Emission concerns
  - Ash disposal
  - Expensive
MATERIALS MAY BE "RIGHT IN YOUR BACKYARD"

- Variety of municipal and industrial wastes
- Inexpensive supply of plant nutrients, organic matter, and/or lime
- Includes soil testing and other services
- Utilization often research based and monitored
- A contribution to society
PRODUCERS CAN ADAPT TO OPPORTUNITIES
WHAT TO ASK BEFORE APPLYING MATERIAL TO FIELDS

- **WHAT IS IT?**
  - Material source
  - Processing (C:N)
  - Previous experience

- **WHAT IS IN IT?**
  - Analysis
  - Nutrient source, lime, soil conditioner, or ?
  - Inert materials, metals, other compounds

- **APPLICATION CONSIDERATIONS?**
  - WDNR permit needed
  - Nutrient availability
  - Rate, method, timing
BENEFITS OF LANDSPREADING

- Soil testing and nutrient planning
- Soil conditioning/tilth improvement
- Full crop nutrient (N) need, plus other nutrients
- “Free” primary tillage
- Direct payment in some cases
CONCERNS ASSOCIATED WITH LANDSPREADING WASTE MATERIALS

- **EFFECTS ON THE ENVIRONMENT AND HEALTH**
  - Heavy metals, organic compounds, pathogens
  - Nutrient loading (N and P)
  - Nitrate leaching or P loss

- **EFFECTS ON CROP GROWTH**
  - Uncertain nutrient availability
  - Soil compaction
  - N immobilization from high C:N organic additions

- **AESTHETICS**
  - Odors
  - Inert additions
  - NIMBY and BANANA
OBJECTIVES OF A LANDSPREADING PROGRAM

- Provide a safe and economical alternative to land filling or other disposal methods
- Beneficially re-use nutrients and/or organic material
- Protect the quality of the soil, and surface water and groundwater
- Limit risk to public health
- Offer a cost-savings service to producers and taxpayers/industries
WDNR CODES GOVERNING LAND APPLICATION

- NR 113 – Septage/holding tanks
- NR 204 – Municipal biosolids
- NR 214 – Industrial by-products
- NR 518 – Solid waste

SITES MUST BE APPROVED AND PERMITTED PRIOR TO APPLICATION !!
## TREATED ACREAGE

<table>
<thead>
<tr>
<th>Material</th>
<th>Permitted acreage</th>
<th>Est. treated acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septage/holding tank</td>
<td>159,000</td>
<td>80,000</td>
</tr>
<tr>
<td>Biosolids</td>
<td>210,000</td>
<td>70,000</td>
</tr>
<tr>
<td>Industrial wastes</td>
<td>1,146,000</td>
<td>345,000</td>
</tr>
<tr>
<td>Solid waste</td>
<td>na</td>
<td>na</td>
</tr>
</tbody>
</table>

*Source: Fred Hegeman, WDNR*
A LAND APPLICATION PROGRAM BEGINS WITH A SITE EVALUATION

- Location of the site on an approved map with separation distances to various features
- Use of site and adjacent properties
- Ownership and acreage of the site
- Crop to be grown
- Soil series and slope
- Current UWEX soil test
MOST ORGANIC MATERIALS
APPLIED ACCORDING CROP N NEED

- Maximum application rate based on the crop N recommendation identified by the soil test
- Most materials applied to corn
  - Follow MRTN at 0.05 price ratio
- N rate depends on material
  - Biosolids: 25% of organic-N + 100% of NH₄-N. Second and third year credits
  - Industrial wastewater: Total N, unless .....
SEPTAGE MANAGEMENT

- Encouraged to take material to WWTP

- Rate based EPA recommendation
  - Low Use: 39,000 gal/a/yr
  - High Use: gal/a/yr = Crop N rate / 0.0026
  - 13,000 gal/week max. application for either

- Site requirements:
  - Setbacks from wells, structures, streams, and slope limitations
  - Soil depth and slope considerations

- Pathogen reduction by liming each load to pH 12 and cropping limitations
<table>
<thead>
<tr>
<th>Sample</th>
<th>Solids</th>
<th>TKN</th>
<th>NH4-N</th>
<th>NO3-N</th>
<th>P</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>w/ Lime</td>
<td>2.4</td>
<td>512</td>
<td>140</td>
<td>0.04</td>
<td>332</td>
<td>45</td>
</tr>
<tr>
<td>w/o Lime</td>
<td>3.2</td>
<td>431</td>
<td>122</td>
<td>0.14</td>
<td>135</td>
<td>44</td>
</tr>
</tbody>
</table>
INDUSTRIAL WASTEWATER AND SLUDGES

- LIQUID WASTES, BY-PRODUCT SOLIDS, SLUDGES
  - Fruit and vegetable processing
  - Dairy product and food processing
  - Papermill residuals

- Setbacks from wells, structures, streams, and slope limitations

- Material can not alter soil permeability

- Chloride limited to 170 lb/yr
POTATO RESPONSE TO PAPERMILL RESIDUALS

- State-wide 740,000 dry tons/yr
  - Most is landfilled

- Materials variable
  - Lime sludge
  - Primary vs. secondary fiber sludge

- C:N is a concern

EFFECT OF PAPERMILL RESIDUAL PRE-TREATMENT ON POTATO YIELD, RHINELENDER, WIS.
SOLID WASTES

- Materials are typically landfilled
- Household garbage, construction debris, foundry sand
- Permit requires:
  - Detailed chemical analysis
  - Physical description
  - Source of material
  - Pre-treatment process
  - Proof of benefit vs. detriment

Foundry sand/papermill sludge study, Kiel, Wis.

Re-vegetate a non-metallic Mine site
COLUMBIA COUNTY MSW COMPOST

RECYCLABLES SORTED

COLLECTED GARBAGE

VESSEL COMPOSTER

CURING SHED

CALIBRATED TREATMENT

PLOT LAYOUT
EFFECT OF MSW COMPOST MATURITY AND RATE ON CORN GRAIN YIELD, (PORTAGE, WIS.)

![Graph showing the effect of MSW compost maturity and rate on corn grain yield. The graph includes data from 1993 and 1994, with yields in bushels per acre (bu/a) and compost rate in tons dry matter per acre (T DM/A). The graph distinguishes between fresh, 6-week mature, and mature compost stages.]
ALL WISCONSIN COMMUNITIES (AND SOME INDUSTRIES) HAVE FACILITIES THAT BIOLOGICALLY TREAT WASTEWATER

Fond du Lac WWTP
WHAT ARE BIOSOLIDS

Biosolids are the by-products of the biological treatment of organic wastes.

They are composed of organic material, plant nutrients, and other elements which reflect the origin of the waste.

Typically from sewage, however other organic wastewaters can be processed to produce similar materials.

Biosolids are a product of our current best technology of managing wastewater. Land application is encouraged.
BIOSOLIDS CATEGORIES

**CLASS “A”**

**MANAGED FOR:**
- PATHOGENS
- HEAVY METALS
- VECTOR ATTRACTION

**CLASS “B”**
MANAGING HEALTH RISK

There is a potential for pathogenic organisms and heavy metals in biosolids.

Access to “Class B” biosolids amended land is determined by the type of crop grown and whether the biosolids are incorporated into the soil.

Adjust soil pH and limit concentration to reduce heavy metal risk.
### TIME BETWEEN APPLICATION AND CROP HARVEST ON CLASS B BIOSOLIDS TREATED LAND

<table>
<thead>
<tr>
<th>CROP SITUATION</th>
<th>WAIT PERIOD (mo.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food crop touching soil</td>
<td>14</td>
</tr>
<tr>
<td>(beans, melons)</td>
<td></td>
</tr>
<tr>
<td>Food crop grown in soil</td>
<td>20/38</td>
</tr>
<tr>
<td>(potato, carrot)</td>
<td></td>
</tr>
<tr>
<td>Other (field corn, hay</td>
<td>1</td>
</tr>
<tr>
<td>sweet corn)</td>
<td></td>
</tr>
<tr>
<td>Livestock grazing</td>
<td>1</td>
</tr>
<tr>
<td>Public access</td>
<td></td>
</tr>
<tr>
<td>– High potential</td>
<td>12</td>
</tr>
<tr>
<td>– Low potential</td>
<td>1</td>
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</tbody>
</table>
## SELECTED SITE RESTRICTIONS FOR BIOSOLIDS APPLICATION (NR 204)

<table>
<thead>
<tr>
<th>SITE CRITERIA</th>
<th>SURFACE</th>
<th>INCORP.</th>
<th>INJECTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEDROCK</td>
<td>3 ft.</td>
<td>3 ft.</td>
<td>3 ft.</td>
</tr>
<tr>
<td>GROUNDWATER</td>
<td>3 ft.</td>
<td>3 ft.</td>
<td>3 ft.</td>
</tr>
<tr>
<td>WATER SETBACK</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– 0-6 % SLOPE</td>
<td>200 ft.</td>
<td>150 ft.</td>
<td>100 ft.</td>
</tr>
<tr>
<td>– 6-12 % SLOPE</td>
<td>NA</td>
<td>200 ft.</td>
<td>150 ft.</td>
</tr>
<tr>
<td>SLOPE</td>
<td>0-6 %</td>
<td>0-12 %</td>
<td>0-12 %</td>
</tr>
<tr>
<td>COMM. WELL</td>
<td>1000 ft.</td>
<td>1000 ft.</td>
<td>1000 ft.</td>
</tr>
<tr>
<td>PRIVATE WELL</td>
<td>250 ft.</td>
<td>250 ft.</td>
<td>250 ft.</td>
</tr>
<tr>
<td>SCHOOLS</td>
<td>1000 ft.</td>
<td>1000 ft.</td>
<td>500 ft.</td>
</tr>
<tr>
<td>PROPERTY LINES</td>
<td>50 ft.</td>
<td>25 ft.</td>
<td>25 ft.</td>
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# Heavy Metals in Biosolids

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>CEILING CONC.</th>
<th>APPLETON</th>
<th>WAUPACA</th>
<th>WEYAWEGA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>75</td>
<td>3.8</td>
<td>7.3</td>
<td>2.0</td>
</tr>
<tr>
<td>Cadmium</td>
<td>85</td>
<td>2.0</td>
<td>8.1</td>
<td>0.5</td>
</tr>
<tr>
<td>Copper</td>
<td>4300</td>
<td>403</td>
<td>700</td>
<td>68</td>
</tr>
<tr>
<td>Lead</td>
<td>840</td>
<td>74</td>
<td>41</td>
<td>6.8</td>
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<tr>
<td>Mercury</td>
<td>57</td>
<td>1.2</td>
<td>1.1</td>
<td>0.4</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>75</td>
<td>2.3</td>
<td>bd</td>
<td>6.8</td>
</tr>
<tr>
<td>Nickel</td>
<td>420</td>
<td>24</td>
<td>16</td>
<td>8.0</td>
</tr>
<tr>
<td>Selenium</td>
<td>100</td>
<td>1.4</td>
<td>2.7</td>
<td>1.1</td>
</tr>
<tr>
<td>Zinc</td>
<td>7500</td>
<td>709</td>
<td>820</td>
<td>123</td>
</tr>
</tbody>
</table>
BIOSOLIDS AND PHOSPHORUS LOADING

1 ppm P in effluent required, therefore P is concentrated in biosolids

Biosolids application rates based on crop N need will over-apply P by 4 – 6 X crop P removal

Management:
- Apply to lower P testing fields
- Apply periodically, not annually
- Maintain soil conservation practices
- Plant crops that remove large amounts of P
SUMMARY

- Land application can be a good alternative to landfilling or incineration
- Proper management optimizes economic factors and reduces environmental risk
- Know what you are applying
- Comprehensive site evaluation is critical
- A good land application program requires coordination between the generator, the DNR, the farmer, and the crop advisor
PRODUCERS CAN HELP COMMUNITIES AND INDUSTRIES AVOID WASTE!!