

OVERVIEW OF MUNICIPAL AND INDUSTRIAL LAND APPLICATION RULES

DICK WOLKOWSKI

**DEPT. OF SOIL SCIENCE
UW-MADISON**



WE LIVE IN A WASTEFUL SOCIETY

➤ ***LAND APPLICATION***

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

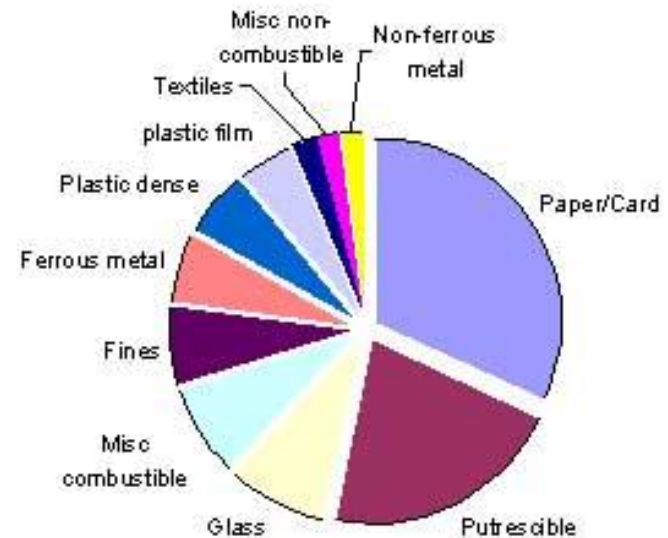
➤ ***LANDFILLING***

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

➤ ***INCINERATION***

- Emission concerns
- Ash disposal
- Expensive

Household waste



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

Material	Permitted acreage	Est. treated acreage
Septage/holding tank	159,000	80,000
Biosolids	210,000	70,000
Industrial wastes	1,146,000	345,000
Solid waste	na	na

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 $\text{NH}_4\text{-N}$. 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

SEPTAGE NUTRIENT CONTENT



Sample	Solids	TKN	NH4-N	NO3-N	P	K
	%	----- ppm -----				
w/ Lime	2.4	512	140	0.04	332	45
w/o Lime	3.2	431	122	0.14	135	44

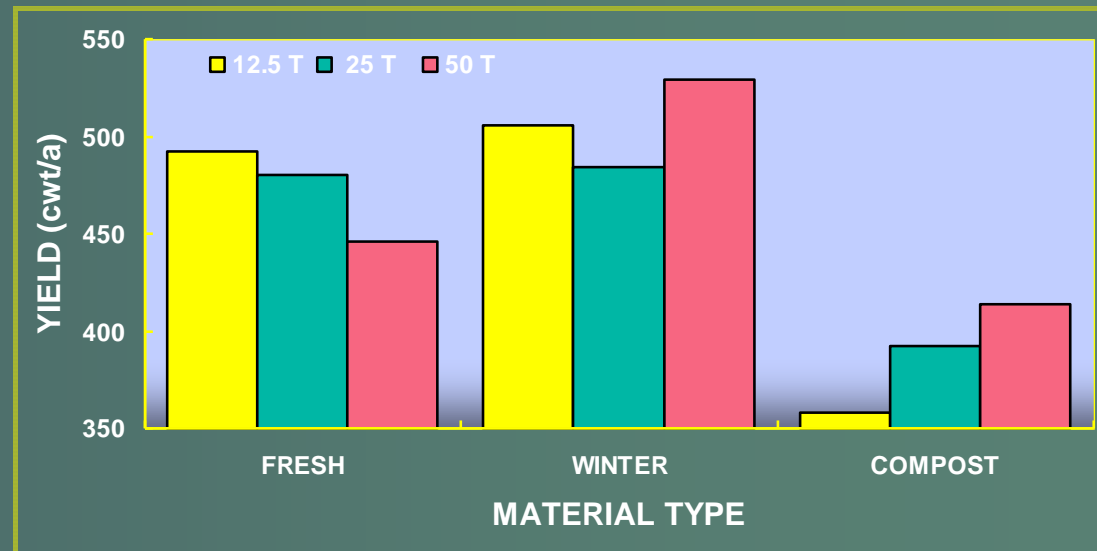
INDUSTRIAL WASTEWATER AND SLUDGES

- **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, RHINELANDER, 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

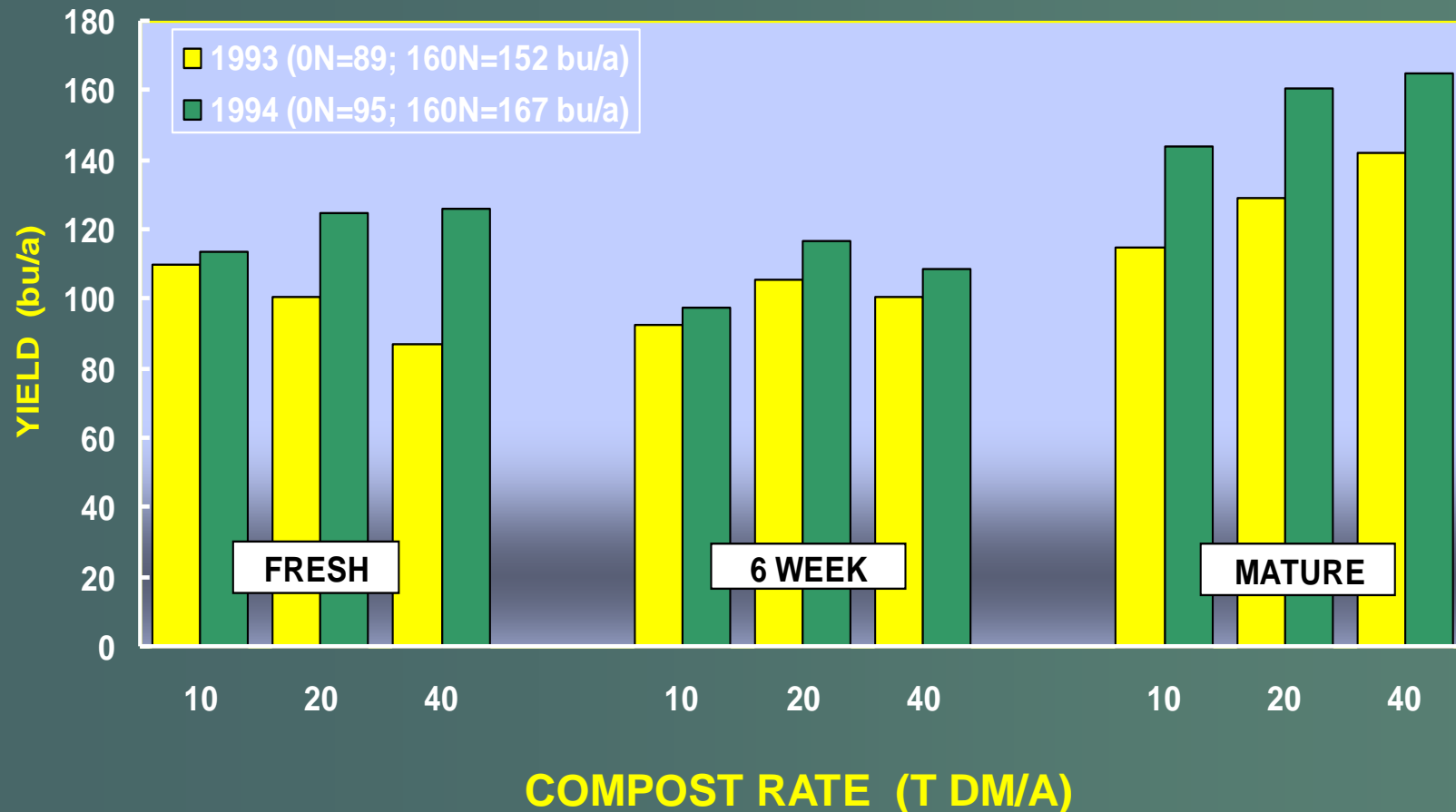


CALIBRATED TREATMENT



PLOT LAYOUT

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



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

<u>CROP SITUATION</u>	<u>WAIT PERIOD (mo.)</u>
Food crop touching soil (beans, melons)	14
Food crop grown in soil (potato, carrot)	20/38
Other (field corn, hay sweet corn)	1
Livestock grazing	1
Public access	
– High potential	12
– Low potential	1

SELECTED SITE RESTRICTIONS FOR BIOSOLIDS APPLICATION (NR 204)

SITE CRITERIA	SURFACE	INCORP.	INJECTED
BEDROCK	3 ft.	3 ft.	3 ft.
GROUNDWATER	3 ft.	3 ft.	3 ft.
WATER SETBACK			
— 0-6 % SLOPE	200 ft.	150 ft.	100 ft.
— 6-12 % SLOPE	NA	200 ft.	150 ft.
SLOPE	0-6 %	0-12 %	0-12 %
COMM. WELL	1000 ft.	1000 ft.	1000 ft.
PRIVATE WELL	250 ft.	250 ft.	250 ft.
SCHOOLS	1000 ft.	1000 ft.	500 ft.
PROPERTY LINES	50 ft.	25 ft.	25 ft.

HEAVY METALS IN BIOSOLIDS

ELEMENT	CEILING CONC.	APPLETON	WAUPACA	WEYAWEGA
	----- ppm -----			
ARSENIC	75	3.8	7.3	2.0
CADMIUM	85	2.0	8.1	0.5
COPPER	4300	403	700	68
LEAD	840	74	41	6.8
MERCURY	57	1.2	1.1	0.4
MOLYBDENUM	75	2.3	bd	6.8
NICKEL	420	24	16	8.0
SELENIUM	100	1.4	2.7	1.1
ZINC	7500	709	820	123

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 !!**