



Civil & Environmental Consultants, Inc.

Do's and Don'ts of Leachate Management (ASSET your Leachate!)

Prepared For:

**NY FEDERATION SOLID WASTE &
RECYCLING CONFERENCE**

Presented By:

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*** Registered in Specific States**

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Introduction

- ▶ CEC is a Multi-Disciplined Consulting & Engineering Firm
- ▶ 25th Year in business in 2014
- ▶ Consistently ranked highly among the *Engineering News-Record's* Top 200 Environmental Firms List and Top 500 Design Firms List
- ▶ Named a Top Workplace in Pittsburgh and Nashville



Introduction

More Than 650 Employees in 19 Cities

1. Austin, TX
2. Bridgeport, WV
3. Boston, MA
4. Charlotte, NC
5. Chicago, IL
6. Cincinnati, OH
7. Columbus, OH
8. Detroit, MI
9. Export, PA
10. Indianapolis, IN
11. Knoxville, TN
12. Nashville, TN
13. Philadelphia, PA
14. Phoenix, AZ
15. Pittsburgh, PA
16. Sayre, PA
17. Sevierville, TN
18. St. Louis, MO
19. Toledo, OH



Introduction

Our Practice Areas

Civil Engineering

Environmental
Engineering & Sciences

Ecological Sciences

Waste Management

Water Resources

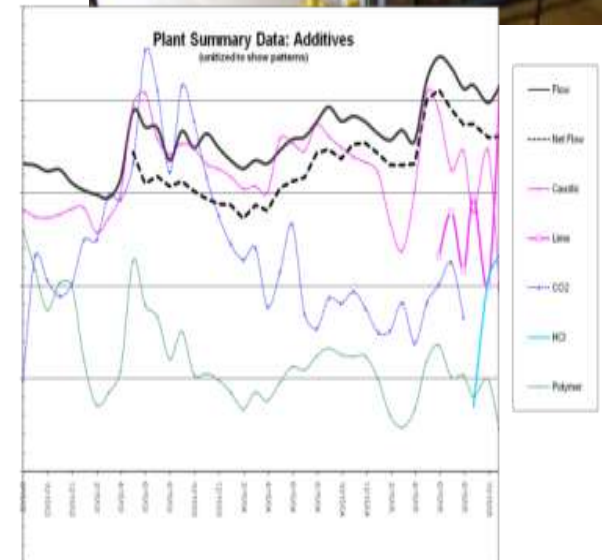
The Markets We Serve

- ▶ **Solid Waste**
- ▶ **Mining**
- ▶ **Manufacturing**
- ▶ **Natural Gas**
- ▶ **Power**
- ▶ **Public Sector**
- ▶ **Real Estate**



ASSET (your Leachate!)

- ▶ **Assemble** a leachate management team
- ▶ **Study** collected leachate data for decision making
- ▶ **Study** and understand the entire leachate management system
- ▶ **Evaluate** impacts and chances to improve performance of treatment system proactively
- ▶ **Talk** and negotiate with regulatory agencies



Lessons Learned

- ▶ **Leachate treatment**
 - Wrong side of the balance sheet
- ▶ **Leachate management**
 - A necessary evil, but needs attention
- ▶ **Without it...**
 - Treatment system downtime cost
 - Health and safety incidents
 - Permit violation occurs



Lesson Learned (Health and Safety 1st)

- ▶ Hazardous materials inventory and control
- ▶ Electrical safety
- ▶ Confined spaces
- ▶ Access platforms
- ▶ Lifting considerations
- ▶ Maintenance access
- ▶ Stored energy



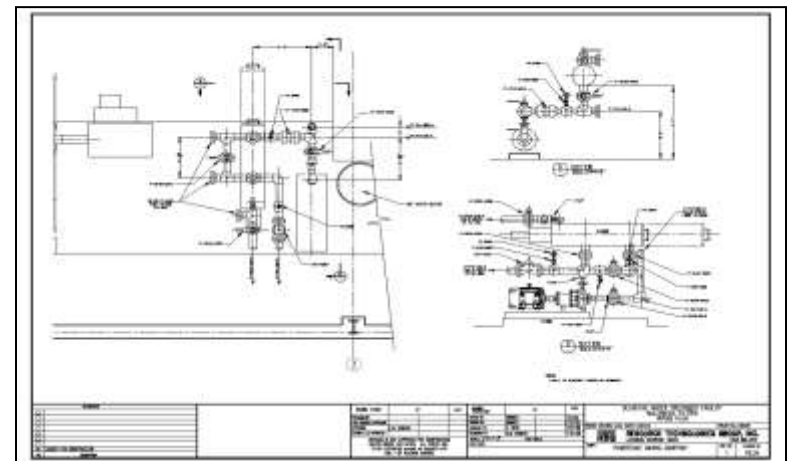
Lesson Learned (Advanced Maintenance)

- ▶ **Maintenance management program**
 - Computerized systems good
 - Manages routine work orders
- ▶ **Spare parts management**
- ▶ **Cross-training of personnel**
- ▶ **Identify specialized maintenance support sources**



Lesson Learned (Document Changes)

- ▶ Changes to system will occur
- ▶ Acquisitions of facilities are common
- ▶ Lack of documentation makes troubleshooting difficult
- ▶ Types of documents
 - Operations and maintenance manuals
 - Process and instrument diagrams
 - Electrical distribution systems
 - Control systems
- ▶ Examples of changes
 - Configuration of equipment
 - Chemical addition systems
 - Underground piping connections
 - Electrical wiring
 - Control panels



Lesson Learned (Dealing with Regulations)

DON'T

agree to permit changes
without careful thought and
analysis



DON'T

analyze leachate only for
regulated constituents

▶ Talk to your Regulators

- Be sure there is a logical basis for your limits and requirements

▶ TDS limit

- Toxicity to organism- local organisms okay
- Mixing zone granted

▶ Alternative Discharge Locations

- Usually many options available
- Collaborate to identify

▶ Regulated constituents: clearly important

▶ Decrease in removal efficiency: caused by a number of factors

▶ Measurements of other constituents: very valuable

Lesson Learned (Hire Knowledgeable Support)

DO

track and understand
water balances and
sources of contaminant
loads

- ▶ **Source identification:** can help point to opportunities for source control
- ▶ **Model overall system:** to understand sensitivities
- ▶ **Identify cost savings opportunities**
 - Plan better
 - Understand impacts early
 - Respond to potential permit changes

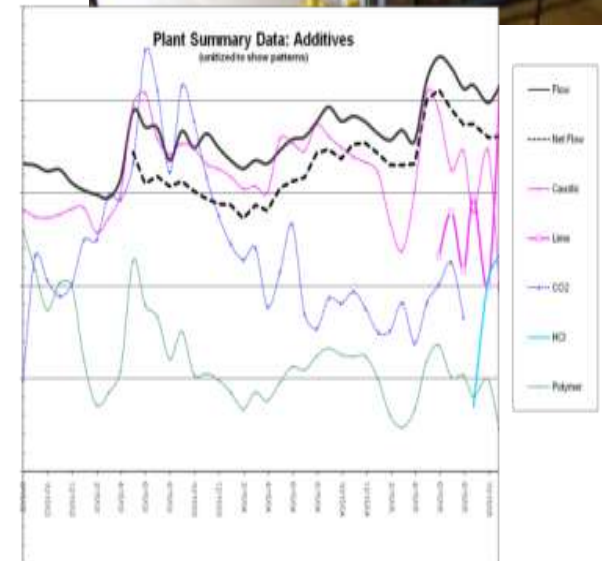
DO

retain an experienced
leachate treatment
consultant and form a
partnership

- ▶ **Leachate treatment project**
 - Workable solution selected
 - Realistic cost estimate used for budgeting
- ▶ **Leachate study projects**
 - Desk top, bench & pilot testing studies
 - Support services to help the client

SUMMARY (ASSET your Leachate!)

- ▶ **Assemble** a leachate management team
- ▶ **Study** collected leachate data for decision making
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- ▶ **Evaluate** impacts and chances to improve performance of treatment system proactively
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Technology Advances for Problem Constituents

▶ Ammonia

- High nitrogen (nutrients) becoming an issue in some areas
- POTWs do not like it -leachate contains 60 times the ammonia of household waste
- Ammonia – aquatic toxicity issue
- Nitrate – drinking water issue

▶ COD/BOD

- Potential surface water discharge issue
- Basis for most pretreatment permit surcharges

▶ Dissolved Solids and Metals

- Issue if mixing zone not granted or for some reuse strategies
- Can be a toxicity issue for surface discharge

Biological Treatment



Membrane Treatment



Ammonia, Nitrogen, and Removal Options

▶ Ammonia vs. TKN

- Ammonia – NH_3 is considered a nutrient
- TKN – total of organic nitrogen and ammonia, includes amino acids

▶ Ammonia vs. Nitrate

- Ammonia – can be aerobically converted to nitrate
- Nitrate – NO_3 must be an-aerobically converted to nitrogen - a nutrient

▶ Total Nitrogen includes Nitrate

▶ Removal Options

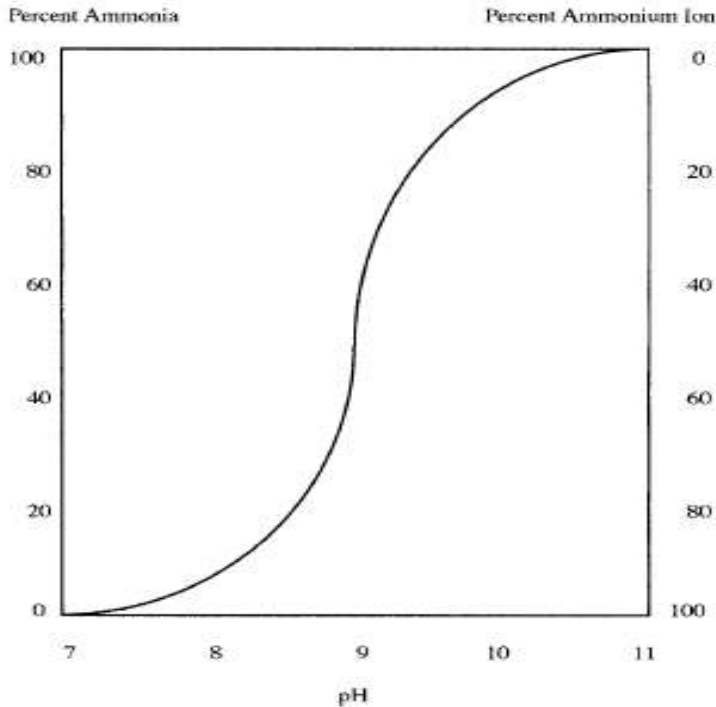
- Is aeration of leachate storage tanks the answer?
 - Under ideal conditions ammonia can be air stripped
 - With operational control ammonia can be biologically converted to nitrate
- Is zero discharge or treatment with wetlands an option?
- Can upgrades to POTW be made to facilitate acceptance?
- Will recirculation help?



Ammonia Removal Options Explained

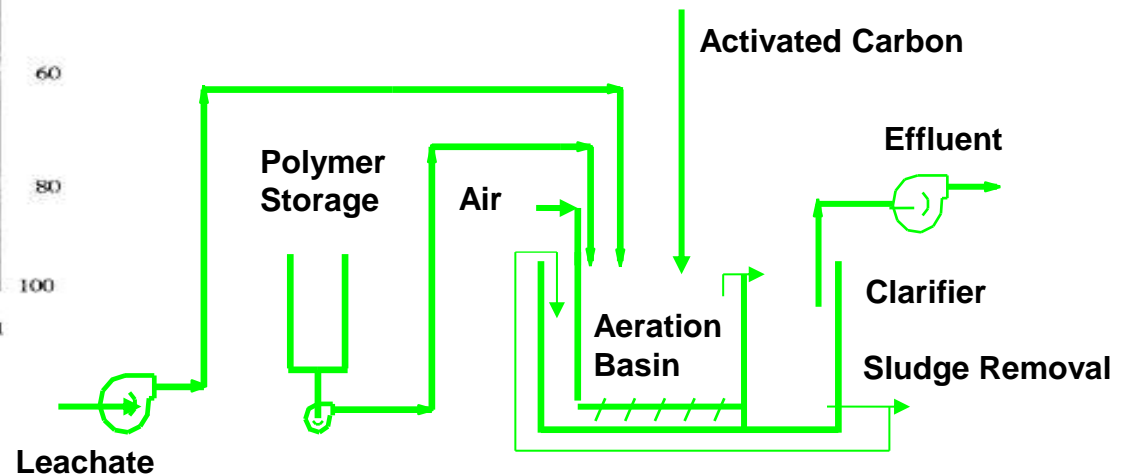
► Air Stripping

- pH dependent
- Temperature dependent



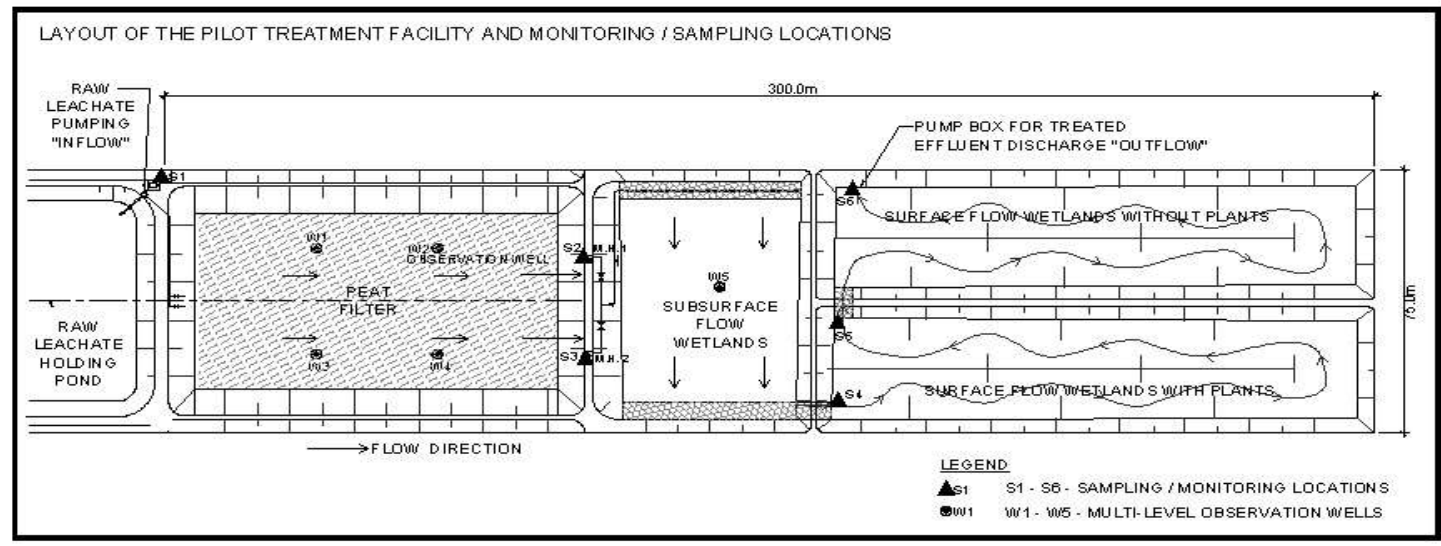
► Biological Treatment in Reactors or Tanks

- Activated sludge – bio-solids maintenance
- Aeration
- Chemicals
- Wastewater operator skills
- Ammonia pre-treatment at typical landfill is \$0.02 per gallon not including nitrate removal



Wetland Treatment Considerations

- ▶ Settle/filter of suspended materials and precipitates
- ▶ Land surface available
- ▶ System longevity
- ▶ Disposal of residuals – metals accumulation
- ▶ Odors



Leachate Recirculation

▶ Leachate Recirculation Mistakes

- Too much leachate too fast
 - Better design of infiltration galleries
 - More monitoring – pH, volatile organic acid (VOA), ammonia, landfill liquid levels
 - Better operating plans and data review are needed
 - Rotate infiltration locations based on measured parameters
 - Recycle between cells
 - Leachate increases in concentrations for total dissolved solids (TDS), ammonia, and metals
- ▶ High flow rate can remove methanogens and buffering capacity for organic acids produced**
- ▶ Monitor leachate pH (6.8-7.4) but also VOA to alkalinity ratios as an early indicator**
- ▶ Rotate areas of applications**
- ▶ COD declines with older/closed cells: circulate high strength leachate to those cells for treatment**

Biological Process Development

▶ Key parameters – what controls ?

- Bioreactor sizing
 - Hydraulic Retention Time (HRT)
 - Loading (lbs/unit volume/day)
- Microorganism health
 - pH
 - Nutrients

▶ Lab, Bench and Pilot testing

- Well understood applications
- Most design data obtained

▶ Activated Sludge, MBR or Anaerobic

- New or more complex applications
- All design data obtained can be helpful



TDS Regulations and Treatment Options

▶ TDS limits will continue to be a treatment issue

- Both NPDES and POTW discharges
- Re-use water quality requirements

▶ Limited options for TDS reduction

- Evaporation/Distillation
- Ion Exchange
- Nano Filtration
- Reverse Osmosis



Lesson Learned (Consider All Costs)

- ▶ Tendency to look at capital investment and internal rate of return (IRR) in decision making
- ▶ Operating costs can dominate
 - Reagents
 - Secondary waste
- ▶ Life cycle cost with net present value (NPV) analysis can provide a better decision making tool



Questions / Contact Information



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