Recirculation-To-Energy
Crow Wing County, Minnesota

RTE . . . Small Landfill . . . Big Results

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EPA Bioreactor Workshop

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Outline

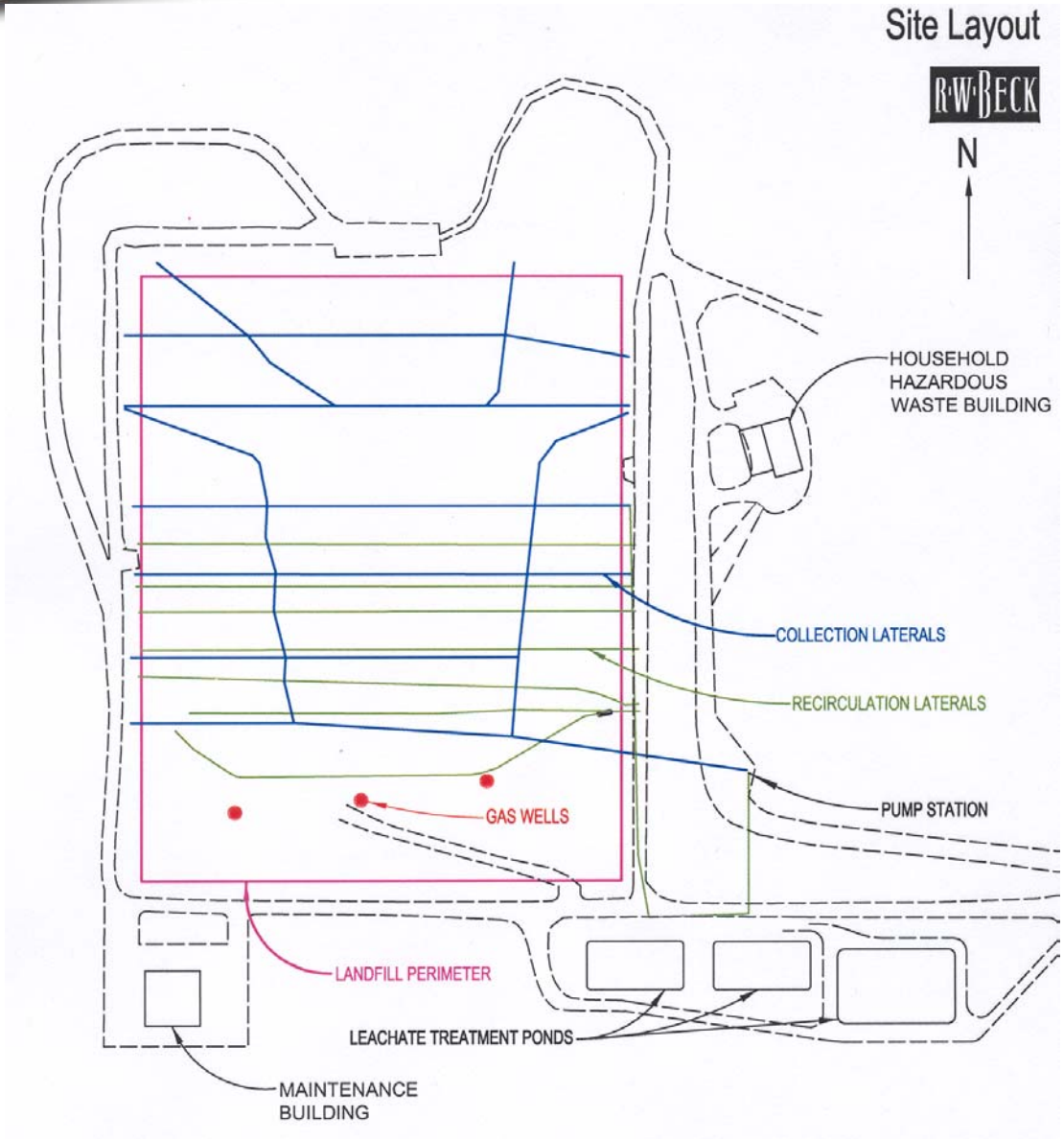
- Site Background
- Visual Tour
- Project Goals and Supporting Data
- Nitrification - Denitrification
- RTE Development
- The Future

Site Background

- Began Operation in 1991
- 40,000 tons/year
- Annual Precipitation - 30 inches
- 3 cells
  - 7.8 acres open
  - Remaining Life - 20+ years
- Integrated Public System
  - Recycling
  - Yard waste
  - Demolition Debris
  - HHW
  - Industrial Waste
  - MSW Disposal

Leachate Management

- Pretreatment
- Hauling to WWTP
- Land Application - 1996
- Recirculation - 1998


Site Layout
R·W·BECK
N
HOUSEHOLD
HAZARDOUS
WASTE BUILDING
COLLECTION LATERALS
RECIRCULATION LATERALS
PUMP STATION
GAS WELLS
LANDFILL PERIMETER
LEACHATE TREATMENT PONDS
MAINTENANCE
BUILDING

RTE Operation Goals

- Minimize leachate hauling
- On-site responsibility
- Optimize airspace
- Minimize long-term liability
- Energy recovery

Leachate Generation and Disposal

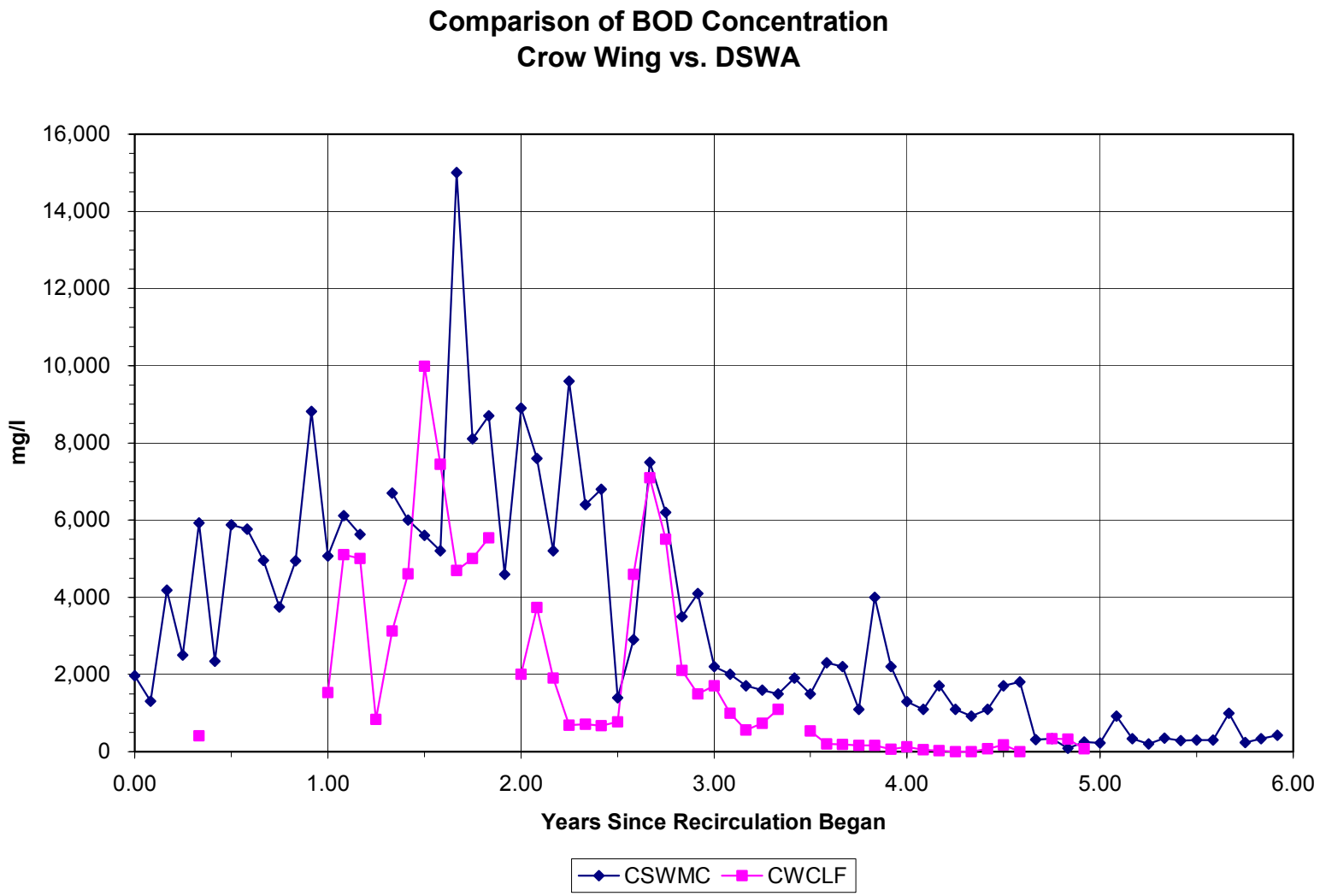
Year	Total Leachate Generated (gallons)	Leachate Hauled (gallons)	Leachate Land Applied (gallons)	Leachate Recirculated (gallons)
1992	1,900,000	1,600,000	NA	NA
1993	2,200,000	2,000,000	NA	NA
1994	1,600,000	1,700,000	NA	NA
1995	2,200,000	2,000,000	24,000	NA
1996	2,800,000	500,000	1,500,000	NA
1997	2,600,000	1,000,000	1,700,000	36,000
1998	2,200,000	0	1,800,000	400,000
1999	2,000,000	0	2,500,000	900,000
2000	1,700,000	0	1,600,000	900,000
2001	2,000,000	0	2,800,000	1,400,000
2002	4,400,000	200,000	4,200,000	2,300,000

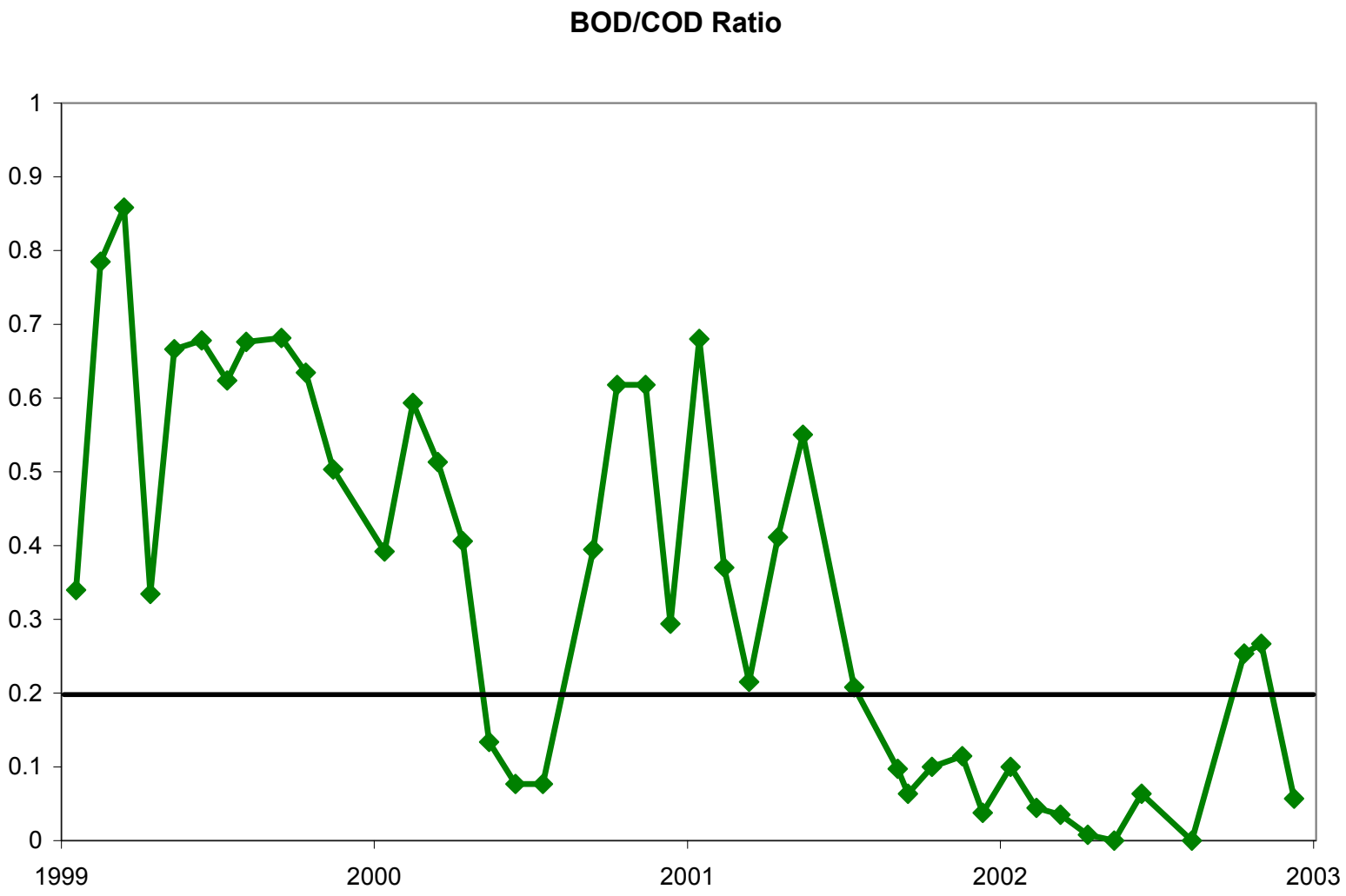
NA = Not Available

Recirculation Volume per Ton Disposed

Year	Recirculation Volume (gal)	Tonnage Disposed	Gallons per Ton
1998	434,830	33,110	13.1
1999	877,675	33,174	26.5
2000	869,988	35,731	24.2
2001	1,395,782	38,673	36.1
2002	2,276,015	42,863	53.1
Total	5,848,290	183,551	31.9
DSWA			6.8

Field Capacity: 50 to 130 Gallons/ton


Comparison of BOD Concentration
Crow Wing vs. DSWA
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
mg/l
0.00
1.00
2.00
3.00
4.00
5.00
6.00
Years Since Recirculation Began
CSWMC
CWCLF

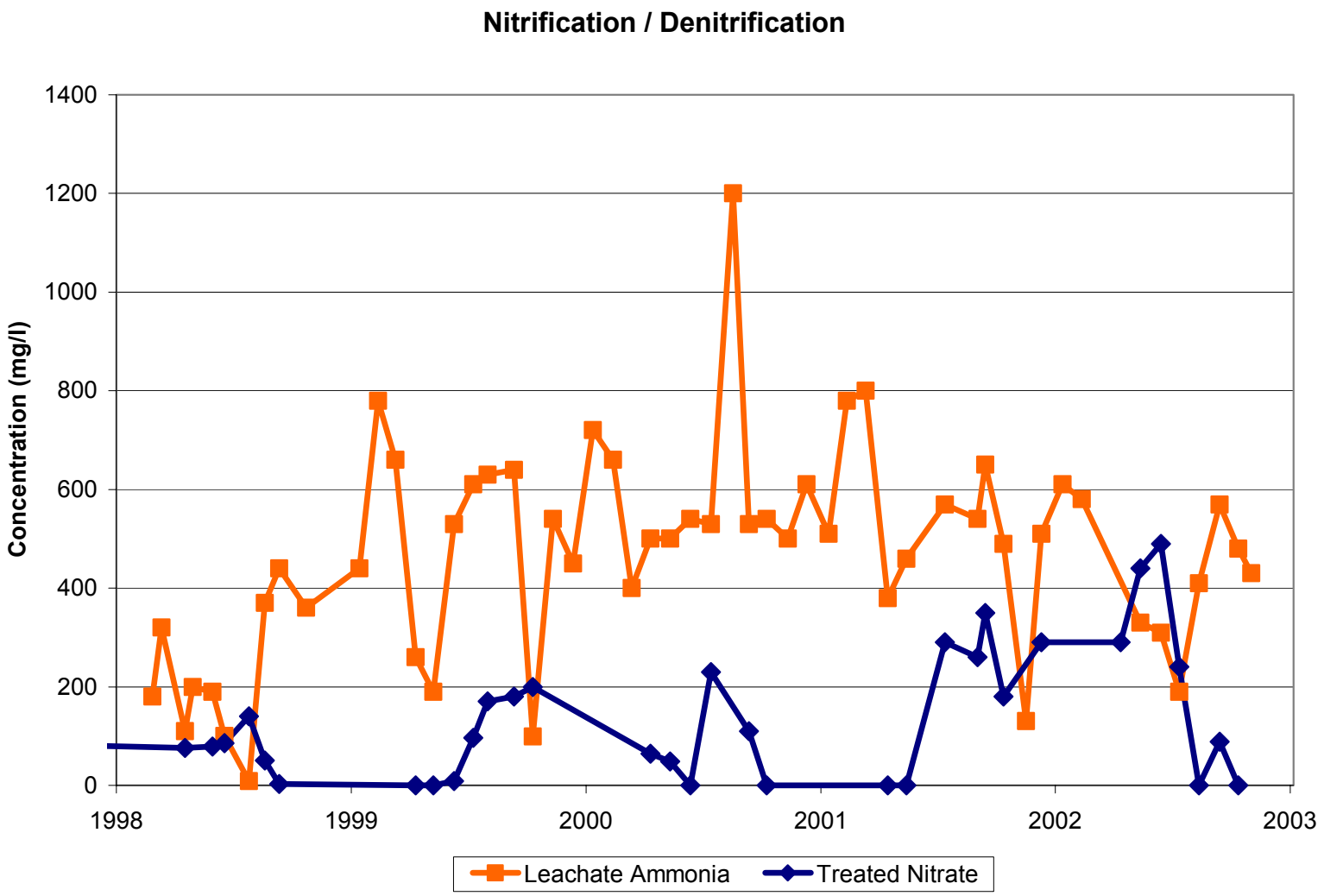

BOD/COD Ratio
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1999
2000
2001
2002
2003

Leachate Quality vs. Groundwater Standards (ug/l)

Parameter	Value [a]	MCL
Arsenic	95	10 [b]
Barium	410	2,000
Chromium	52	100
P-Dichlorobenzene	25	75
Ethylbenzene	66	700
Toluene	40	1,000
Total Xylenes	184	10,000

[a] October 2002

[b] Proposed 2006


Nitrification / Denitrification
Concentration (mg/l)
1400
1200
1000
800
600
400
200
0
1998
1999
2000
2001
2002
2003
Leachate Ammonia
Treated Nitrate

Recirculation to Energy (RTE)

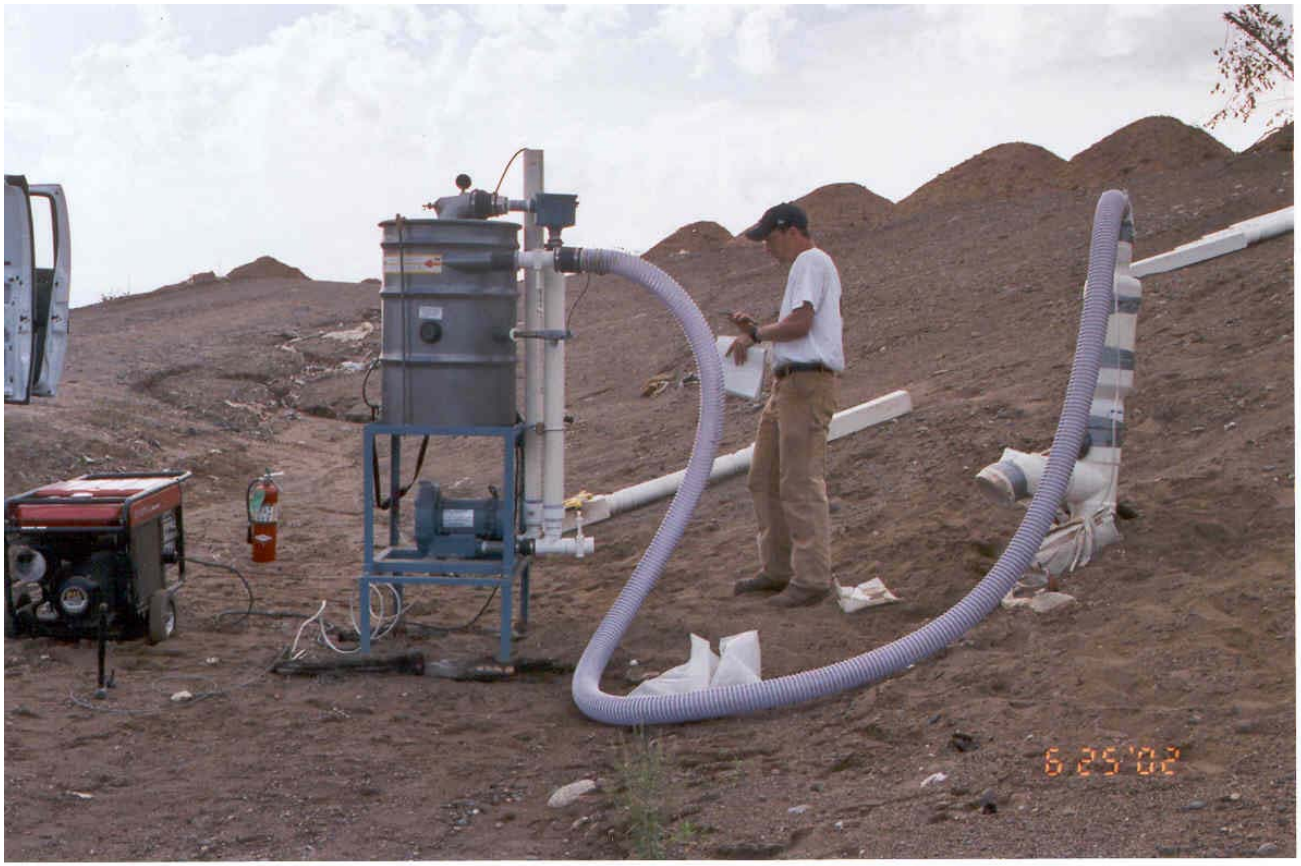
At a small Landfill where active control is <u>not</u> required:

- Converts methane to a productive reuse for energy generation and heat recovery;
- Reduces greenhouse and organic emissions; also reduces organics in leachate;
- Provides a reliable source of renewable power, at a reasonable price; and
- MN utilities are required to include renewable energy in their portfolio.

Recirculation to Energy Steps

- Feasibility Verification
  - Modeling
  - Field Pump Tests
  - Evaluation
- Utility Negotiation
- Air Permitting
- Construction
- Start-Up

LFG Feasibility Test



Equilibrium Test Results

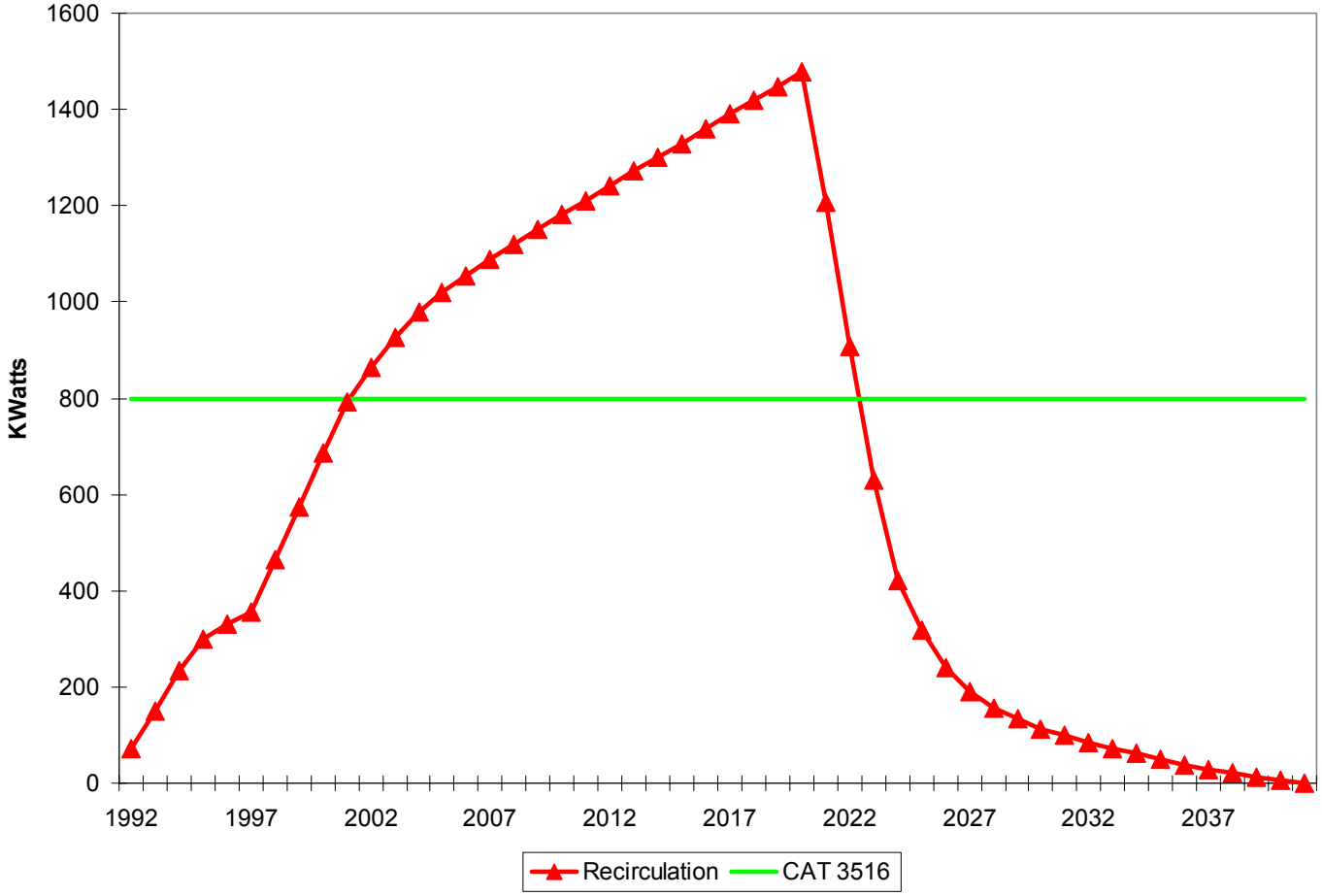
Location	Flow (cfm)	CH_4 (%)
GW-4	100	55
GW-4 (a)	140	55
GW-4 (b)	110	60
RL-6	0	<1
LC-3	130	45

24-hr tests except RL-6, GW-4 (b)

(a) Leachate pumped out before test

(b) 1-month test

Power Production



Operational/Design Hurdles

- Recirculation lateral layout/distribution;
- Recovery LFG from a recirculating landfill;
- Winter Operation;
- Settlement; and
- Seep Control.

Administrative Hurdles

- Long term purchase agreement with local power utility;
  - Utility is over capacity/downsizing
  - Transmission to market demand - wheeling cost
  - Utility currently meets renewable standards
  - Small project - 800 kW
- Long term commitment from waste haulers; and
- Long term regulatory acceptance.

The Future

- Continue to Recirculate
- Expand recirculation into Cell 3
- Spray Cell 3 Working Face
- Continue data collection
  - Leachate temperature (Cell 3)
  - Nitrification/Denitrification
- Develop RTE project