BEFORE THE OHIO POWER SITING BOARD

In the Matter of the Application of Champaign Wind LLC, for a Certificate to Construct a Wind-Powered Electric Generating Facility in Champaign County, Ohio	**)** **)** **)** **)** **)**	**Case No. 12-0160-EL-BGN**

EXHIBITS L TO Z OF THE AMENDED DIRECT WRITTEN TESTIMONY OF WILLIAM PALMER, FILED ON BEHALF OF INTERVENORS UNION NEIGHBORS UNITED, INC., DIANE AND ROBERT McCONNELL, AND JULIA F. JOHNSON

CERTIFICATE OF SERVICE

I hereby certify that, on November 6, 2012, a copy of this document was served by electronic mail on M. Howard Petricoff (mhpetricoff@vorys.com); Michael J. Settineri (mjsettineri@vorys.com); Miranda Leppla (mrleppla@vorys.com); Chad Endsley (cendsley@ofbf.org); Nick Selvaggio (nselvaggio@champaignprosecutor.com); Jane Napier (jnapier@champaignprosecutor.com), Stephen Reilly (Stephen.Reilly@puc.state.oh.us), Devin Parram (Devin.Parram@puc.state.oh.us); Kurt P. Helfrich (Kurt.Helfrich@ThompsonHine.com); Philip B. Sineneng (Philip.Sineneng@ThompsonHine.com); Ann B. Zallocco Ann.Zallocco@ThompsonHine.com); and G.S. Weithman (diroflaw@ctcn.net).

s/ Jack A. Van Kley
Jack A. Van Kley

EXHIBIT L-1

Compiled by
William KG Palmer

Exhibit L Industrial Wind Turbine Failures
Jan 2008 - Sept 2012

Basic Source of Data
www.caithnesswindfarms.co.uk

Date	Failure Type	Turbine Type	Failure	Location
Nov-12	Blade	Vestas V27	Full blade comes off wind turbine, falls near hiking trail	Falkenberg,Sweden
Aug-12	Blade	Gamesa 2 MW	University of Delaware turbine blade failure after lightning strike	Delaware, USA
Jul-12	Blade	GE 1.5 MW	Blade shatters - parts away from tower	Wyoming, USA
Jun-12	Blade	Repower-MM82-2M	Blade snaps off wind turbine and falls 100m	Austria
Jun-12	Blade	GE 1.6 MW	Blade failure at Settlers Park in lightning, some parts travel over wide ar	Illinois, USA
May-12	Blade	Repower-MM82-2M	Blade comes off turbine, narrowly misses A10 motorway	France
May-12	Blade	GE 1.6 MW 100	5 turbines lose blade(s) in mini-tornado - parts travel 1 mile	Kansas, USA
Apr-12	Blade	Vestas V100	2 Blades damaged on Vestas turbine - 6.6 lb part went 764 ft	Ohio US
Mar-12	Blade	Repower-MM82-2M	Blade failure - lightening strike - central web on Ground	Vic. Australia
Jan-12	Blade	Vestas	Turbine damaged in December looses blade(s) in storm in Jan	Faroe Islands
Jan-12	Blade	Jeumont J48-750	One blade lost and 2 damaged during storm	France
Jan-12	Blade	Vestas	Lightning strike destroys blade - 2 maintainers in turbine at time	Mors, Denmark
Sep-11	Blade	Gamsea 805kW	Blade breaks off hits transmission line	India
Aug-11	Blade	Nextgen 400 kW	Turbine blade damaged - lightning strike - spreads debris	Conn US
Aug-11	Blade	Nextgen 400kW	Second turbine blade damaged lightening strike - tip blown off	Conn US
Jul-11	Blade		Thunderstorm - at least 6 turbines damged many w blade(s) missing	Minn US
May-11	Blade		NextEra - Broken Blade in March reported in May	Illinois US
May-11	Blade		2 blades of wind turbines damaged in storm	North Dak US
Dec-10	Blade	GE 1.5 MW	Fails in gusty winds, blade struck tower, no icing, cause unknown	Canada
Sep-10	Blade		Blade comes off hits vehicle	Texas US
Sep-10	Blade	Vestas V112	6 to 7 m piece of blade breaks off	Denmark
Aug-10	Blade		Elkhorn ridge turbine damaged by lightning	Nebraska US
Jul-10	Blade		2 blades of separate turbines broke in half - Invenergy Wind	Illinois US
Jun-10	Blade		Blade shredded by lightning	Australia
May-10	Blade		Blade bent at base and split along 40m length	Illinois US
May-10	Blade	WES	Lightning strike results in 60 cm split in blades (reported in Oct.)	Nebraska US
Mar-10	Blade	Siemens 2300	Blade snaps off turbine	Scotland UK
Jan-10	Blade	WES	Blade fails, 6 m piece breaks off, lands 54 m away	Mass US
Dec-09	Blade	Gamesa 2 MW	All blades cracked on 25 turbines, 2 blades lose 1/3 to 1/2 after storm	Calif US
Dec-09	Blade	Suzlon 2.1 MW	Turbine "explodes" losing a blade	Brazil
Nov-09	Blade	Vestas V47	Blade lands on path used by hikers (Falkenberg)	Sweden
Nov-09	Blade		45m turbine blade breaks - Trondheim	Norway
Oct-09	Blade	Vestas V90	Turbine failure, braking fails in 30m/s winds, blade breaks	Sweden
Sep-09	Blade	WES	Second blade failure in 15 months on same turbine, U Sheffield	England UK

EXHIBIT L-2

Compiled by
William KG Palmer

Exhibit L Industrial Wind Turbine Failures
Jan 2008 - Sept 2012

Basic Source of Data
www.caithnesswindfarms.co.uk

Jul-09	Blade	GE 1.5 MW	Turbine loses 39m blade after lightning strike	Montana US
Jul-09	Blade	Vestas V80	40m blade "explodes" after lightning strike, parts travel 150m	Germany
Jun-09	Blade	GE 1.5 MW	Turbine blade failure after lightning strike	Montana US
May-09	Blade		Blade falls onto highway A6 Lelystad	The Netherlands
May-09	Blade		Blade bent in half, Wilton	North Dak US
Mar-09	Blade	GE 1.5 MW	Turbine blade failure	Illinois US
Jan-09	Blade	Enercon E48	One blade lost due to bolt failure, damages second blade	England UK
Dec-08	Blade	Vestas V90	Blade damage, pieces travel 490 m	PEI Canada
Nov-08	Blade	GE 1.5 MW	Fails in gusts, no icing or manufacturing defect, cause unknown	Canada
Oct-08	Blade	Suzlon 2.1 MW	42m blade breaks off turbine - lands 46 m away	Illinois US
Jul-08	Blade	Nordex S77 1.5MW	32 m blade breaks off	Germany
Jun-08	Blade	WES	Blade failure after 2 months in service Sheffield U	England UK
May-08	Blade	Vestas V47	23m blade breaks off, passes over road	The Netherlands
Apr-08	Blade		2 blades on separate turbines each lose 37 m blade in storm	Japan
Mar-08	Blade	Gamesa 2 MW	10 m section breaks off blade, flies 200m	Italy
Feb-08	Blade	Vestas V47	Turbine loses blade, travels 100m	Denmark
Feb-08	Blade	Nordex	Blade failure	Norway
Feb-08	Blade	Vestas	Loses blade - travels 40m	Sweden
Jan-08	Blade	GE 1.5 MW	Turbine looses blade portion in storm - Prince Wind Farm	ON Canada
Sep-12	Collapse	Ming Yang 1.5 MW	Worker killed in turbine collapse, foundation bolts not tight	China
Jun-12	Collapse	66 kW	Rankin Inlet turbine loses all blades	Nunavut, Canada
Feb-12	Collapse		Tower collapse in Faroe Islands	Faroe Islands
Feb-12	Collapse	Kenetech 375 kW	Cowley Ridge wind turbine collapses	AB, Canada
Jan-12	Collapse	Mitubishi 300kW	Nacelle and blades "blown off" turbine (Wales)	Wales, UK
Dec-11	Collapse		Turbine collapse during storm - newly erected	Scotland UK
Dec-11	Collapse		Turbine collapse	England UK
Nov-11	Collapse	Ecotecnia 600kW	Alstom turbine collapses while out of service on Spanish Highway N-340	Spain
Jul-11	Collapse		Turbine collapses in thunderstorm	Minn US
Nov-10	Collapse		Foote Creek Turbine collapse	Wyoming US
May-10	Collapse	Vestas V25	Complete collapse	France
Dec-09	Collapse	GE 1.5 MW	Turbine at Fenner Wind Farm collapses on loss of power	NY US
Nov-09	Collapse	Wincon	All blades on 40m turbine come off - hit power transformer	Denmark
Nov-09	Collapse	1.5 MW	Acciona turbine at Aibar Wind - nacelle, blades and tower collapse	Spain
May-09	Collapse	Vestas	Turbine overspeeds and collapses, Palm Springs	Calif US
Apr-09	Collapse		60 m turbine failure and collapse, North Palm Springs	Calif US

EXHIBIT L-3

Compiled by
William KG Palmer

Exhibit L Industrial Wind Turbine Failures
Jan 2008 - Sept 2012

Basic Source of Data
www.caithnesswindfarms.co.uk

Mar-09	Collapse	Ge 1.5 MW	Turbine collapses at Noble Environmental Site - blades overspeed	NY US
Feb-09	Collapse		Turbine collapses during construction - blades overspeed	Idaho US
Oct-08	Collapse		Turbine blade contacts tower, collapsing it	Vermont US
Mar-08	Collapse	Lagerway	Turbine collapse	The Netherlands
Feb-08	Collapse	Vestas	Second turbine overspeeds, blades hit tower, parts travel 500m	Denmark
Feb-08	Collapse	~ 260 kW	Turbine Collapse - Island of Texel	The Netherlands
Jan-08	Collapse	Vestas V25	Turbine collapses, Cumbria	England UK
Oct-11	Craning		5 killed in craning accident	China
Jul-11	Craning		Craning accident lifting rotor - kills operator	Brazil
Jan-11	Craning		Tower collapse during construction due to craning failure	Minn US
May-10	Craning		Blade dropped during construction, kills worker	England UK
May-10	Craning		Crane collapses, dropping blades and rotor	Germany
Sep-09	Craning		Crane collapse	NY US
May-08	Craning	Vestas V90	Crane colapse during construction	The Netherlands
Oct-11	Debris		Part of turbine fell to ground	Ohio US
Oct-12	Fire	Vestas V90	Turbine catches fire at Crofton Bluffs Windfarm - fire out I/S 2012	Nebraska, USA
Aug-12	Fire		Buffalo Ridge wind turbine - burning blades fall to ground	Minnesota, USA
Jul-12	Fire	NEG Micron 82	Turbine bursts into flames, ignites ground fire	California, USA
Jun-12	Fire	Vestas V90	Turbine fire - electrical arc - employee burned	Spain
May-12	Fire	Gamsea G87 2MW	Turbine nacelle catches fire	Iowa, USA
Mar-12	Fire	Vestas V112 3 MW	Vestas new "flagship" turbine destroyed by fire	Germany
Feb-12	Fire		Fire completely destroys turbine 90 m tall (to hub)	Austria
Feb-12	Fire	Gamesa 2 MW	Fire destroys wind turbine at Allegheny Wind Farm,	Penn US
Feb-12	Fire	CSR China 1.65MW	Fire kills one maintainer, second missing - work on power converter	inn. Mongolia, China
Jan-12	Fire	GE 1.5 MW	Altona turbine catches fire, destroyed	NY, USA
Dec-11	Fire	Vestas V80	Turbine catches fire during storm - burning debris wide spread	Scotland UK
Oct-11	Fire		Turbine fire - Abilene TX - throwing "fireballs"	Texas US
Oct-11	Fire	Vestas 1.65	Turbine fire spreads debris over wide area	Japan
Sep-11	Fire	Vestas	Fire destroys wind turbine	Sweden
Aug-11	Fire		Turbine fire - Abilene TX - spreads to surroundings	Texas US
Aug-11	Fire		Scout Moor wind farm fire (earlier in year) - damage unspecified	UK
Aug-11	Fire		McBain wind turbine fire - damage unspecified	Mich US
Jan-11	Fire		Fire destroys turbine at Fitzpatrick Mountain	NS Canada
Jan-11	Fire		Fire in nacelle, 1 dies, 2 injured	China
Dec-10	Fire		Fire destroys turbine	Germany

EXHIBIT L-4

Compiled by
William KG Palmer

Exhibit L Industrial Wind Turbine Failures
Jan 2008 - Sept 2012

Basic Source of Data
www.caithnesswindfarms.co.uk

Dec-10	Fire		Fire destroys FPL turbine	Iowa US
Nov-10	Fire		Fire destroys turbine - stand back 500m - blade tips fly off	Australia
Oct-10	Fire		Unable to fight turbine fire - let burn out	Wales UK
Sep-10	Fire		2 Turbines 3 km apart catch fire in storm - widely scattered debris	France
Apr-10	Fire		Turbine destroyed by fire	Denmark
Dec-09	Fire		Fire at 130m in air - burning material falling	Germany
Oct-09	Fire	Vestas	Turbine destroyed by fire	France
Oct-09	Fire		Second turbine destroyed by fire	France
Oct-09	Fire		Fire at Wind Turbine transformer station - second fire at this location	NY US
Aug-09	Fire	Vestas	Fire at Kent Hills turbine destroys turbine	NB Canada
May-09	Fire	G87	Locust Ridge 1 Wind Farm Fire destroys turbine	Penn US
Apr-09	Fire		Fire destroys turbine	Spain
Feb-09	Fire	Vestas 2 MW V90	Cathedral Rocks wind turbine fire - falling embers ignite ground	Australia
Jan-09	Fire		2 separate electrical fires in one day - damage unspecified	Spain
Sep-08	Fire		Turbine destroyed by fire	Spain
Jul-08	Fire		Turbine destroyed by fire	Germany
Jul-08	Fire	Gamesa	Turbine destroyed by fire - burning nacelle and blades - video	Portugaul
May-08	Fire		Turbine fire - Palm Springs CA - falling embers ignite ground	Calif US
May-08	Fire	Suzlon	Turbine fire, burning blades fall to ground	Minn US
Mar-08	Fire	Suzlon 2.1 MW	Fire destroys turbine at Ewington wind farm	Minn US
Mar-08	Fire	GE 1.5 MW	Fire destroys FPL turbine at Birds Landing	Calif US
Jan-08	Fire	Gamesa 2 MW	Fire destroys NexPower turbine at Mt. Storm	West Virginia US
Mar-12	Injury		Worker crushed at MacArthur Windfarm Site	Australia
Nov-11	Lightning		Report shows 197 turbine lightning strikes in Japan in 2004-2009	Japan

Red text identifies multiple blades on ground due to event.

Lines highlighted in blue for information only - not counted

EXHIBIT M

Compiled by
William K.G. Palmer

Exhibit M - Failure Rate for Accidents putting
Wind Turbine Blades or parts on the Ground

Failure Data from Appendix 1

	End 2006	End 2007	End 2008	End 2009	End 2010	End 2011	End Jun 2012	4.75 Yr Avg
World Turbine MW	74151	93927	121188	146094	190730	219365	228808	
United States	11603	16819	25170	32919	40216	46919	48619	
Canada	1460	1846	2369	3301	4015	5265	5435	
Europe	48625	57232	66160	72447	86328	95877	98121	
Pacific (Australia, NZ, Japan, & the Philipines)	2297	2667	3724	3999	4756	5413	5542	
MW Assessed for Failure	63985	78564	97423	112666	135315	153474	157717	
Year End Delta		14579	18859	15243	22649	18159	4243	
Per Turbine	0.75	1.00	1.50	1.75	2.00	2.00	2.50	
Calculated # Turbines	85313	99892	112465	121175	132500	141579	143276	
Turbine Yrs/period		92603	109322	120087	132500	141579	107776	611263
Op Yrs Exp								
Failures Blade at distance from turbine			9	8	9	6	11	43
Failures Fire			8	7	7	8	6	36
Failures Collapse (not counted for distant part throw)			5	6	2	3	4	20
Failure Rate per year			0.00016	0.00012	0.00012	0.00010	0.00016	0.00013
Failure Rate per Million Yrs			156	125	121	99	158	129

Since Only Failures from:
- North America
- Europe
- Pacific Region

are counted, similarly only
operational hours for those
regions are counted.
Only count events that can put parts at a distance from turbine

EXHIBIT N

Exhibit N – Equivalent Energy From Falling Wind Turbine Blades			
	Southwest Windpower Air X Wind Generator	GE 2.5 XL Wind Turbine	
			Sample Calculation for GE 2.5 XL Turbine: • Kinetic Energy in Rotating Blade = ½ mv^2 = ½ x 13,000 x [(π x 100/2m x 14rpm) / 60 sec/min]^2 = 8.7 x 10^6 joules • Energy gained from static fall calculated by determining time to fall from hub height (Distance = ½ at^2) 100 m = ½ x 9.81 m/sec^2 x t^2 t = 4.5 sec • Velocity on impact at ground (V = at) = 9.81 m/sec^2 x 4.5 sec = 44.3 m/sec (145 ft/sec) • Energy on impact at ground from fall = ½ x m x v^2 = ½ x 13,000 kg x (44.3 m/s)^2 = 1.3 x 10^7 joules • Total Energy = Kinetic energy of rotation + energy from static fall = 8.7 x 10^6 joules + 1.3 x 10^7 joules = 2.2 x 10^7 joules
Blade Diameter	1.18 m	100 m	
Rated Blade Speed	~1000 RPM	14 RPM	
Blade Tip Speed	58 m/s	73.3 m/s	
Blade Mass	~ 0.5	~ 13,000 kg	
Tower Top Weight	5.9 kg	~ 85,000 kg	
Tower Hub Height	68 ft (20.7 m)	100 m	
Energy in Each Rotating Blade	~ 200 joules	~ 8.7 x 10^6 joules	
Energy Gained in Falling	~ 100 joules	~ 1.1 x 10^7 joules	
Total Energy	~ 300 joules	~ 2.2 x 10^7 joules	
Energy if outer 10% of blade falls from hub height Equivalent effect calculations assume drop with no initial speed to calculate effective heights.	~47 joules Equivalent to dropping a can of pop (0.38 kg) from a 4th floor window (12.5 metres)	~ 2.5 x 10^6 joules Note – this takes no credit for blade rotational speed. Equivalent to dropping a Ford Crown Victoria (1875 kg) from a height of 136 m (446 ft) – over 2 and a half times the 167 foot height of Niagara Falls	

- Blade Mass estimated from the rotor mass (40,000 kg) for GE 2.5 XL per manufacturer data
- Energy in rotating blade estimated by taking velocity as half of tip speed (for average velocity)
- Energy in outer 10% of blade estimated by using half of 10% of blade mass to account for blade taper
- Used tip speed to estimate velocity for outer 10% of blade
- All blade fall calculations assumed to occur from hub height

Exhibit O – Equivalent Energy in Falling bit from Wind Turbine

	From Turbine (work down this column from top)	Equivalent Object (work up this column from bottom to determine distance)	
Mass of Object	3 kg (6.6 pounds)	Concrete Block 18 kg (40 pounds)	**In Conclusion, a 3 kg piece of a wind turbine blade coming from mid blade (where blade typically buckles) considering the object starts at the velocity of the blade at mid point, and then falls from hub height to earth, is equivalent to dropping a 18 kg (40 pound) concrete block from an 8 storey window.**
Initial Velocity of Object	Consider at mid blade length $V = [(\pi \times 100/2m \times 14rpm) / 60sec/min]$ V = 36.6 m/sec (120 ft/sec)	At rest V = 0	
Kinetic Energy from Initial Velocity	$KE = ½ \times m \times V^2$ $KE = ½ \times 3kg \times (36.6m/s)^2$ KE = 2009 joules	KE = 0	
Energy gained from static fall calculated by determining time to fall from hub height	(Distance = $½ at^2$) 100 m = $½ \times 9.81 m/s^2 \times t^2$ t = 4.5 sec	Distance = $½ \times 9.81 m/s^2 \times (2.4s)^2$ = 28.2 m (~ 92 ft) (or 8 stories up)	
Velocity on impact at ground	(V = at) = $9.81 m/s^2 \times 4.5 s$ = 44.3 m/s (145 ft/s)	23.4 m/s = $9.81 m/s^2 \times t$ Thus t = 2.4 s	
Energy on impact at ground from fall	= $½ \times m \times V^2$ = $½ \times 3 kg \times (44.3 m/s)^2$ = 2944 joules	4953 joules = $½ \times m \times V^2$ = $½ \times 18 kg \times V^2$ Thus V = 23.4 m/s (~ 77 ft/s)	
Total Energy = Kinetic energy of rotation + energy from static fall	= 2009 joules + 2944 joules = 4953 joules	Work up this column	

Exhibit P – The Impact of an Object falling From a Wind Turbine

- A very simplistic assessment of the equivalency of dropping a 3 kg piece of blade (or of ice) from the Buckeye II wind turbines was shown in the previous appendix 4, which suggests the impact might be in the order of that from dropping an 18 kg concrete block from an 8 storey window.
- The photo following (Figure 3) is the result of someone dropping a brick (approximately 1 kg) from an overpass (approximately 5 to 10 metres above the car) onto a car window in Montreal as reported in the CBC News Website for August 11, 2011. The caption under the picture on the Montreal CBC site states, "*A chunk of concrete the size of a brick smashed a car windshield on Papineau Street Thursday afternoon, injuring a passenger. (CBC)"* Since this is only a brick sized piece, and an overpass is considerably less elevation than an 8 storey window, it is fairly easy to conclude that the object falling from the turbine as has been documented to fall from a wind turbine in Ohio, might well lead to a fatality.

Figure 4 – From CBC Montreal Website – August 11, 2011

And Fires do Occur

GE 1.5 MW wind turbine - Altona NY on fire Jan 29, 2012

EXHIBIT R-1

Compiled by
William K.G. Palmer

Exhibit R - Buckeye II Wind Development
Public Safety Assessment

Source of Data
Figure 05-4 Site Layout of Buckeye II

Wind Turbine	Nearest Road	Distance (ft)	Bearing (deg)	Nearest Home	Distance (ft)	Bearing (deg)	# Homes in 3000ft
71	Parkview Rd	1750	90	SH36	1600	10	7
71	US Hy 36	1800	350				
72	CR160	1300	280	CR157	1100	65	11
72	CR157	1400	80	CR160	1200	260	
73	CR216	1500	350	CR216	1400	270	14
74	CR160	2500	95	CR160	2800	95	9
74	CR216	2600	340	CR216	1800	30	
75	CR167	2000	230	CR167	2000	205	12
75	CR216	2200	350	CR216	2400	350	
76	CR167	1800	245	CR167	1600	225	3
77	CR167	2200	275	CR167	1900	270	
78	St Rd 29	1600	175	Ov29	1300	220	10
79	CR166	1200	20	CR166	800	90	9
80	CR166	2200	10	CR166	1200	45	9
80	Talbot Rd	2600	270				
80	St Rd 161	3000	180				
81	TWHY223	1000	275	TWHY223	1500	230	9
81	Evans Rd	1800	10				
82	TWHY223	1200	250	TWHY223	1400	210	9
82	CR167	2200	100	CR167	1400	80	
83	CR167	1400	100	CR167	1400	115	10
83	TWHY223	1600	270	TWHY223	1200	260	
84	CR166	1200	20	CR166	1600	10	9
84	TWHY168	1800	280				
85	TWHY168	600	275	TWHY168	600	260	4
86	TWHY168	2400	290				3
86	Talbot Rd	3200	90	Talbot Rd	1200	90	
87	Swisher Rd	2000	150	Ov814	1100	270	7
88	St Rd 56	1400	270	Ov56	1100	220	14
88	St Rd 56	1400	220				
89	St Rd 56	1300	75	Ov56	1600	40	20
89	TWHY175	1900	270				
90	St Rd 161	1800	180	Ov161	1700	190	8
91	TWHY205	800	50	TWHY205	1100	90	7

EXHIBIT R-2

Compiled by
William K.G. Palmer

Exhibit R - Buckeye II Wind Development
Public Safety Assessment

Source of Data
Figure 05-4 Site Layout of Buckeye II

91	TWHY204	1050	140				
92	TWHY205	1800	80	TWHY205	1400	60	6
93	TWHY205	1350	25	TWHY205	1500	0	
94	St Rd 161	2000	0	Ov161	2000	10	10
94	Parkview Rd	2600	230	Parkview Rd	1800	170	
95	St Rd 161	1350	5	Ov161	1400	20	3
95	St Rd 559	2400	100				
96	TWHY204	1300	305	TWHY204	1400	340	7
97	CR166	1600	20				15
97	Talbot Rd	1800	90	Talbot Rd	1800	80	
98	TWHY168	1300	275	TWHY168	1300	290	2
99	CR166	1700	20	CR166	1600	50	12
100	N Parkview	1500	270	N Parkview	1800	175	9
101	TWHY205	800	50	TWHY205	1000	100	8
101	Parkview Rd	1900	270	Parkview Rd	1800	270	
105	Evans Rd	900	105	Evans Rd	1200	340	8
105	CR167	1600	100				
106	CR167	800	90	CR167	1400	125	7
106	Evans Rd	2000	320				
107	Swisher Rd	1000	310	Swisher Rd	1200	280	9
107	TWHY233	1400	90				
108	CR167	1100	100	CR167	1200	80	9
108	TWHY223	2000	280				
109	CR167	1200	100	CR167	1400	90	10
109	TWHY223	1600	280	TWHY223	1300	240	
110	St Rd 814	3200	250	Ov814	3200	280	4
112	CR167	1100	280	CR167	1200	260	13
112	CR166	1800	5				
112	TWHY168	2200	110				
113	TWHY168	1500	100	TWHY168	1500	20	10
113	CR167	1700	280				
114	St Rd 29	1800	5	Ov29	1700	20	18
115	CR160	1550	100	CR160	1800	170	3
116	CR160	2200	100	CR160	2500	110	3
117	CR160	1600	100	CR160	1800	80	8

EXHIBIT R-3

Compiled by
William K.G. Palmer

Exhibit R - Buckeye II Wind Development
Public Safety Assessment

Source of Data
Figure 05-4 Site Layout of Buckeye II

118	TWHY168	1000	100	CR167	1600	240	
118	CR167	1800	250				
119	TWHY168	1100	100				15
119	CR167	2100	275	CR167	1800	280	
122	CR236	1000	5	CR9	2500	45	3
123	Dolly Varden	800	190	Dolly Varden	1500	140	7
123	St Rd 54	1200	95				
125	CR236	1100	5	CR236	2200	360	3
126	N Parkview	3300	260	N Parkview	3200	255	0
127	TWHY205	850	230	SH36	1200	0	6
127	US Hy 36	1200	330				
128	St Rd 559	1200	120	Ov559	1400	90	3
129	N Parkview	2100	270	N Parkview	2400	300	10
129	US Hy 36	2400	160				
130	St Rd 161	850	190	Ov161	1000	170	2
131	Talbot Rd	1100	280	Talbot Rd	1200	320	8
131	St Rd 161	2100	180				
132	TWHY174	1600	260	Allison Rd	1400	95	14
133	Swisher Rd	1600	160	Swisher Rd	1400	160	12
133	St Rd 814	1900	260				

10 Turbines — Location of professional safety concern due to proximity to roadway **and** buildings

25 more Turbines — Location of professional safety concern due to proximity to roadway **or** buildings

Roadways of concern at < 1000 ft
Buildings of concern at < 1600 ft

EXHIBIT S

Compiled by
William K.G. Palmer

Exhibit S - Physical Safety Setbacks
Less than 1 mile (~ 1600 m)

Source of Information
Buckeye II Wind Project Layout - Figure 5-04

Family	Wind Turbine	Property Line (feet)	Bearing (degrees)	Residence (feet)	Bearing (degrees)
Gordon	WT 131	1000	180	1500	120
Gordon	WT 90	1250	235	2200	235
Johnson	WT 113	2000	260	> 1 mile	275
Johnson	WT 119	2000	270	> 1 mile	285
Gordon	WT 80	2200	210	3000	215
Johnson	WT 112	2200	230	> 1 mile	260
Johnson	WT 118	2200	280	> 1 mile	295
Bartlett	WT 109	2400	130	2800	135
Rodriguez	WT 109	2800	140	3000	135
Gordon	WT 79	3300	200	3800	205
Bartlett	WT 108	3500	160	3800	160
Rodriguez	WT 108	4000	160	4100	160
Rodriguez	WT 112	4000	30	4600	30
Rodriguez	WT 84	4000	335	4600	335
Johnson	WT 85	4000	255	> 1 mile	275
Peace	WT 84	4200	25	4500	30
McConnell	WT 109	4400	250	5200	240
Gordon	WT 97	4500	140	5000	145
Bartlett	WT 83	4600	165	4800	165
Bartlett	WT 112	4600	25	4800	25
Bartlett	WT 84	4600	335	4800	335
Johnson	WT 98	4600	265	> 1 mile	280
Peace	WT 99	4800	15	5000	15
Gordon	WT 86	4800	115	5100	120
Rodriguez	WT 85	4800	355	> 1 mile	335
McConnell	WT 112	4900	290	> 1 mile	310
Rodriguez	WT 83	5000	160	5200	160
Rodriguez	WT 113	5000	20	> 1 mile	15

Distance to Homes or Property Line
< 500 m (1610ft)
Flagged

EXHIBIT T

EXHIBIT U-1

Hydro One Networks Inc.
483 Bay Street
South Tower, 8th Floor
Toronto, Ontario M5G 2P5
www.HydroOne.com

Tel: 416-345-6799
Fax: 416-345-6984

Enza Cancilla
Manager
Public Affairs

November 3, 2008

Mr. William Palmer
TRI-LEA-EM
RR 5
Paisley, ON N0G 2N0

Re: Bruce to Milton Transmission Reinforcement Draft Environmental Assessment (EA) Report

Dear Mr. Palmer:

Thank you for submitting your comments on the Bruce to Milton Transmission Reinforcement Draft EA Report. I did receive your letter of November 19, 2007, and Mr. Fawcett did provide me with your letter submitted at the Hanover Public Information Centre. This information was provided to our transmission planning and standards groups, who are aware of the potential risks and have been researching the issue. They reviewed the information in your letter and provided a response to our project team. I apologize that I did not communicate Hydro One's findings to you sooner.

Hydro One has conducted a thorough review. The review included an analysis from first principles on wind-induced conductor motion which was employed to assess the risks posed by wind turbine generator operations to our transmission lines and other transmission assets in their vicinity. I also note that these efforts will continue on an ongoing basis.

As part of this review, local and international experience was also reviewed to arrive at a set of recommendations on the distances between wind turbine generators and Hydro One facilities. Mechanical risks (e.g., blade failure, tower collapse, ice throw) and wind-induced risks (e.g., aeolian vibration, galloping, wake-induced, turbulence-induced) were examined. Of these, the mechanical risk of complete blade failure (detachment) or wind turbine tower collapse set the furthest limits of risk to transmission structures.

To avoid these risks, we developed technical directives for a required wind turbine setback from our transmission assets. After due process, the technical directives will become a Hydro One standard. As this is a relatively new field, the guiding principles have evolved over time.

- From 2005 to December 2007, overall height of turbine (tower height plus blade radius) from the edge of right-of-way;
- From December 2007 to July 2008, the greater of 150 metres and overall height of turbine from the edge of right-of-way
- July 2008 to the present time, 500 m from 500 kV assets, 250 m from 230 kV assets and 150 m from 115 kV assets.

It is expected that this standard will be revised once we have completed some additional research, which is currently in progress.

In those situations where wind turbines are closer to the right-of-way than permitted by today's technical directives, we have a provision in our operating agreement with the turbine owner that, in emergency conditions, permits Hydro One to order that a particular turbine, group of turbines or the entire farm shut down to ensure public safety to safeguard life, property or the environment. This provision is intended to mitigate a situation in which the risk of turbine failure is higher than what is normally expected or in which a turbine is interfering with maintenance activities.

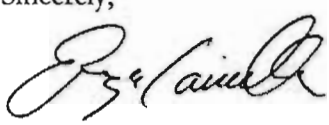
However, we consider the risk of adverse impact on the power system as the result of a failure of one of the critical wind turbines to be extremely small. First, there are only about thirteen turbines located within 500 m of a 500 kV corridor. That is a small number in the overall population of wind turbines expected to be operating within a few years. Second, the blade of one of those turbines would need to fail with the wind blowing directly toward the line and with the wind being of a velocity sufficient to carry large pieces into the transmission line. Even if that occurs, there is a Special Protection System that would initiate action suitable to protect the integrity of the power system.

In addition to the setback requirement, we also require that all wind turbines within 500 m of a transmission right-of-way (measured from the edge of the corridor) be marked and identified in our GIS (Geographical Information System) database and have aircraft warning lights to ensure that they are seen by our helicopter patrols and maintenance crews.

I trust these conclusions and recommendations address your concerns with respect to wind turbine proximity to transmission lines. Hydro One will continue to monitor this issue, and technical directives may change accordingly. Hydro One will update Appendix C of the Draft EA Report for the Bruce to Milton Project to incorporate the information communicated in this letter with respect to our recommendations on wind turbine and transmission line and asset proximity.

I apologize for not having responded directly to you on this matter. If you have follow-up questions, please do not hesitate to contact me at 416-345-5892.

Sincerely,



Enza Cancilla
Manager, Public Affairs

cc: Mr. Paul Crawford, Ontario Energy Board
Northeast Power Coordinating Council

Exhibit V – Photographs of Ice on Operating GE Wind Turbines in Ontario – Jan 2010

Turbine 22 – still operating, yet iced		Note Some Ice Has Already Dropped
		

Turbine Ice Throw

Exhibit W

Projecting Ice Throw Distances - either from real data in Bruce County, or from Wind Turbine Manufacturer recommendations given in “Wind Turbines in Cold Climates” study show that setbacks of up to 302 meters (991 ft) are needed to protect passerbys from potentially lethal ice drop. - Yet, drawings show some roads only separated 600 feet (183 m) from turbine tower. Ice pieces of a size seen from turbines in Bruce County falling from these towers is equialent to dropping a 18-kg concrete block from a 10 story window.

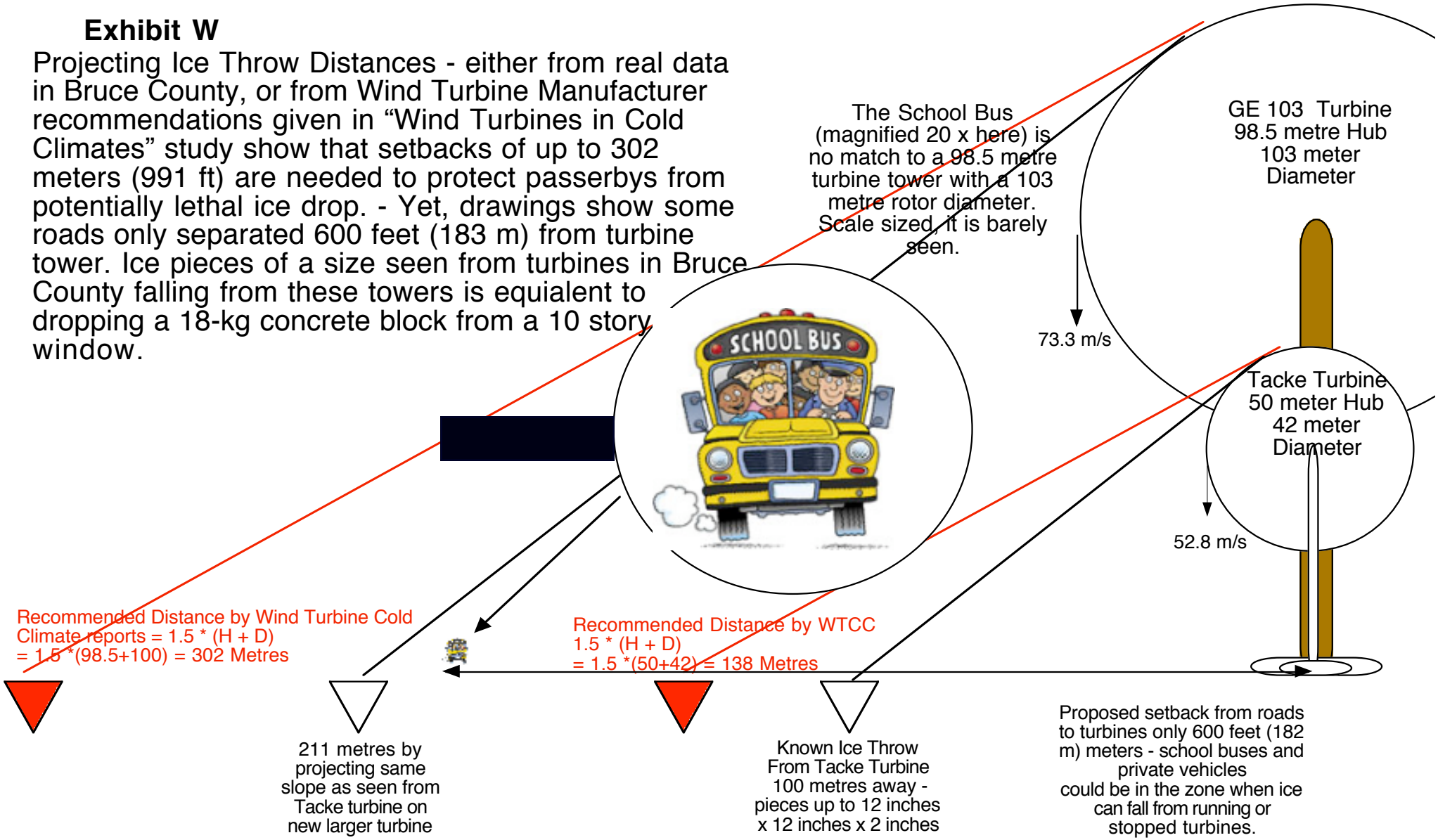


Exhibit X: Wind Turbine Blade Failures

When considering wind turbine blade failures, it is important to understand the size of these devices that are nominally well up in the air, where they look small. This photo is a blade for a Vestas V-82 turbine, with an 82-metre rotor diameter. The turbines suggested for Buckeye II will have 24% larger blades with their 100-metre rotor diameter. Comparing the blade to the size of the men with it helps to understand the threat that even a small part of the turbine blade poses to human health if it falls.

EXHIBIT Y

Interesting Quote
From: Simcoe Reformer, Friday 04 May 2007
(Attached to letter from Counsel for Enbridge, May 4, 2007)

"Mike Crawley, president and CEO of AIM PowerGen, said the wind turbine performed just as it was designed to do when hit." "The blade took a direct hit from lightening and buckled, but did not separate from the rest of the turbine."

Looking at the pictures from
A Channel News
Monday April 30, 2007

Does "the blade" mean only the exterior coating, and not include any of the heavy structural material inside the gel-coat?

FILE

TIMBER ROAD
WIND FARM

A wind farm owned by Poulding wind Farm LLC, Poulding wind Farm II LLC and Poulding wind Farm III LLC

RECEIVED-DOCKETING DIV
2011 NOV 14 PM 2:51
PUCO

9630 State Route 49
Payne, OH 45880

419 263 0137 phone
419 263 0151 fax

November 12, 2011

To Whom It May Concern:

Regarding Case No: **10-3128-EL-BGA**, enclosed please find two notices for Timber Road II Wind Farm LLC. Please add these notices to our docket.

Sincerely,

Erin Bowser
Project Manager
Timber Road II Wind Farm LLC

EXHIBIT Z-2

A wind farm owned by Pauldin Wind Farm LLC, Pauldin Wind Farm II LLC and Pauldin Wind Farm III LLC

TIMBER ROAD
WIND FARM

9630 State Route 49
Payne, OH 45880

419 263 0137 phone
419 263 0151 fax

November 12, 2011

To Whom It May Concern:

Regarding Case No: **10-3128-EL-BGA** in the matter of Timber Road II Wind Farm LLC, this is official notice that construction of the facility was substantially complete on June 28, 2011.

Sincerely,

Erin Bowser
Project Manager
Timber Road II Wind Farm LLC

EXHIBIT Z-3

A wind farm owned by Paulding Wind Farm LLC, Paulding Wind Farm II LLC and Paulding Wind Farm III LLC

TIMBER ROAD
WIND FARM

9630 State Route 49
Payne, OH 45880

419 263 0137 phone
419 263 0151 fax

November 12, 2011

To Whom It May Concern:

Regarding Case No: **10-3128-EL-BGA** in the matter of Timber Road II Wind Farm LLC, this is official notice that our facility became fully operational on July 19, 2011.

Sincerely,

Erin Bowser
Project Manager
Timber Road II Wind Farm LLC

Summary: Exhibit L to Exhibit Z of William Palmer's Amended Testimony electronically filed by Mr. Jack A Van Kley on behalf of Union Neighbors United and Johnson, Julia Ms. and McConnell, Robert Mr. and McConnell, Diane Ms.