

TENORM in Water Filter Backwash

May 2007



Neal Wilson



Minnesota
Pollution
Control
Agency

Neal Wilson

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Water Filter Backwash (WFB)

- A liquid and solid
- From treating potable water for TSS, TDS
- Typically use a recirculating sand &/or anthracite filter, periodically backwashed

Discharge
after main
flush

WFB Characteristics

- WFB is from groundwater
- Generation rates vary
- Most likely high in colloids (clay), iron and manganese
- May contain elevated levels of arsenic and Ra 226
- Other COC?





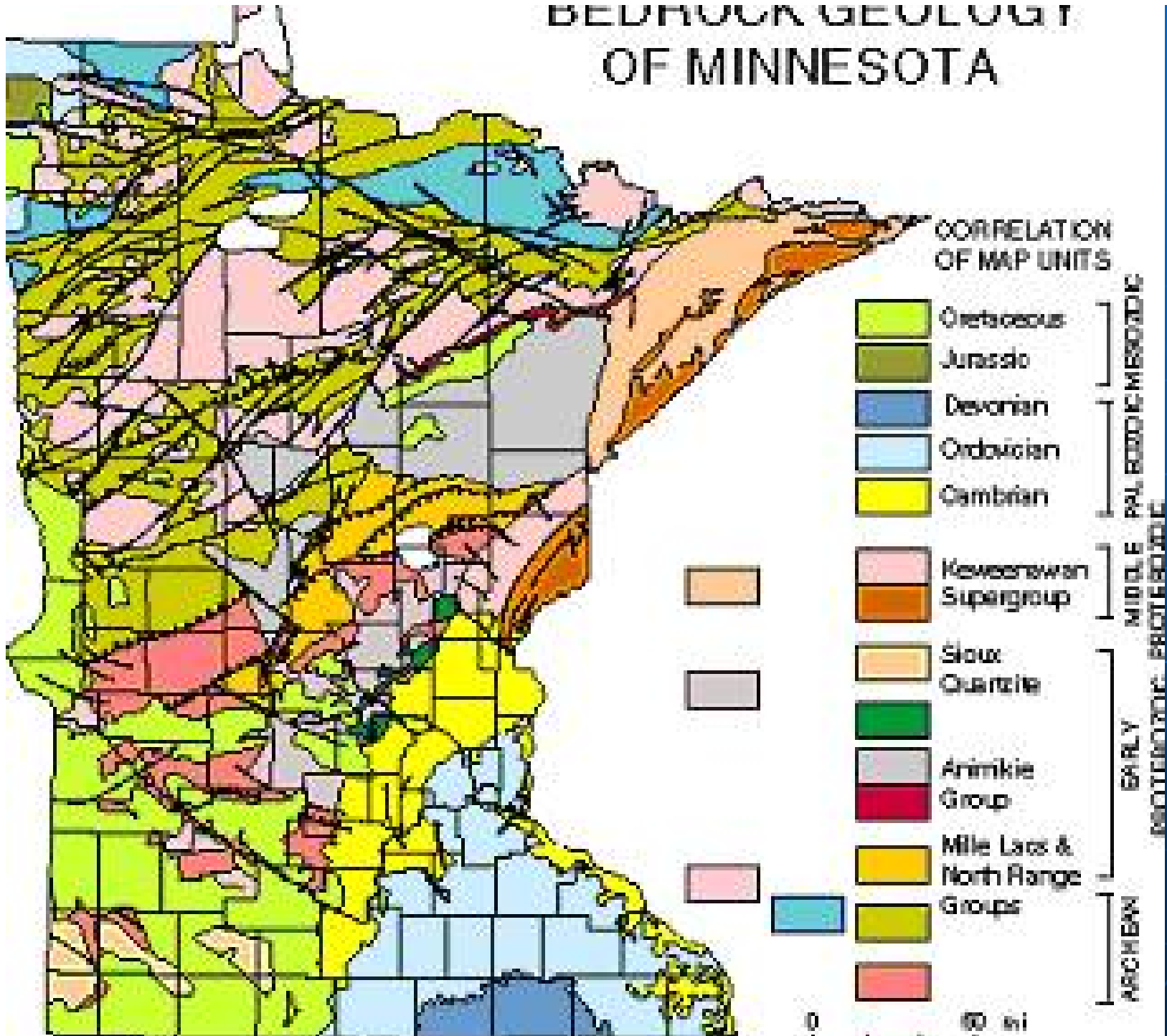




Groundwater initially anaerobic, elements dissolved

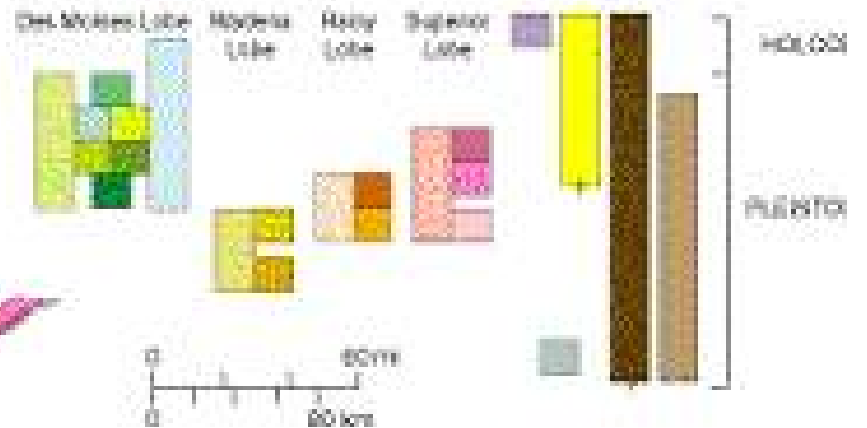
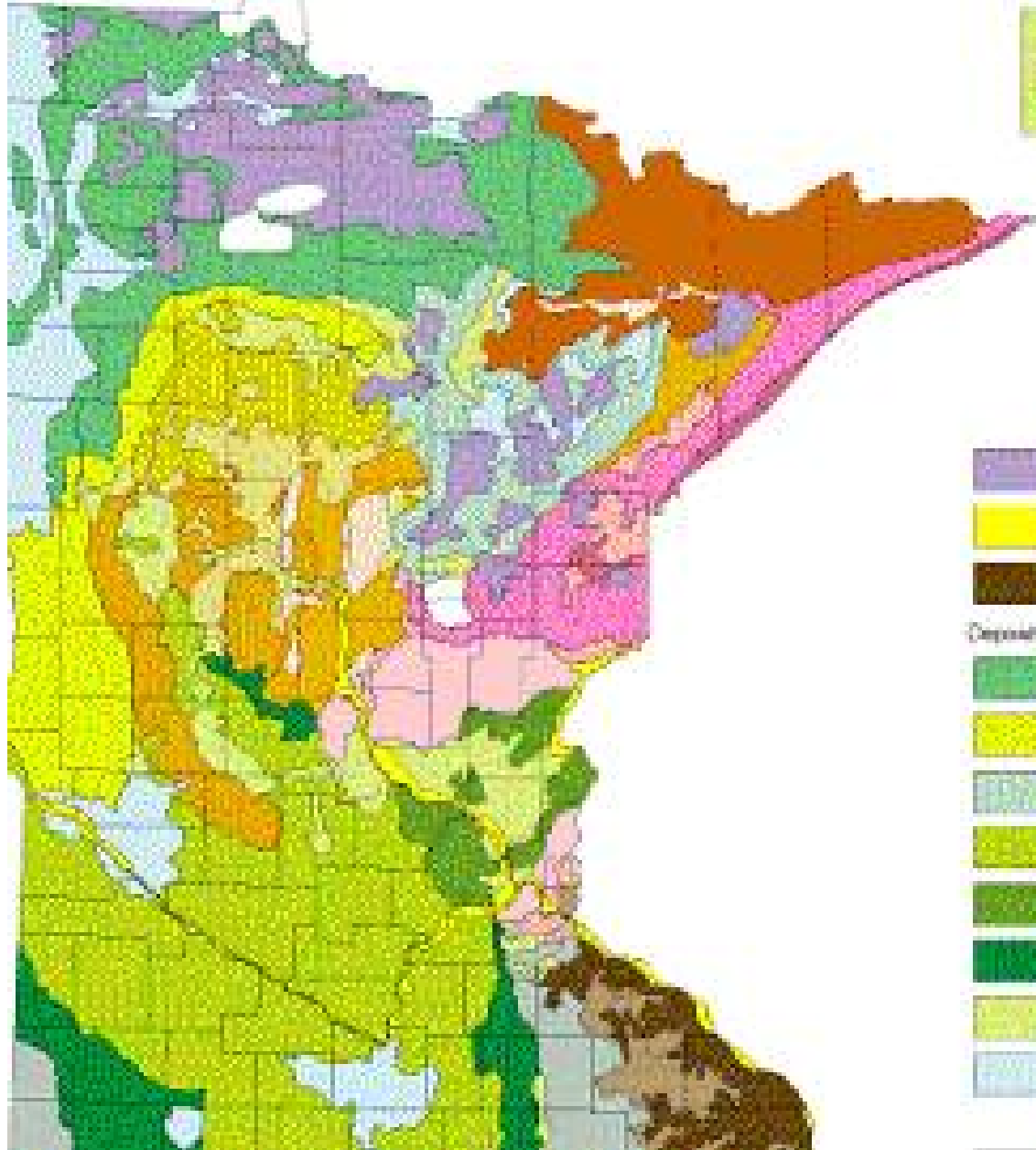
- when aerated elements (iron, manganese) precipitate out of solution
- other elements (arsenic, Ra-226) co-precipitate
- results in a sludge high in iron, manganese, arsenic, Ra-226, others?

BEDROCK GEOLOGY OF MINNESOTA



Morton Gneiss
 Ely Greenstone
 Iron Range
 Limestone
 Sandstones

OF MINNESOTA



DESCRIPTION OF MAP UNITS

- | | | | |
|-----------------------------|-----------------------------------|---|--|
| Pleist. | Alluvium and lacustrine deposits. | Colluvium. | Deposits Associated with the Superior |
| Till of the Eskimo moraine. | Till of the Big Stone moraine. | Till of the Quiver and Sugar Hill moraines. | Till of the Nicoisson moraine. |
| Till of the Alton moraine. | Till of the Pine City moraine. | Till of the Bemis moraine. | Till of the Crook and Mille Lacs Highland moraine. |
| Outwash. | Glacial lake sediments. | | Till of the St. Croix moraine. |
| | | | Outwash. |
| | | | Deposits Associated with the Holly L. |
| | | | Till of the Vermilion and Northwest moraines. |
| | | | Till of the St. Croix moraine. |
| | | | Outwash. |
| | | | Deposits Associated with the Mazonia |
| | | | Till of the Mazonia moraine. |
| | | | Till of the Ancker moraine. |
| | | | Outwash. |

Older Deposits







Discharge after
1.5 min.



Involves Water Quality and Solid Waste

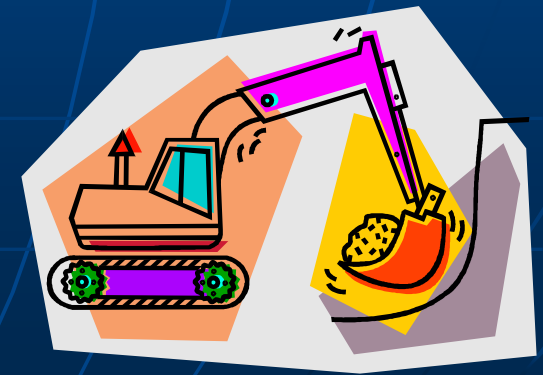
- Minnesota Estimate:
 - At least 35 under NPDES MNG64 general permit (permit expires 7/07)
 - At least 15 MN00 individual permits
- WFB is defined as a solid waste: MR 7035.0300 Subp. 100: "Solid waste" means garbage, refuse, sludge from a water supply treatment plant...

✓ Management Options

- Liquid and solids both to a WWTF
- Liquid and solids both to a pond
- Liquid to a WWTF, solids to a pond (or opposite)
- Solids: to a WWTF, a landfill, land application, or construction fill

Pond Solids Cleanout

- Frequency of pond cleanout related to volume of water, TSS and TDS
- Some cleaned out every year, some only every 20 years



Current Status

- Several WFB NPDES permits with specific language and date requirements non-compliant
- Some discharged into "ravines"
- How to best manage WFB?

← Backwash effluent pipe from WTP



Proposed WFB Management Options

- Landfill
- Land application
- Through to a WWTF
- Construction fill



Management Option 1 Landfilling

- Pass the paint filter test
- Chemically tested, compared to standards in the ISWMP
- Un-lined LF's Ra-226 < 5 pCi/g
lined LF's Ra-226 < 30pCi/g



Management Option 2

Land Application



- Chemically tested
- Follow "AFS" method

Possible Acre Furrow Slice Method

Determine maximum land application rate

Possible Limits:

- Biosolids (soil) cumulative limits
- MPCA Tier I Soil Leaching Values
- MPCA Tier I Soil Reference Values
- Others?

---Use most restrictive, calculated limit---

DRAFT Acre Furrow Slice Arsenic Calculation



- AFS = top 6" topsoil = 2,000,000 lb/acre

exp. Arsenic: **SRV** = 5 mg/kg; 5 mg/1 kg = X mg/909,091 kg; X
= 4,545,455 mg/acre allowable;

4.54 kg * 2.2 lb/kg = 10 lb./acre

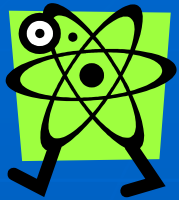
(note: Biosolid As limit is 37 lb/acre)

Exp.: Arsenic in sample = 269 ug/g = 0.000269 g/g;

SRV = 10 lb/A;

[(10 lb/A)/0.000269 lb./lb.]= 37,175 lb/A

**37,175 lb./A maximum of dry RRRWS backwash
that can be land applied if using the SRV**



Acre Furrow Slice Ra-226 Calculation

MDH proposed standard = 5 pCi/g = 5000 pCi/kg;
[(5000 pCi/kg) = (X kg/909090 kg/A)]; X =
4,545,455,000 pCi/acre

Proposed MDH AFS limit = 4,545,455,000 pCi/A

Exp.: Ra-226 = 29 pCi/G = 29000 pCi/kg;
[4,545,455,000 pCi/ 29000 pCi/kg] = 156,739
kg/A;

[(156,739 kg)(2.2 lb/kg)] =
344,827 lb/A (dry weight)

[(344,827 lb)/(2,000 lb/ton)]/[(0.15*)] =
1,149 tons (wet weight)

* 15% solids



Formulas Used to Determine Cumulative Limits

DRAFT

Arsenic maximum cumulative application (dry tons/acre)

$$37 \text{ lb/acre} \div (\text{arsenic conc. (mg/kg)} \times 0.002)$$

Ra-226 maximum cumulative application (dry tons/acre)

$$4.5 \text{ milliCi/ac} \div (\text{radium 226 conc. (pCi/g)} \times 0.0009)$$

The maximum allowable WFB application is the lesser of the two results above minus any amount applied to the site from previous applications.

$$\text{Solids Applied (dry tons/acre)} = \text{Wet tons/acre Applied} \times \% \text{ total solids (as a decimal fraction)}$$



Management Option 3 WWTF

- Test the material
- Volume, concentrations acceptable to WWTF?
- COC will end up in biosolids- OK?

Use as Construction Fill



- Test the WFB for analytes
- Use AFS method
- Use limits table (directly)
- Calculate maximum amount of fill to stay under the limits

MPCA WFB Guidance

Is being drafted

Will address

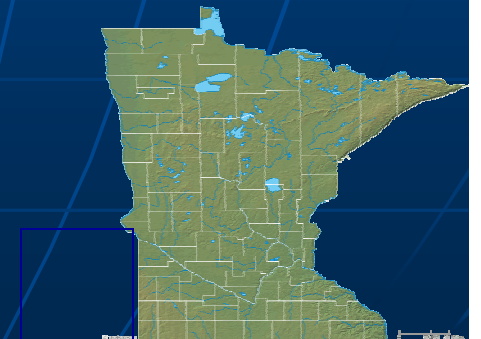
- Testing requirements
- Management options
- Reporting requirements

May only require testing, management
of As and Ra-226



Summary and Conclusions

- In Minnesota, WFB is a solid waste
- WFB management will be delegated to NPDES permits
- Need to finalize land application limits, testing parameters



Questions

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