

APPENDIX B

Surveillance of Waupaca County's Benzene Emission

NR 445.08(3)(a)(b) tolerates no cumulative inhalation risk greater than 1 / 100,000 (10E-5). Any county's annual average daily HAP emission concentration that is greater than 4.59 $\mu\text{g}/\text{m}^3/\text{day}$ creates cumulative inhalation risk greater than 1 / 100,000. Waupaca County's cumulative inhalation risk is less than 1 / 100,000 when its annual NR 438 HAP emission is less than 27.32 Tons Per Year ⁽¹⁾.

Table 1

Waupaca' County's Actual HAP Emission Concentration Limit (TEQ TPY, $\mu\text{g}/\text{m}^3/\text{day}$) vs Waupaca Foundry Plants 1 & 2/3 HAP Emissions & Average Daily Concentrations⁽²⁾

Year	NR 445 HAP Limit TPY	Plant 1 + Plant 2/3 Emission TPY	=	Total TPY	= Actual HAP <u>vs</u> ($\mu\text{g}/\text{m}^3/\text{day}$)	NR 445.08(3) Limit	
1995	27.32	12.18		26.49	36.67	7.3*	4.59
1996	27.32	12.65		24.35	37.00	7.3*	4.59
1997	27.32	19.26		30.18*	49.44	8.3*	4.59
1998	27.32	17.89		31.18*	48.17	8.3*	4.59
1999	27.32	18.70		31.08*	49.78	8.4*	4.59
2000	27.32	14.24		28.91*	43.15	7.3*	4.59
2001	27.32	12.81		23.83	36.64	6.0*	4.59
2002	27.32	20.99		25.79	46.78	7.9*	4.59
2003	27.32	20.75		18.16	38.61	6.5*	4.59
2004	27.32	27.50*		23.08	50.58	8.5*	4.59
2005	27.32	28.00*		31.31*	59.36	9.9*	4.59
2006	27.32	27.58*		33.54*	61.13	10.2*	4.59
2007	27.32	17.26		26.70	43.96	7.4*	4.59
2008	27.32	15.81		19.66	35.47	5.9*	4.59
2009	27.32	11.22		12.49	23.71	4.0	4.59
2010	27.32	15.74		22.44	38.18	6.4*	4.59
2011	27.32	19.63		25.99	45.66	7.6*	4.59

** Emission exceeds NR 445.08(3)a,b tolerance.

Table 1 shows that sixteen of Waupaca Foundry's combined seventeen yearly emissions created average daily concentrations greater than 4.59 $\mu\text{g}/\text{m}^3$. These sixteen emissions, CASRN concentrations > E-5, created cumulative inhalation risks > 10⁻⁵. Waupaca Foundry's Plant 1 exceeded the HAP standard in three of seventeen years while its Plant 2/3 exceeded the HAP standard in six of the seventeen years. HAP is 62% benzene and 48% toxic equivalents of benzene (TEQ). Extreme benzene concentrations are known to jeopardize public health, welfare and the environment.

Table 2

Waupaca County's Benzene Dose-Response: Morbidity of Leukemia

Period	Waupaca's Exposure $\mu\text{g}/\text{m}^3$ Benzene	Morbidity / 100K			
		State	95% UL	County	Excess
'95 - '99	49.2	15.0	15.5	20.8	5.8
'96 - '00	43.3	14.7	15.2	20.2	5.7
'97 - '01	36.5	14.8	15.3	18.9	4.1
'98 - '02	38.1	15.0	15.5	18.8	3.8
'99 - '03	36.7	14.9	15.4	17.2	2.3
'00 - '04	36.3	14.8	15.3	17.9	3.1
'01 - '05	38.6	15.2	15.6	18.5	3.3
'02 - '06	42.6	15.0	15.5	18.6	3.6
'03 - '07	43.3	15.3	15.7	18.3	3.0
'04 - '08	43.6	15.3	15.8	18.6	3.3
'05 - '09	46.2	15.5	16.0	17.5	2.0
'06 - '10	44.1	15.6	16.1	15.5	---

Table 2.i

Waupaca County's Benzene Dose-Response: Morbidity of Non-Hodgkin Lymphoma

Period	Waupaca's Exposure $\mu\text{g}/\text{m}^3$ Benzene	Morbidity / 100K			
		State	95% UL	County	Excess
'95 - '99	49.2	20.0	20.5	23.7*	3.7 **
'96 - '00	43.3	19.8	20.3	22.3*	2.5 **
'97 - '01	36.5	19.8	20.4	20.3	ns
'98 - '02	38.1	19.7	20.2	18.8	ns
'99 - '03	36.7	19.7	20.2	20.0	ns
'00 - '04	36.3	19.9	20.4	20.2	ns
'01 - '05	38.6	20.0	20.5	20.2	ns
'02 - '06	42.6	20.3	20.9	20.9	ns
'03 - '07	43.3	20.4	20.9	23.4*	3.0**
'04 - '08	43.6	20.6	21.1	24.2*	3.6**
'05 - '09	46.2	20.4	20.9	23.7*	3.3**
'06 - '10	44.1	20.5	21.0	23.1*	2.6**

* $p < 0.025$ ** $p < 0.001$

Figure 1

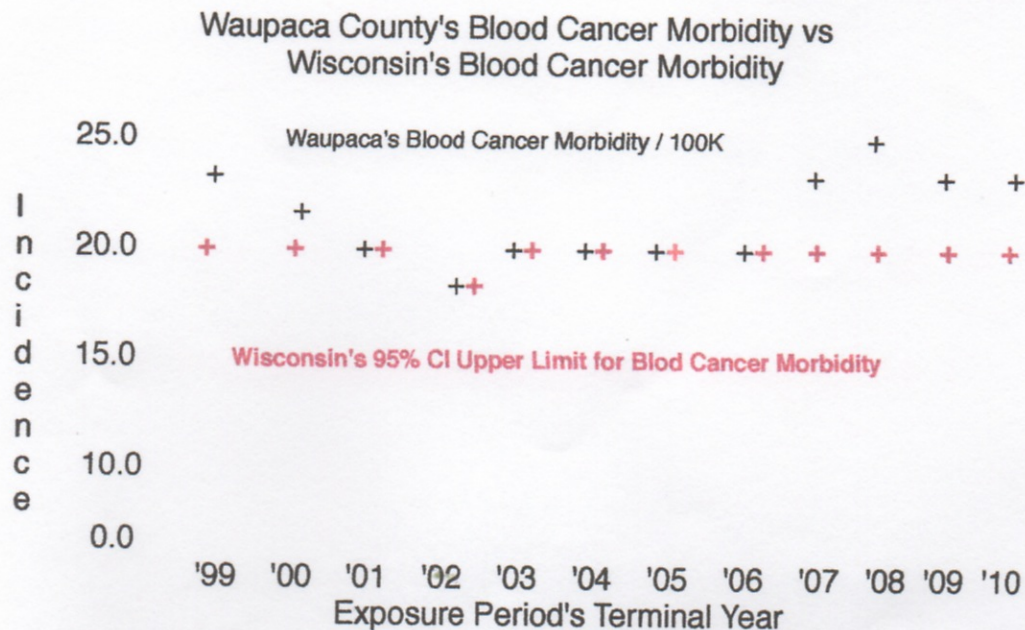


Table 2 and Figure 1 show the long term / sub-acute effects of benzene concentrations on Waupaca County's blood cancer morbidity (incidence of Leukemia and Non-Hodgkin lymphoma).

Benzene emissions are heavier than air. They sink, settle in the county's inhalation environment, are dispersed by natural dynamics such as relentless air turbulence. Standard analytic methods are not reliable sensors of concentrations $< 130 \text{ ug} / \text{m}^3$.

Leukemia and Non-Hodgkin lymphoma incidence rates are reliable indicators of benzene concentrations $< 130 \text{ ug} / \text{m}^3$. Persons who inhale a $40.0 \text{ ug} / \text{m}^3$ benzene concentration have a 1.0 / 10,000 risk for being diagnosed with blood cancers. New cases (incidence) of benzene induced blood cancers are diagnosed / reported within five to fifteen years after a person's first inhalation exposure ⁽³⁾.

Blood cancers are caused by factors common to most of the state's residents. Their average incidence ranges normally. Waupaca County's blood cancer incidence rates have met or exceeded the state's upper limit by significant margins.

Leukemia's the most frequently diagnosed cancer among Wisconsin's 0-18 year old population ⁽⁴⁾. Waupaca County's excess blood cancer rates result from exposure to high benzene emissions; these may very likely occur in the county's 0-18 age group ⁽⁵⁾.

Wisconsin air rule ⁽⁶⁾ allows no cumulative inhalation impact greater than 1×10^{-5} . Permit variances to rule may be allowed if all other possible operations are economically unfeasible. Table 3 shows that Milwaukee, Sheboygan and Winnebago counties are other counties that significantly exceed the state's leukemia morbidity rate.

Table 3

Counties That Exceed EPA's CASRN: Leukemia Morbidity / 100K ⁽⁴⁾
 (* Exceeds Wisconsin's 95% CI Upper Limit)

Period	Wisconsin UL	Milwaukee	Sheboygan	Winnebago	Waupaca
'95 - '99	15.5	13.9	17.1*	14.1	20.8*
'96 - '00	15.2	13.4	16.5*	14.3	20.2*
'97 - '01	15.3	13.6	17.8*	13.2	18.9*
'98 - '02	15.5	13.8	18.0*	13.2	18.8*
'99 - '03	15.4	14.0	17.7*	14.1	17.2*
'00 - '04	15.3	14.2	16.0*	13.3	17.9*
'01 - '05	15.6	15.1	17.6*	14.5	18.8*
'02 - '06	15.5	15.5	18.5*	14.8	18.6*
'03 - '07	15.7	16.5*	18.5*	15.4	18.3*
'04 - '08	15.8	16.5*	18.6*	15.9*	18.6*
'05 - '09	16.0	16.8*	19.1*	17.2*	17.5*
'06 - '10	16.1	16.7*	18.7*	18.0*	15.5

The EPA CASRN screening* of APPENDIX A demonstrates that four of Wisconsin's seventy-two counties were exposed throughout 2010 to industrial benzene emission concentrations greater than $4.59 \mu\text{g}/\text{m}^3$. EPA classifies these highest four counties as E-5: their 2010 benzene concentrations create cancer risks $> 1 / 100,000$.

* For purposes of determining emissions and concentrations of hazardous air contaminants a source may rely on information generated by the EPA screening to demonstrate the concentrations of hazardous air contaminants will not exceed the ambient standards (NR 445.08(5)(d)).

Table 3 shows these four counties' leukemia incidence has significantly exceeded the state's average leukemia incidence (morbidity). Table 4 shows the same for these counties' leukemia's mortality. Benzene-induced cancer morbidity and mortality rates in Milwaukee, Sheboygan, Winnebago and Waupaca counties have exceeded $1 / 100,000$ continuously since 2003.

Table 4

Wisconsin's E-5 Counties: Leukemia Mortality / 100K⁽⁴⁾ (* > 95% CI / UL)

Period	WI UL	Milwaukee	Sheboygan	Winnebago	Waupaca
'95 - '99	8.8	8.5	7.6	8.9*	11.2*
'96 - '00	8.8	8.4	8.5	9.4*	11.8*
'97 - '01	8.9	8.8	8.8	9.8*	11.8*
'98 - '02	8.7	8.7	8.4	8.9*	10.4*
'99 - '03	8.6	8.1	8.3	9.1*	9.2*
'00 - '04	8.6	8.2	8.5	8.1	10.4*
'01 - '05	8.7	8.6	9.0*	8.5	11.0*
'02 - '06	8.6	8.5	10.3*	8.0	11.5*
'03 - '07	8.5	8.6*	9.2*	8.0	12.1*
'04 - '08	8.5	9.0*	8.9*	7.6	12.7*
'05 - '09	8.3	8.5*	9.2*	7.9	13.5*
'06 - '00	8.3	8.6*	8.5*	8.4*	10.9*

Table 5.1

Waupaca County's Benzene Exposure: Excess Morbidity of Benzene-induced Blood Cancers / 100K (Leukemia & Non-Hodgkin Lymphoma)

Period	Exposure* $\mu\text{g}/\text{m}^3$	Minimum CASRN Predicted Excess*	Waupaca's Excess / 100K	Waupaca's Actual New Cases / Year
'95 - '99	49.2	> 1.0	9.5	4.75
'96 - '00	43.3	> 1.0	8.2	4.10
'97 - '01	36.5	> 1.0	4.1	2.05
'98 - '02	38.1	> 1.0	3.8	1.90
'99 - '03	36.7	> 1.0	2.3	1.65
'00 - '04	36.3	> 1.0	3.1	3.05
'01 - '05	38.6	> 1.0	3.3	1.65
'02 - '06	42.6	> 1.0	4.2	4.10
'03 - '07	43.3	> 1.0	6.0	3.00
'04 - '08	43.6	> 1.0	6.9	3.45
'05 - '09	46.2	> 1.0	5.3	2.65
'06 - '00	44.1	> 1.0	2.3	1.65

Table 5.2

**Waupaca County's Benzene Exposure, Benzene-Induced Mortality Rates / 100K
and Costs Attributable to Benzene-induced Excess Mortality: 1995 - 2010**

Period	Exposure* ug/m ³	Leukemia Mortality			NHL Mortality			County Net Excess	Net Cost**
		State	County	Excess	State	County	Excess		
'95-'99	49.2	8.4	11.2	2.8	9.4	11.2	1.8	4.6	\$ 31.7 M
'96-'00	43.3	8.4	11.8	3.4	9.3	11.0	1.7	5.1	35.2 M
'97-'01	36.5	8.5	11.8	3.3	9.0	10.4	1.4	4.7	32.4 M
'98-'02	38.1	8.3	10.4	2.1	8.6	11.0	2.4	4.5	31.1 M
'99-'03	36.7	8.3	9.2	0.9	8.1	11.5	3.4	4.5	31.1 M
'00-'04	36.3	8.3	10.4	2.1	7.7	8.5	0.8	2.9	20.0 M
'01-'05	38.6	8.3	11.0	2.7	7.6	8.7	1.1	3.8	26.2 M
'02-'06	42.8	8.3	11.5	3.2	7.5	9.6	2.1	5.3	36.6 M
'03-'07	43.3	8.2	12.1	3.9	7.4	8.0	0.6	4.5	31.1 M
'04-'08	43.8	8.1	12.7	4.5	7.4	8.5	1.1	5.7	39.3 M
'05-'09	46.2	8.0	13.5	5.5	7.2	9.9	2.7	8.2	56.7 M
'06-'10	44.1	8.0	10.9	2.9	7.0	10.3	3.3	6.2	42.8 M

* Exposures greater than 4.59 ug/m³ create risks greater than 1 / 100,000 (10⁻⁵). Waupaca's benzene-induced excess mortality rates result from cumulative inhalation exposures that exceed the tolerance of Wisconsin's Ch. NR 445.08.

** EPA's 2008 Value of A Statistical Life Lost = \$ 6.9 Million. Since 1995 Waupaca's cost of benzene induced blood cancers has ranged from \$ 20.0 M - \$ 56.7 M per year.

(1) Derivation of Waupaca's HAP Emission Standard according to NR 445.08(3): HAP concentrations > 4.59 ug/m³ create cumulative inhalation risks > 10⁻⁵. NR 445.08 protects from HAP emissions that create cumulative inhalation risk > 10⁻⁵. Waupaca County = 1.9 x 10⁹ sq meter. Waupaca may tolerate no more HAP than 8.72 Kg / day (4.59 ug/m³ x 1.9 x 10⁹ meter³). When this value is adjusted by 7.8 (the standard dispersion factor for benzene) the county's limit is 68.0 Kg / day (7.8 x 8.72 Kg / day). Accordingly, the county's yearly HAP emission can be no more than: (68 Kg/day x 365 days / year), 24,833 Kg / year, 27.32 TPY.

(2) Wisconsin Ch. 438, FID Nos. 469033730 and 469033840. These emission inventories create Waupaca County's benzene concentrations.

(3) USEPA, CASRN 71-43-2

(4) WISH Data Query System, <http://dhs.wisconsin.gov/wish/>.Cancer Module, accessed March - August, 2012, March 12 - 24, 2013.

(5) Research under Wis. Stat. 255.04(2)(3)(c)1,2 may confirm that Waupaca's excess leukemia is juvenile-age related.

(6) Wisconsin NR 445.08(3)(a),(b)

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