



CONESTOGA-ROVERS & ASSOCIATES

VPLE Passive Venting Demonstration

Holtz Krause Landfill
Wausau, Wisconsin
March 2012



LEGEND

 APPROXIMATE WASTE LIMIT



figure 2.1
AERIAL PHOTO
HOLTZ KRAUSE LANDFILL
Wausau, Wisconsin



Background

- Landfill operated 1957 to 1980
- 57 acres
- Municipal, demolition and industrial waste
- Remediated in 1994/1995 with double-barrier cap and active venting
- 2011 ROD Amendment of monitored natural attenuation of groundwater



Plans for 2012

- VPLE application has been submitted
- 15 soccer field complex



LEGEND:
 GLE EXTRACTION WELL
 WATER IN PIPE
 NO WATER OBSERVED IN PIPE
 NO ACCESS TO PIPE SECTION

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PRELIMINARY CONCEPT PLAN B
 WAUSAU SOCCER COMPLEX
 HOLTZ-KRAUSE PROPERTY
 WAUSAU, WISCONSIN

NO.	BY	DATE	REVISION	NO.	BY	DATE	REVISION

FILE NUMBER	SHEET NUMBER	SHEET TOTAL
24484.001	1	1

DATE: 07.12.11
 DRAWN BY: DWG
 CHECKED BY: DWG
 SCALE: 1"=100'



Landfill Cap Layers

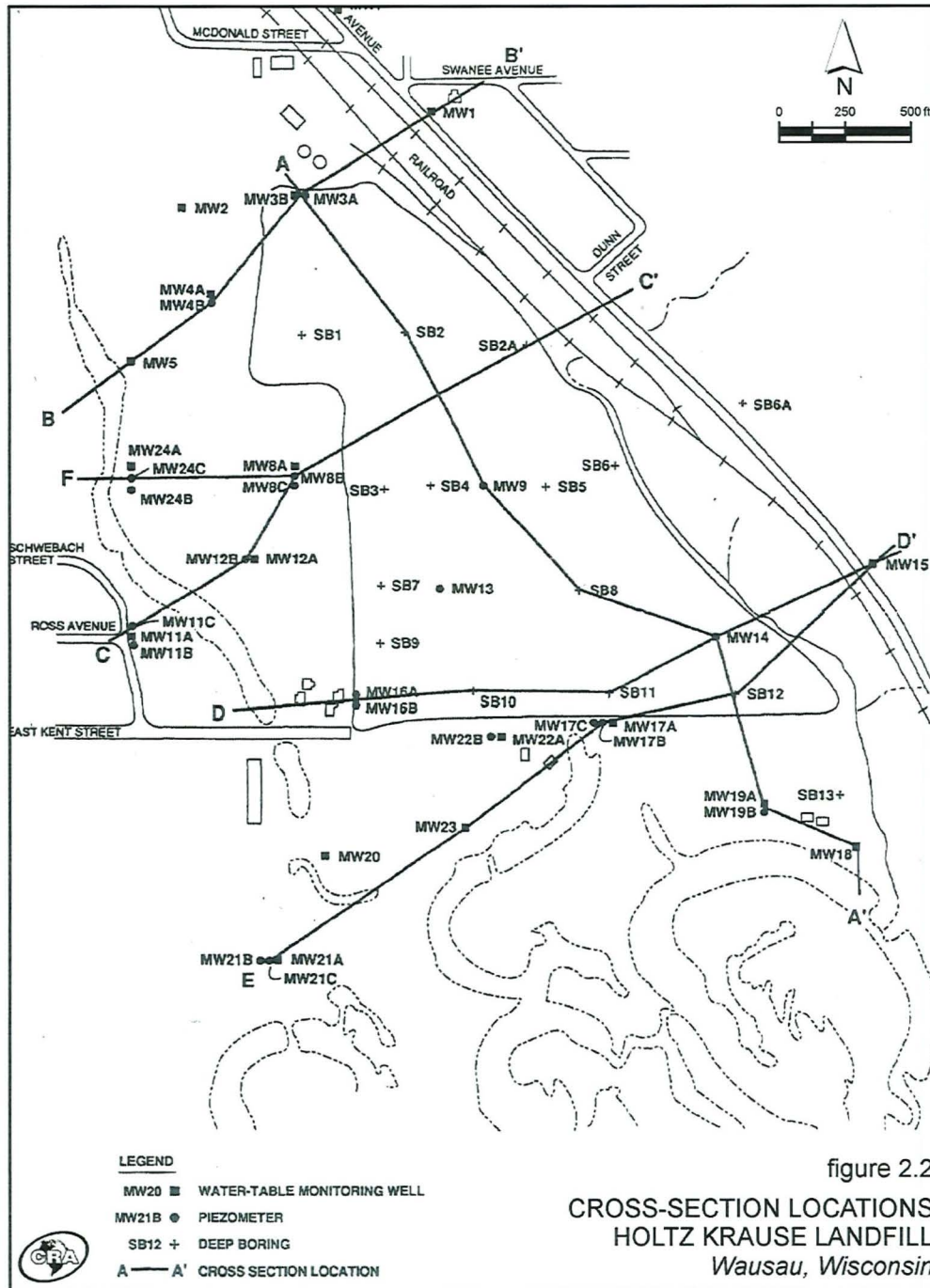
- 6 inches of topsoil
- 2.5 feet of rooting zone
- Primary barrier (40 mil VLDPE)
- Secondary barrier (2 feet of clay)
- 1982 soil cover (2 feet)



Landfill Gas - Background

- Few receptors near landfill
- Wetlands limit landfill gas migration
- Landfill gas production are declining
- Methane levels are declining





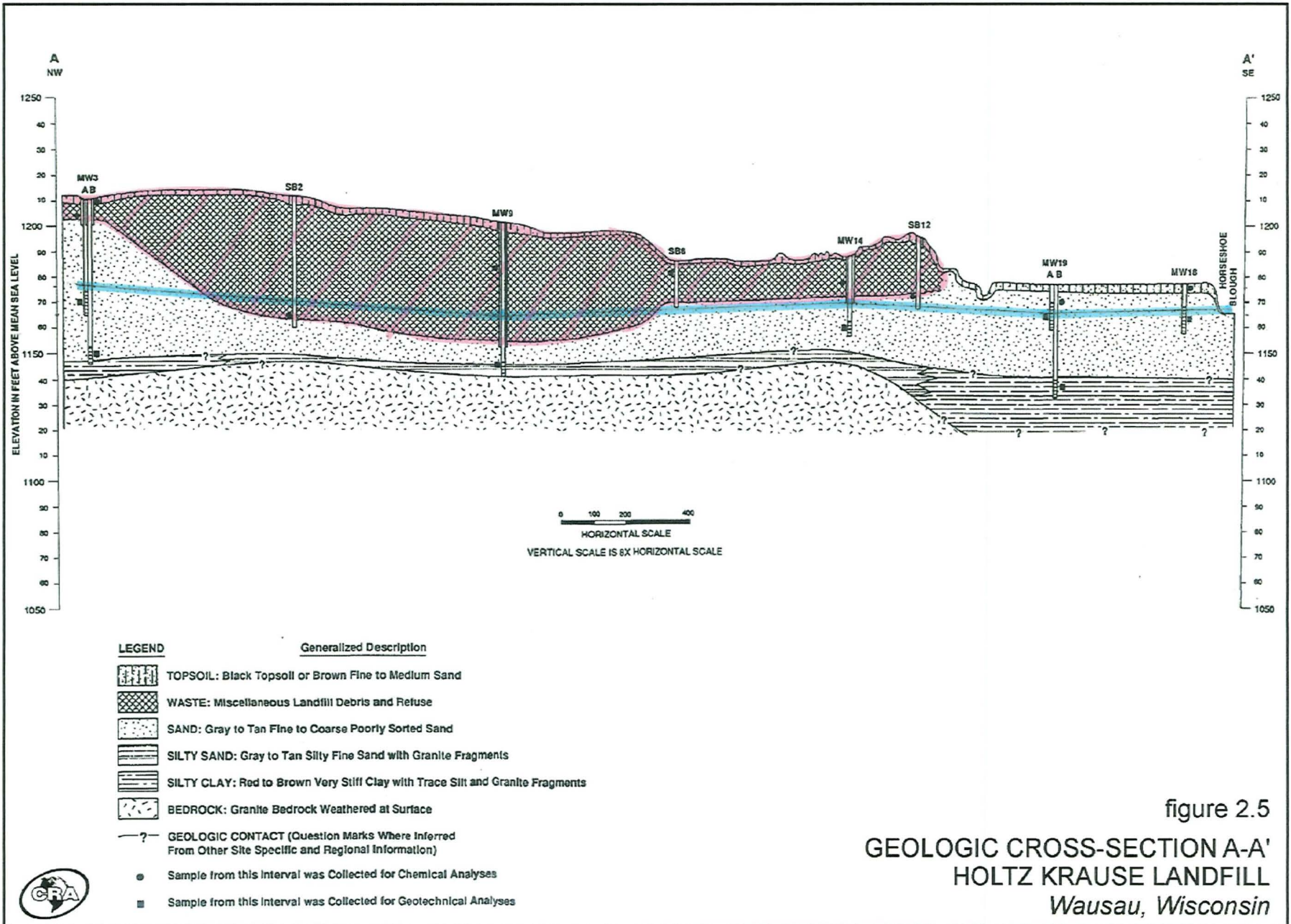
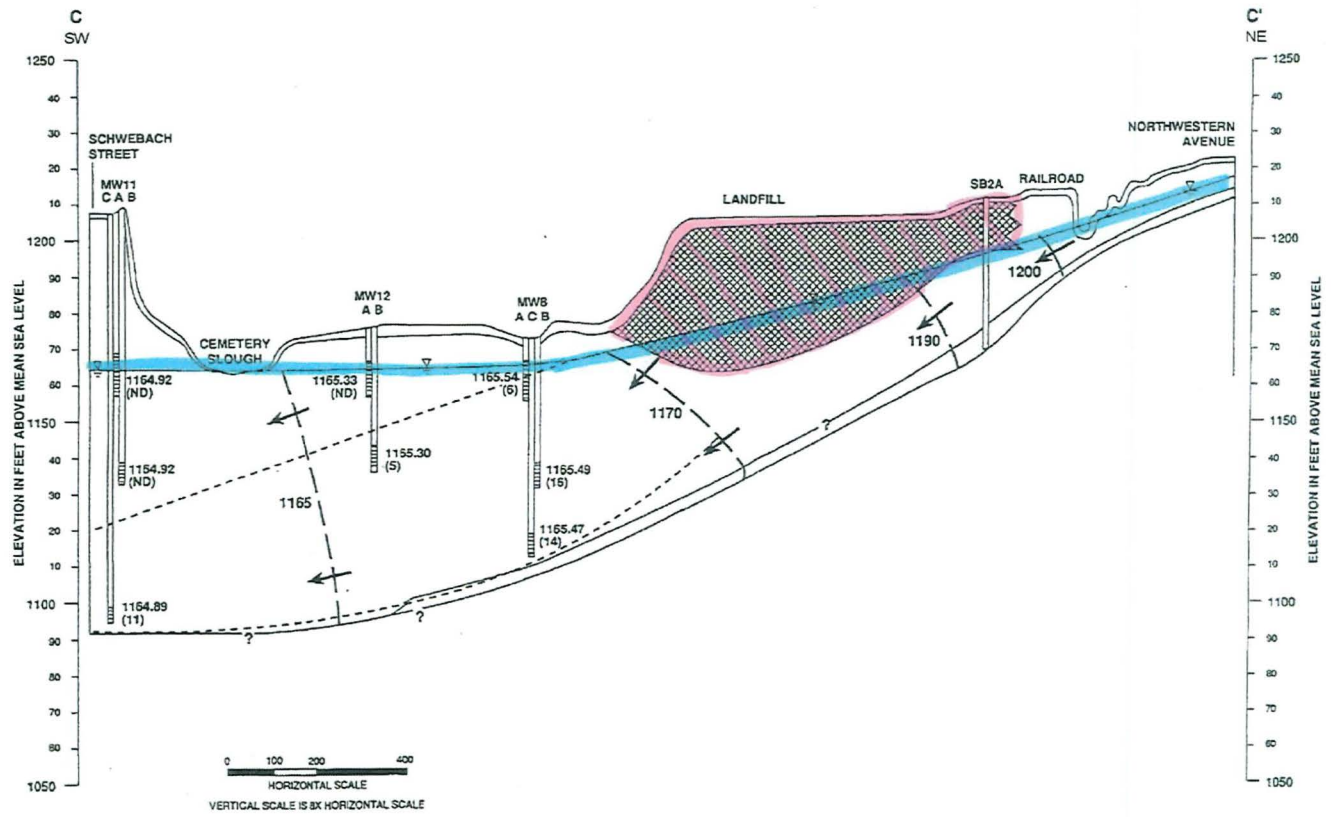


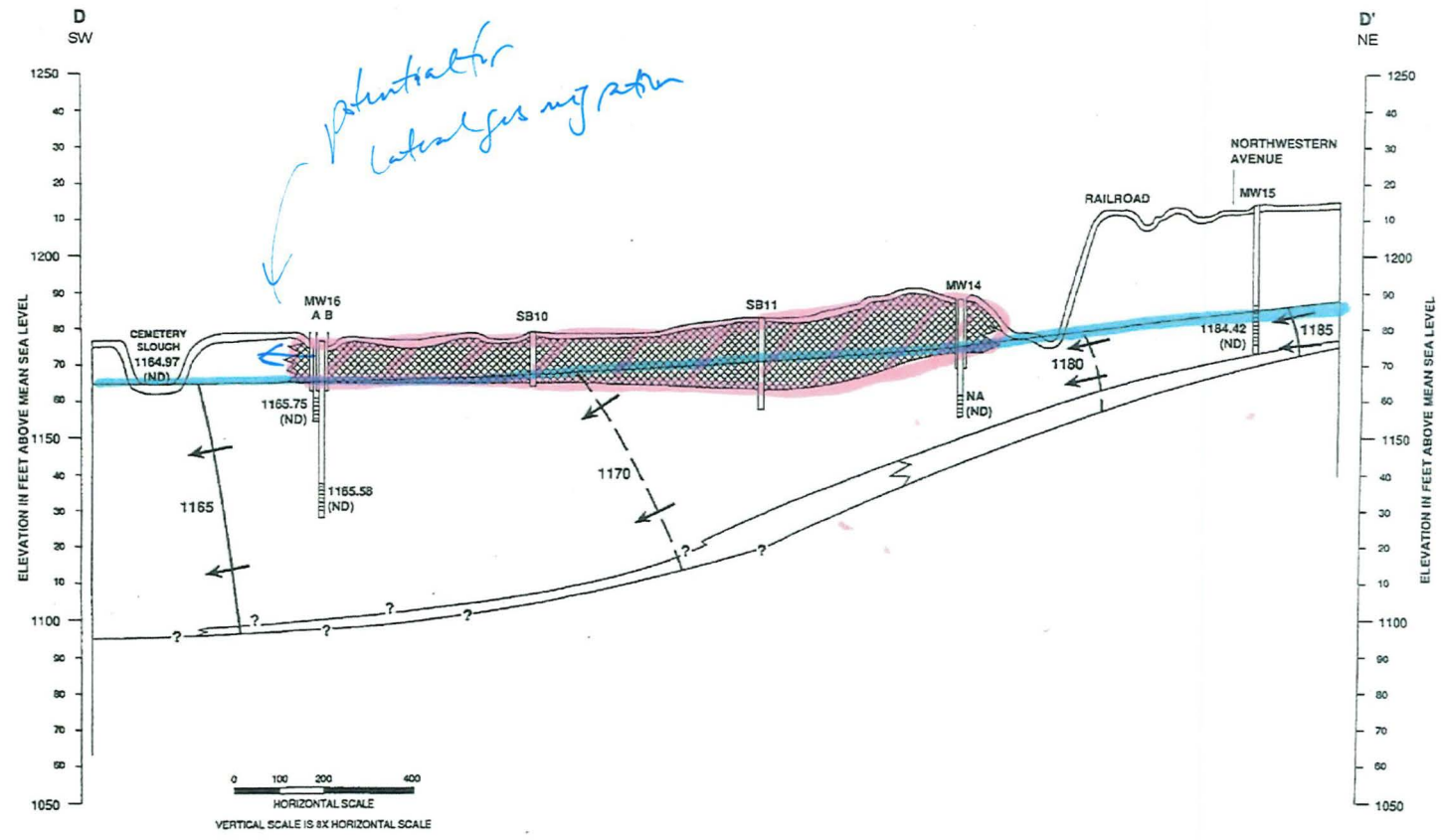
figure 2.5
GEOLOGIC CROSS-SECTION A-A'
HOLTZ KRAUSE LANDFILL
Wausau, Wisconsin



- LEGEND**
- ▽ WATER-TABLE
 - EQUIPOTENTIAL LINE (Dashed Where Inferred) (Reference to Mean Sea Level)
 - ← DIRECTION OF GROUND WATER FLOW
 - (31) --- ESTIMATED LIMITS OF TOTAL AROMATICS CONCENTRATIONS PRESENTED IN PARENTHESES
 - (ND) CONCENTRATION OF TOTAL AROMATICS WERE NOT DETECTED IN SAMPLE
 - ? — GEOLOGIC CONTACT (Question Marks Where Inferred)
 - 1163.84 □ GROUND-WATER ELEVATION MEASURED IN THE WELL
 - ▨ WASTE
 - CONTOUR INTERVAL = VARIABLE
 - SAMPLES WERE COLLECTED FROM JUNE 26 TO JUNE 28, 1990

figure 2.4
**DISTRIBUTION OF TOTAL AROMATICS
 DETECTED IN GROUNDWATER
 CROSS-SECTION C-C'
 HOLTZ KRAUSE LANDFILL
 Wausau, Wisconsin**

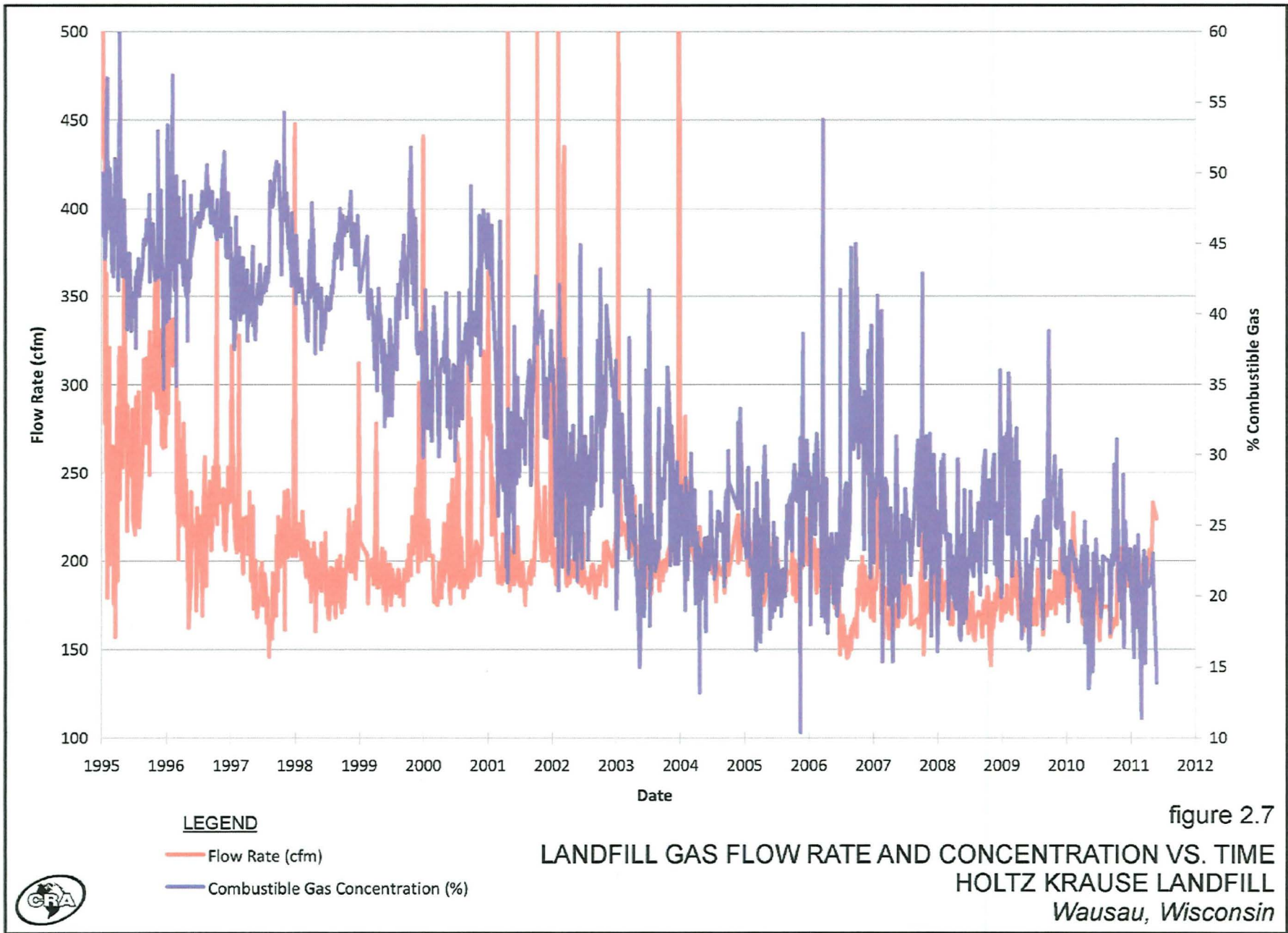




- LEGEND**
- WATER-TABLE
 - EQUIPOTENTIAL LINE (Dashed Where Inferred) (Reference to Mean Sea Level)
 - DIRECTION OF GROUND WATER FLOW
 - ESTIMATED LIMITS OF TOTAL AROMATICS CONCENTRATIONS PRESENTED IN PARENTHESES
 - CONCENTRATIONS OF TOTAL AROMATICS WERE NOT DETECTED IN SAMPLE
 - GEOLOGIC CONTACT (Question Marks Where Inferred)
 - GROUND-WATER ELEVATION MEASURED IN THE WELL
 - WASTE
 - CONTOUR INTERVAL = VARIABLE
 - SAMPLES WERE COLLECTED FROM JUNE 26 TO JUNE 28, 1990

figure 2.3
**DISTRIBUTION OF TOTAL AROMATICS
 DETECTED IN GROUNDWATER
 CROSS-SECTION D-D'
 HOLTZ KRAUSE LANDFILL
 Wausau, Wisconsin**

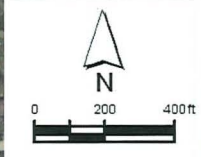






Passive Venting Will Prevent Off Site Migration

- 35 existing vents to be converted to passive
- Add 23 new vents
- Total of 58 vents (1 per acre)
- Passive venting is a common remedy at old landfills
- Proposed design is based on other similar landfills that have been effective



LEGEND

- FUTURE PASSIVE VENT CONVERTED FROM EXISTING GAS EXTRACTION WELL
- FUTURE PASSIVE VENT LOCATION
- ▲ EXISTING GAS PROBE LOCATION
- APPROXIMATE WASTE LIMIT



figure 3.1
CONCEPTUAL PASSIVE VENTING SYSTEM
HOLTZ KRAUSE LANDFILL
Wausau, Wisconsin

TABLE 3.1

PASSIVELY VENTED CLOSED LANDFILLS
MINNESOTA CLOSED LANDFILL PROGRAM

Landfill Name	Landfill Location	Disposal Area Size (acres)	Estimated Volume of Waste (yd ³)	Gas Control Method	Number of Passive Vents	Number of Passive Vents per Acre	Yd ³ of Waste Per Vent	Off-Site Migration	Comments
Aitkin County	Aitkin County, Minnesota	4	271,000	Passive	8	2.0	33,875	None reported	
Anderson	Wadena County, Minnesota	5.1	53,500	Passive	10	2.0	5,350	None reported	
Battle Lake	Ottertail County, Minnesota	7	140,000	Passive	13	1.9	10,769	None reported	
Benson	Swift County, Minnesota	11	360,178	Passive	11	1.0	32,743	None reported	
Big Stone	Big Stone County, Minnesota	11	180,000	Passive	13	1.2	13,846	None reported	
Brookston	St. Louis County, Minnesota	8	101,005	Passive	6	0.8	16,834	None reported	
Bueckers #1	Stearns County, Minnesota	17	287,000	Passive	16	0.9	17,938	None reported	
Carlton County 2	Carlton County, Minnesota	29.5	815,000	Passive	18	0.6	45,278	None reported	
Carlton South	Carlton County, Minnesota	7	77,000	Passive	5	0.7	15,400	None reported	
Cass Co. Longville/Remer	Cass County, Minnesota	3.5	80,000	Passive	5	1.4	16,000	None reported	
Cass Co. Walker-Hackensack	Cass County, Minnesota	10	100,000	Passive	10	1.0	10,000	None reported	
Cass County Maple	Cass County, Minnesota	21	307,000	Passive	15	0.7	20,467	None reported	
Chippewa County	Chippewa County, Minnesota	18	690,000	Passive	13	0.7	53,077	Yes - reported	Unable to confirm if migration resolved
Cook Area	St. Louis County, Minnesota	8	46,000	Passive	5	0.6	9,200	None reported	
Cook County	Cook County, Minnesota	4.5	200,000	Passive	4	0.9	50,000	None reported	
Cotton Area	St. Louis County, Minnesota	6.3	38,000	Passive	8	1.3	4,750	None reported	
Crosby	Crow Wing County, Minnesota	8	87,000	Passive	8	1.0	10,875	None reported	
Crosby American	Dakota County, Minnesota	37	1,400,000	Passive	?	?	-	Yes - reported	Unable to confirm if migration resolved
Dodge County	Dodge County, Minnesota	11	328,000	Passive	26	2.4	12,615	Some concern reported	
East Mesaba	St. Louis County, Minnesota	20	720,000	Passive	21	1.1	34,286	None reported	
Eighty Acres	Beltrami County, Minnesota	4	87,000	Passive	10	2.5	8,700	None reported	
Faribault County	Faribault County, Minnesota	23.2	785,000	Passive	21	0.9	37,381	None reported	
Fifty Lakes	Crow Wing County, Minnesota	4	28,000	Passive	8	2.0	3,500	None reported	
French Lake	Wright County, Minnesota	6.3	200,000	Passive	7	1.1	28,571	None reported	
Gofer	Martin County, Minnesota	12	523,000	Passive	15	1.3	34,867	None reported	
Hansen	Blue Earth County, Minnesota	14.7	240,000	Passive	6	0.4	40,000	None reported	
Hibbing	St. Louis County, Minnesota	30	1,445,566	Passive	21	0.7	68,836	None reported	
Hickory Grove	Aitkin County, Minnesota	8	192,000	Passive	7	0.9	27,429	None reported	
Highway 77	St. Louis County, Minnesota	4.67	88,391	Passive	?	?	-	None reported	
Houston Co.	Houston County, Minnesota	5.7	303,000	Passive	3	0.5	101,000	None reported	plus 7 trenches
Hoyt Lakes	St. Louis County, Minnesota	10	133,000	Passive	9	0.9	14,778	None reported	
Hudson	St. Louis County, Minnesota	15	126,000	Passive	12	0.8	10,500	None reported	
Iron Range	Itasca County, Minnesota	8.7	150,000	Passive	5	0.6	30,000	None reported	
Ironwood	Fillmore County, Minnesota	13	200,000	Passive	19	1.5	10,526	None reported	
Jackson County	Jackson County, Minnesota	19	213,820	Passive	3	0.2	71,273	None reported	
Killian	Todd County, Minnesota	9	221,000	Passive	8	0.9	27,625	None reported	
Kluver	Douglas County, Minnesota	17.7	525,000	Passive	28	1.6	18,750	Yes - reported	Unable to confirm if migration resolved
Korf Brothers	Pine County, Minnesota	16	445,000	Passive	23	1.4	19,348	None reported	Concern of potential off-site migration
Kummer	Beltrami County, Minnesota	23	750,000	Passive	23	1.0	32,609	Yes - reported	Confirmed not resolved
LaGrande	Douglas County, Minnesota	5.2	155,094	Passive	11	2.1	14,099	None reported	
Lake of Woods	Lake of the Woods County	15	72,033	Passive	6	0.4	12,006	None reported	
Leech Lake	Hubbard County, Minnesota	17	850,000	Passive	24	1.4	35,417	None reported	
Lindala	Wright County, Minnesota	13	560,000	Passive	23	1.8	24,348	None reported	
Long Prairie	Todd County, Minnesota	22	375,000	Passive	8	0.4	46,875	None reported	
Mankato	Blue Earth County, Minnesota	13.7	100,000	Passive	5	0.4	20,000	None reported	plus 14 riser vents
Meeker County	Meeker County, Minnesota	25	400,000	Passive	20	0.8	20,000	None reported	plus 6 riser vents in 4 trenches
Minnesota Sanitation Services	Le Sueur County, Minnesota	9	178,000	Passive	11	1.2	16,182	Minor Concern	

TABLE 3.1

PASSIVELY VENTED CLOSED LANDFILLS
MINNESOTA CLOSED LANDFILL PROGRAM

<i>Landfill Name</i>	<i>Landfill Location</i>	<i>Disposal Area Size (acres)</i>	<i>Estimated Volume of Waste (yd³)</i>	<i>Gas Control Method</i>	<i>Number of Passive Vents</i>	<i>Number of Passive Vents per Acre</i>	<i>Yd³ of Waste Per Vent</i>	<i>Off-Site Migration</i>	<i>Comments</i>
Murray County	Murray County, Minnesota	9.5	230,000	Passive	14	1.5	16,429	None reported	
Northeast Ottertail	Ottertail County, Minnesota	13.25	404,297	Passive	9	0.7	44,922	None reported	
Northome Modified	Koochiching County, Minnesota	5.5	85,000	Passive	2	0.4	42,500	None reported	
Northwoods	St. Louis County, Minnesota	12	192,000	Passive	12	1.0	16,000	None reported	
Paynesville	Stearns County, Minnesota	13	870,000	Passive	13	1.0	66,923	None reported	
Pickett	Hubbard County, Minnesota	9	93,269	Passive	9	1.0	10,363	None reported	vents connected by trenches
Pipestone County	Pipestone County, Minnesota	20	300,000	Passive	18	0.9	16,667	None reported	plus 3 horizontal vents
* Red Rock	Mower County, Minnesota	35	1,738,500	Passive	15	0.4	115,900	None reported	
Redwood County	Redwood County, Minnesota	32	550,000	Passive	11	0.3	50,000	None reported	
Rock County	Rock County, Minnesota	16.5	250,000	Passive	20	1.2	12,500	None reported	
Roseau/Salol	Roseau County, Minnesota	30	670,000	Passive	31	1.0	21,613	None reported	
Sibley County	Sibley County, Minnesota	14	160,000	Passive	8	0.6	20,000	None reported	
Stevens County	Stevens County, Minnesota	15.8	265,000	Passive	27	1.7	9,815	None reported	
Sun Prairie	Le Sueur County, Minnesota	20	130,411	Passive	6	0.3	21,735	None reported	
Vermilion Modified	St. Louis County, Minnesota	7	170,000	Passive	9	1.3	18,889	None reported	
Wadena	Wadena County, Minnesota	17.8	525,000	Passive	18	1.0	29,167	None reported	
Waseca County	Waseca County, Minnesota	15.5	400,000	Passive	18	1.2	22,222	None reported	
Average						1.0			

TABLE 3.3

MASS LOADING CALCULATIONS
HOLTZ-KRAUSE LANDFILL
WAUSAU, WISCONSIN

Analand ⁽¹⁾	CAS #	Flare Station Inlet			Conversion Factor	Flare Station Inlet		Blower Discharge		Calculated Blower Discharge Mass		WDNR Limit		% of WDNR Limit	
		Concentration ⁽²⁾ (ppbv)	Molecular Weight			Concentration ⁽²⁾ (mg/m ³)	Flow Rate ⁽³⁾ (cfm)	(lbs/lr)	(lbs/yr)	(lbs/lr)	(lbs/yr)	(lbs/lr)	(lbs/yr)		
1,1,2,2-Tetrachloroethane	79-34-5	127	167.85	6.98	0.89	215	0.0007	6.3	0.369	--	0.19%				
1,2,4-Trimethylbenzene	25551-13-7	363	120.19	5.00	1.81	215	0.0015	12.8	6.6	--	0.02%				
1,3,5-Trimethylbenzene	25551-13-7	166	120.19	5.00	0.83	215	0.0007	5.9	6.6	--	0.01%				
Benzene	71-43-2	520	78.11	3.25	1.69	215	0.0014	11.9	--	228	5.23%				
Bromomethane	74-83-9	256	94.95	3.95	1.01	215	0.0008	7.1	--	888	0.80%				
Carbon Disulfide	75-15-0	929	76.14	3.17	2.94	216	0.0024	20.9	1.67	124,831	0.14%	0.02%			
Chlorobenzene	108-90-7	332	112.56	4.68	1.55	215	0.0013	11.0	2.47	--	0.05%				
Chloromethane	74-87-3	695	50.49	2.10	1.46	216	0.0012	10.3	5.55	--	0.02%				
Dichlorodifluoromethane (Freon 12)	75-71-8	7073	120.92	5.03	35.57	215	0.0287	251.0	--	--					
Dichloromethane	75-09-2	3110	84.94	3.53	10.99	215	0.0088	77.5	9.33	3,781	0.09%	2.05%			
Ethylbenzene	100-41-4	4350	106.16	4.42	19.21	215	0.0155	135.5	23.3	177,688	0.07%	0.08%			
Trichlorofluoromethane (Freon 11)	75-69-4	195	137.38	5.71	1.11	215	0.0009	7.9	--	--					
Isopropylbenzene	98-82-8	160	120.19	5.00	0.80	215	0.0006	5.6	13.2	--	0.00%				
M, P, O-Xylenes	1330-20-7	5010	106.16	4.42	22.12	215	0.0178	156.1	23.3	--	0.08%				
Methyl Ethyl Ketone	78-93-3	14637	72.11	3.00	43.90	215	0.0354	309.7	--	--					
p-Isopropyltoluene	99-87-6	210	134.22	5.58	1.17	215	0.0009	8.3	--	--					
Tetrachloroethene	127-18-4	114	165.85	6.90	0.79	215	0.0006	5.5	9.11	301	0.01%	1.84%			
Tetrahydrofuran	109-99-9	26500	72.11	3.00	79.48	215	0.0640	560.8	31.7	--	0.20%				
Toluene	108-88-3	2150	92.13	3.83	8.24	215	0.0066	58.1	10.1	71,075	0.07%	0.08%			
Trichloroethene	79-01-6	130	131.40	5.47	0.71	215	0.0006	5.0	14.4	888	0.00%	0.56%			

Notes:

⁽¹⁾ Historically detected analands (1999 to 2011).

⁽²⁾ Maximum detected concentration from well field and flare station inlet sampling (1999 to 2011).

⁽³⁾ Average 2010 flare station landfill gas flow rate.

-- No regulatory limit.



Conclusions on Other Passive Sites

- 62 sites similar to Holtz Krause
- Passive venting is an effective and proven technology



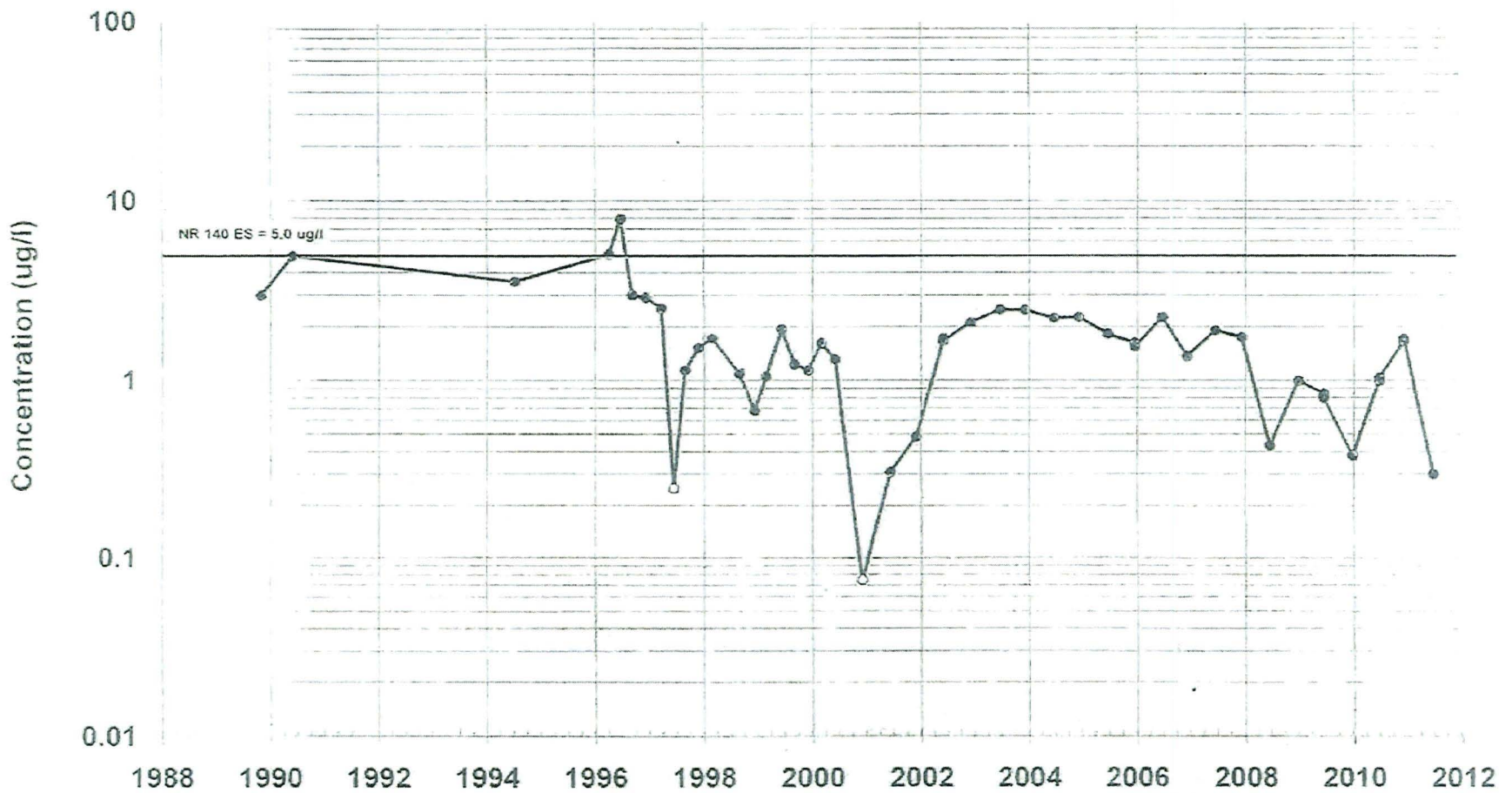
Passive Venting Will Not Impact Air Quality

- VOCs in landfill gas are low
- VOC emissions are well below DNR Limits



Passive Venting Will Not Impact Groundwater Quality

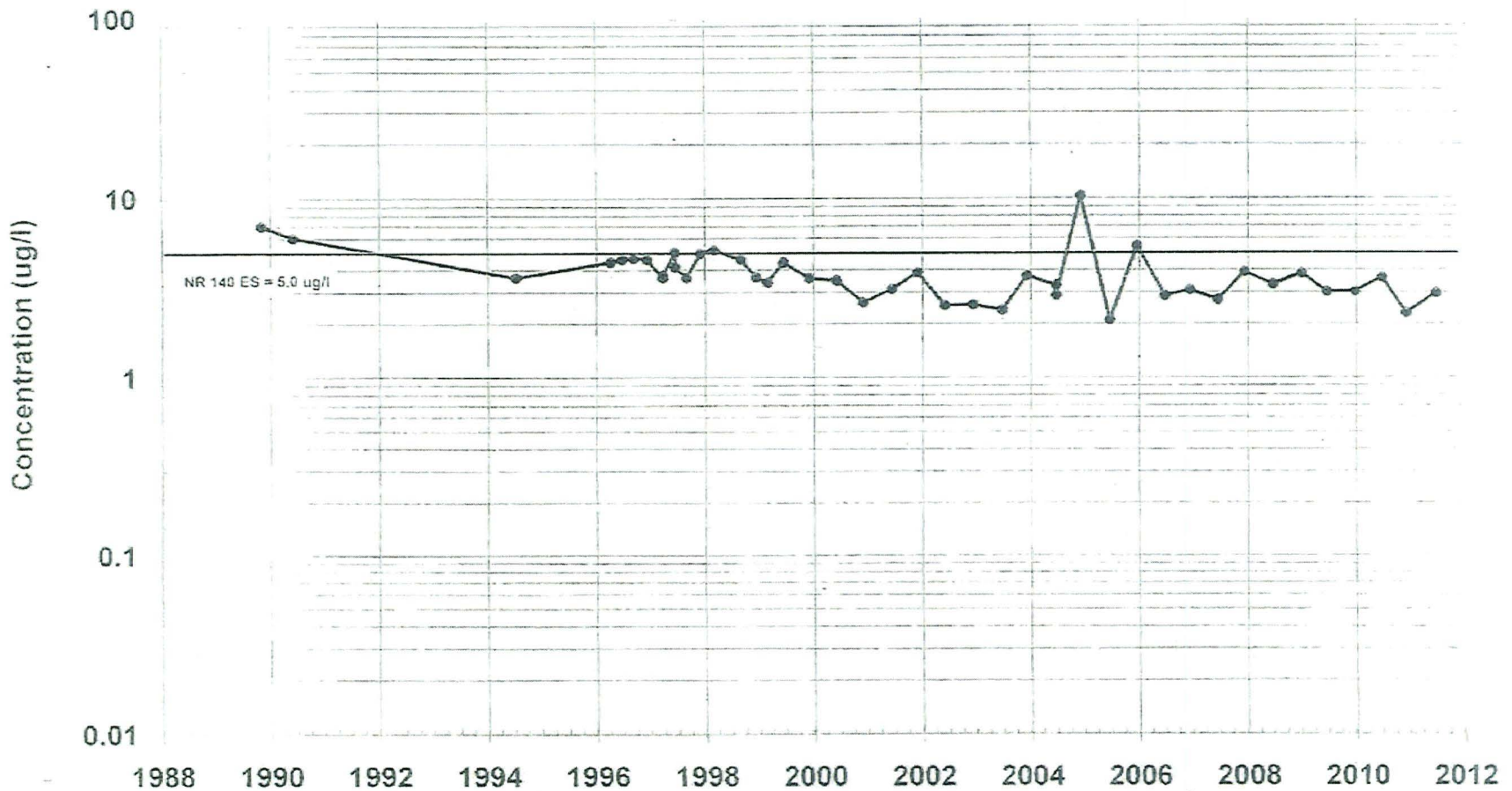
- VOCs in groundwater were low prior to 1994 remedy
- VOCs in landfill gas have always been low
- VOCs slowly improved over time, which is indicative of a low VOC source in the waste



NOTES:
 - OPEN CIRCLE INDICATES THAT COMPOUND WAS NOT DETECTED
 - NON-DETECTED DATA DISPLAYED AT ONE-HALF REPORTING LIMIT

figure 3.2
BENZENE CONCENTRATIONS
MONITORING WELL MW-4B
HOLTZ KRAUSE LANDFILL
Wausau, Wisconsin





NOTES:
 - OPEN CIRCLE INDICATES THAT COMPOUND WAS NOT DETECTED
 - NON-DETECTED DATA DISPLAYED AT ONE-HALF REPORTING LIMIT

figure 3.3
BENZENE CONCENTRATIONS
MONITORING WELL MW-8B
HOLTZ KRAUSE LANDFILL
Wausau, Wisconsin



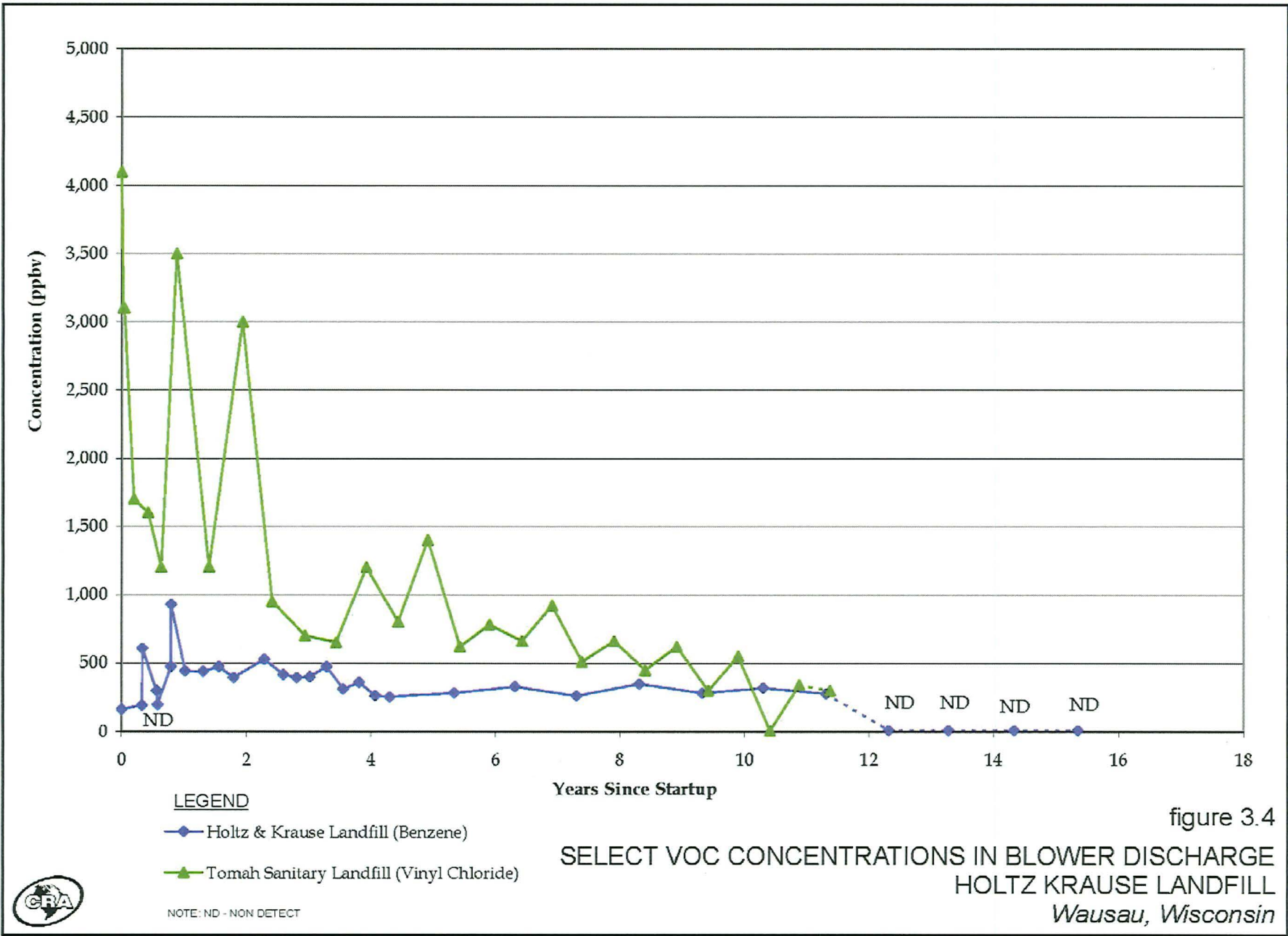


figure 3.4

SELECT VOC CONCENTRATIONS IN BLOWER DISCHARGE
 HOLTZ KRAUSE LANDFILL
 Wausau, Wisconsin





Summary

- Passive venting will prevent off Site migration
- Passive venting will not impact air quality
- Passive venting will not impact groundwater quality