

Indian Point License Renewal Proceeding: Supplemental Sensitivity Analysis Re NYS-16

Calculation: IP2-SENS-POP2, Population sensitivity case for Contention NYS-16 using alternative data/assumptions proposed by NYS witness Dr. Stephen Sheppard in his Rebuttal Testimony (NYS000404) and associated exhibit NYS000409

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Reviewers: Lori Potts (Entergy) and Kou John Hong (Entergy)

Calculation: IP2-SENS-POP2 10/9/2012
Prepared: Grant Teagarden
Population sensitivity for NYS-16 using Dr. Sheppard proposed data 10/9/2012 (MACCS2)
Purpose: Table 4 of NYS000409, plus 10/9/2012 (3 Counties; SAMA imp
Additional population for 3 counties that have population peaks prior to 2035.
Reviewed: Lori Potts
To confirm that Dr. Sheppard's proposed population data does not impact SAMA conclusions.

Inputs / Methodology:

Start with Table 4 of NYS000409, Dr. Sheppard's recommended distribution of census undercount and commuters

This includes undercounts @ 100% and commuters @ 100%

Add in peak population for 3 counties that have population peaks prior to 2035

NY County, NY

Rockland, NY

West Chester, NY

Adjust (escalate) these the population by the undercount & commuter increase of Dr. Sheppard (i.e., 6.38%)

Develop new SITE File with revised population data (no other changes).

Run MACCS2 with the updated SITE File for IP2 using other IP2 MACCS2 input files from basecase.

Compare sensitivity MACCS2 results with IPEC Re-Analysis Results (IP-CALC-09-00265, Table 5 Dose and Cost)

Comments

Dr. Sheppard's recommended distribution does not take into account county to county variation across the 50 mile grid

i.e., a uniform population escalation factor is using throughout the grid.

Population dose risk and cost risk scale linearly with population data, as expected.

Population dose risk and cost risk increase approximately 6.7% and 6.8% respectively, due to the population increase of 6.7%.

The SAMA impact is approximately 6.15%; less than that required to impact the next cost beneficial SAMA for IP2.

Impacts on IP3 would be similar (i.e., population dose and cost scale linearly with population)

Dr. Sheppards recommended population distribution. TABLE 4 of NYS000409

	0.20	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	20.00	30.00	40.00	50.00
	0.3219	1.6093	3.2187	4.828	6.4374	8.0467	9.6561	11.2654	12.8748	14.4841	16.0935	32.1869	48.2804	64.3739	80.4674
N	6	0	288	2190	2661	967	990	1301	1478	1599	1804	24420	32611	42149	54316
NNE	17	7	181	2067	3098	2182	1252	1477	1678	1913	2035	29936	42465	59815	71503
NE	18	205	939	2267	3153	4088	4160	3254	2621	2126	2037	31297	57119	66552	43895
ENE	18	387	1356	2268	3167	3673	4795	5619	6532	7404	7744	79634	126674	161889	187594
E	18	415	1296	2274	3121	4034	4706	5865	5944	7661	8592	125889	166724	213385	221696
ESE	18	435	1336	2272	3160	3821	3934	4103	6100	7216	7882	129272	153476	57638	36554
SE	18	436	1355	2274	3055	4051	4827	5616	6685	7653	8574	119092	93335	251518	404246
SSE	18	383	1349	1750	938	383	527	16	1534	2033	3419	104602	512451	1468353	1295928
S	18	426	746	262	132	660	1636	3461	4393	4739	5466	143842	1238935	3970582	3366291
SSW	18	401	598	532	1809	3066	3770	4454	5184	5869	6552	215538	420628	981544	1100499
SW	18	231	199	1666	2419	3102	3802	4455	4639	5700	6530	195077	294577	209960	261784
WSW	10	0	660	1727	2337	3111	3777	4270	4464	4527	4612	68541	222551	116066	91329
W	3	0	910	1704	2412	2995	2519	1901	1514	1888	2160	34070	54228	65298	61047
WNW	2	0	998	1728	2388	1427	1207	1510	1601	1868	2203	34504	58061	61678	31616
NW	2	48	1036	1690	2056	1034	1213	1437	1639	1895	2227	34651	58039	25581	23742
NNW	3	53	861	1118	1688	787	1281	1497	1723	1901	2157	33681	34648	29361	36568
TOTAL	205	3427	14108	27789	37594	39525	43885	51754	57204	65992	73994	1404146	3566522	7781369	7288608

20,456,122
19,228,712 (Energy SITE Total)
1.06383 Ratio

Postulated contribution from three counties whose population growth peaks prior to 2035.

Postulated Additional Persons 61,915 (in NY County, Rockland County, and West Chester County) if peak year of census data is used.
Undercount & Commuters 1.0638 (Dr. Sheppard increase factor)

Total 65,865 65,865/19,228,712 = 0.343%

Distribution assuming uniform distribution, as advocated by Dr. Sheppard for development of Table 4

	0.20	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	20.00	30.00	40.00	50.00
	0.3219	1.6093	3.2187	4.828	6.4374	8.0467	9.6561	11.2654	12.8748	14.4841	16.0935	32.1869	48.2804	64.3739	80.4674
N	0	0	1	7	9	3	3	4	5	5	6	79	105	136	175
NNE	0	0	1	7	10	7	4	5	5	6	7	96	137	193	230
NE	0	1	3	7	10	13	13	10	8	7	7	101	184	214	141
ENE	0	1	4	7	10	12	15	18	21	24	25	256	408	521	604
E	0	1	4	7	10	13	15	19	19	25	28	405	537	687	714
ESE	0	1	4	7	10	12	13	13	20	23	25	416	494	186	118
SE	0	1	4	6	3	2	0	5	3	7	28	383	301	810	1302
S	0	1	2	1	0	2	5	11	14	15	18	463	1650	4728	4173
SSW	0	1	2	2	6	10	12	14	17	19	21	694	3989	12785	10839
SW	0	1	1	5	8	10	12	14	15	18	21	628	948	3160	3543
WSW	0	0	2	6	8	10	12	14	15	15	15	221	717	374	294
W	0	0	3	5	8	8	8	6	5	6	7	110	175	210	197
WNW	0	0	3	6	8	8	4	5	5	6	7	111	187	199	102
NW	0	0	3	5	7	3	4	5	5	6	7	112	187	82	76
NNW	0	0	3	4	5	3	4	5	6	6	7	108	112	95	118
TOTAL	0	9	44	89	122	128	140	166	184	213	240	4520	11485	25056	23469

20,456,122
19,228,712 (Energy SITE Total)
1.06383 Ratio

TOTAL (TABLE 4 + 3 County Additions)

	0.20	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	20.00	30.00	40.00	50.00	Total
	0.3219	1.6093	3.2187	4.828	6.4374	8.0467	9.6561	11.2654	12.8748	14.4841	16.0935	32.1869	48.2804	64.3739	80.4674	
N	6	0	289	2197	2670	970	993	1305	1483	1604	1810	24499	32716	42285	54491	167318
NNE	17	7	182	2074	3108	2189	1256	1482	1683	1919	2042	30032	42602	60008	71733	220334
NE	18	206	942	2274	3163	4101	4173	3264	2629	2133	2044	31398	57303	66766	44036	224450
ENE	18	388	1360	2275	3177	3685	4810	5637	6553	7428	7769	79890	127082	162410	188198	600680
E	18	416	1300	2281	3131	4047	4721	5884	5963	7686	8620	126294	167261	214072	222410	774104
ESE	18	436	1340	2279	3170	3833	3947	4116	6120	7239	7907	129688	153970	57824	36672	418559
SE	18	437	1359	2281	3065	4064	4843	5634	6707	7678	8602	119475	93636	252328	405548	915675
SSE	18	384	1353	1756	941	529	16	1539	1012	2040	3430	104939	514101	1473081	1300101	3405240
S	18	427	748	263	132	662	1641	3472	4407	4754	5484	144305	1242924	3983367	3377130	8769734
SSW	18	402	600	534	1815	3076	3782	4468	5201	5888	6573	216232	421982	984704	1104042	2759317
SW	18	232	200	1671	2427	3112	3814	4469	4654	5718	6551	195705	295525	210636	262627	997359
WSW	10	0	662	1733	2345	3121	3789	4284	4478	4542	4627	68762	223268	116440	91623	529684
W	3	0	913	1709	2420	3005	2527	1907	1519	1894	2167	34180	54403	65508	61244	233399
WNW	2	0	1001	1734	2396	1432	1211	1515	1606	1874	2210	34715	58248	61877	31718	201539
NW	2	48	1039	1695	2063	1037	1217	1442	1644	1901	2234	34763	58226	25663	23818	156792
NNW	3	53	864	1122	1693	790	1285	1502	1729	1907	2164	33789	34760	29456	36686	147803
TOTAL	205	3436	14152	27878	37716	39653	44025	51920	57388	66205	74234	1408666	3578007	7806425	7312077	20,521,987

19,228,712 (Energy SITE Total)

1.06726 Ratio

BASECASE - IP2

IP2 - IPEC SAMA MACCS2 Re-Analysis (IP-CALC-09-00265) Table 5 Dose and Cost Results (YR 2000 Met)

Source Term	IP2 Freq (per yr)	Dose (sv)	Dose Risk (sv/year)	% of Total	Tot. Cost (\$)	Cost Risk (\$/yr)	% of Total
NCF	1.19E-05	4.75E+01	5.65E-04	0.06%	9.98E+04	1.19E+00	0.00%
Early High	6.50E-07	6.51E+05	4.23E-01	48.44%	2.05E+11	1.33E+05	62.87%
Early Medium	4.23E-07	1.94E+05	8.21E-02	9.39%	5.87E+10	2.48E+04	11.71%
Early Low	1.11E-07	7.93E+04	8.80E-03	1.01%	6.39E+09	7.09E+02	0.33%
Late High	6.88E-07	1.63E+05	1.12E-01	12.84%	4.64E+10	3.19E+04	15.06%
Late Medium	3.43E-06	6.87E+04	2.36E-01	26.98%	6.06E+09	2.08E+04	9.81%
Late Low	6.43E-07	1.61E+04	1.04E-02	1.19%	6.59E+08	4.24E+02	0.20%
Late Low Low	5.82E-08	1.38E+04	8.03E-04	0.09%	5.62E+08	3.27E+01	0.02%
Total	1.79E-05		8.74E-01			2.12E+05	
		Total (rem/yr)	8.74E+01				

Dose (rem)	Dose Risk (rem/year)
4.75E+03	5.65E-02
6.51E+07	4.23E+01
1.94E+07	8.21E+00
7.93E+06	8.80E-01
1.63E+07	1.12E+01
6.87E+06	2.36E+01
1.61E+06	1.04E+00
1.38E+06	8.03E-02
1.19E+08	8.74E+01

IP2 - Sensitivity Pop 2 = 100% Undercount & 100% Commuters & 3 County Peak - IPPOP2.out (10/8/2012)

Source Term	Frequency (per yr)	Dose (sv)	Dose Risk (sv/year)	% of Total	Tot. Cost (\$)	Cost Risk (\$/yr)	% of Total
NCF	1.19E-05	5.06E+01	6.02E-04	0.06%	1.05E+05	1.25E+00	0.00%
Early High	6.50E-07	6.94E+05	4.51E-01	48.42%	2.19E+11	1.42E+05	62.91%
Early Medium	4.23E-07	2.07E+05	8.76E-02	9.40%	6.26E+10	2.65E+04	11.70%
Early Low	1.11E-07	8.47E+04	9.40E-03	1.01%	6.81E+09	7.56E+02	0.33%
Late High	6.88E-07	1.74E+05	1.20E-01	12.85%	4.95E+10	3.41E+04	15.05%
Late Medium	3.43E-06	7.33E+04	2.51E-01	26.98%	6.46E+09	2.22E+04	9.79%
Late Low	6.43E-07	1.72E+04	1.11E-02	1.19%	7.02E+08	4.51E+02	0.20%
Late Low Low	5.82E-08	1.47E+04	8.56E-04	0.09%	5.99E+08	3.49E+01	0.02%
Total	1.79E-05		9.32E-01			2.26E+05	
		Total (rem/yr)	9.32E+01				
		delta base	6.66%			6.76%	

Dose (rem)	Dose Risk (rem/year)
5.06E+03	6.02E-02
6.94E+07	4.51E+01
2.07E+07	8.76E+00
8.47E+06	9.40E-01
1.74E+07	1.20E+01
7.33E+06	2.51E+01
1.72E+06	1.11E+00
1.47E+06	8.56E-02
	9.32E+01

Calculate Peak Population if Peak Value of three counties is used as surrogate for 2035 population.

County	2035 Proj Pop		Peak Year	Transient / Perm	
	ENERCON Table 2.3	Peak Population ENERCON Table 2.1		Ratio ENERCON Table 2.3	Revised Population
New York	1,592,688	1,606,718	2020	0.014	1,629,212
Rockland	285,484	291,706	2010	0.024	298,707
Westchester	936,873	926,798	2010	0.024	949,041
Total	2,815,045			Total	2,876,960
				Increase For 3 Counties	61,915 (using peak population)
Previous 50 Mile Population		19,228,712			
Revised 50 Mile Population		19,290,627		% Increase 50 mile population	0.3%

Table 3 of Entergy IP-RPT-09-00044 Rev 0 (ENT 000459)

Estimated Present Dollar Value Equivalent of Internal Events CDF at IP2

Parameter	Present Dollar Value (\$)	% of Total
Off-site Pop Dose	1,881,355	41.4%
Off-site Econ Costs	2,281,735	50.2%
On-site Dose	6,814	0.1%
On-site Econ Costs	374,303	8.2%
Total	4,544,208	100.0%

This percentage increase would be carried forward when the multiplier for external e

Pop2 Sens Impact

Increase Factor	Present Dollar Value (\$)	Comment
1.0666	2,006,685	
1.0676	2,436,010	
1.0	6,814	On-site not impacted
1.0	374,303	On-site not impacted
	4,823,812	Internal Events

6.15% Increase on Total

events and uncertainty is included.

Dr. Shepherd Table 1 Data (NYS000209,page 8) For Reference Only

County	Pct within 50 mi.	Resident Pop	Transient Pop	Undercount	Commuters	Total Pop
Fairfield	100	918,600	14,228	5,701	52,388	990,917
Litchfield	41.5	90,183	1,397	114	20,633	112,328
New Haven	32.9	294,904	4,568	1,823	85,165	386,459
Bergen	100	1,089,428	25,448	7,056	30,893	1,152,826
Essex	100	868,715	20,292	14,474	62,809	966,290
Hudson	100	690,981	16,140	9,208	30,913	747,242
Middlesex	1.8	18,963	443	180	7,739	27,325
Morris	80.8	527,786	12,328	2,026	83,176	625,317
Passaic	100	553,404	12,926	6,255	12,135	584,721
Somerset	4.5	21,156	494	131	9,169	30,950
Sussex	93.9	204,652	4,780	262	9,762	219,456
Union	92.9	548,682	12,816	5,369	69,446	636,315
Warren	0.5	780	18	1	256	1,056
Bronx	100	1,634,750	22,930	34,396	6,683	1,698,759
Dutchess	88.9	283,939	6,809	1,392	18,957	311,096
Kings	100	2,618,418	36,727	46,188	34,740	2,736,073
Nassau	97.9	1,225,359	29,384	7,610	78,710	1,341,063
New York	100	1,570,657	22,031	21,506	154,793	1,768,987
Orange	100	445,234	10,676	2,177	14,410	472,498
Putnam	100	120,738	2,895	222	1,251	125,106
Queens	100	3,024,717	42,426	50,742	47,269	3,165,154
Richmond	65.4	433,496	6,080	2,914	37,816	480,305
Rockland	100	278,799	6,685	1,931	1,779	289,195
Suffolk	21.3	317,533	7,614	1,467	87,491	414,106
Sullivan	36.3	34,142	819	150	6,724	41,835
Ulster	58.1	129,363	3,102	430	19,466	152,360
Westchester	100	914,934	21,939	7,865	8,702	953,440
Pike	18.7	19,343	3,222	40	2,503	25,108
Total		18,879,657	349,218	231,632	995,778	20,456,285
Check		18,879,656	349,217	231,630	995,778	20,456,287