



ILLINOIS BALLOT INTEGRITY PROJECT

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IMPLEMENTING PRECINCT SAMPLING FOR THE 2006 GENERAL ELECTION

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IMPLEMENTING PRECINCT SAMPLING IN THE 2006 CONGRESSIONAL ELECTIONS

Jurisdictional Considerations

Significant discussion has centered around statistical methods of sampling precincts to secure ballot integrity in upcoming elections. The 2006 General Election has been targeted for a first implementation of sampling methods to detect fraud or error which results in miscounting of votes at the precinct level. Our analysis indicates that sampling is an inappropriate methodology when applied to individual precincts. However, we have also seen that sampling of 100% audits in a relatively small number of precincts has a very high probability of detecting miscounted precincts. Specifically, with an audit of 5% of precincts, the probability of uncovering errors exceeds 99.8% with a five percent sample assuming that at least 5% of precincts have been miscounted.¹

Efforts of the Illinois Ballot Integrity Project have focused on Suburban Cook County to a great extent with some attention being paid to the City of Chicago. In the 2004 General Election in the race for president/vice president, 1,032,878 votes were cast in the City of Chicago and 1,008,910 in Suburban Cook County); the number of precincts (Chicago - 2,709, Cook County – 2,402); creating an average precinct turnout in Chicago of 381 and Cook County, 420.

The range of votes cast by precinct in Chicago varied from a low of 23 to a high of 1,023. Average votes per precinct by ward varied from a low of 229 to 623² In Suburban Cook County, votes cast by precinct by township showed similar results with a low of 54 and a high of 1,060. Average votes per precinct varied from a low of 282 to a high of 608.³ Thus, in terms of number of precincts and actual votes per precinct in the 2004 general election for president/vice president, the City of Chicago and Suburban Cook County are relatively similar in precinct/voter distribution.

In examining the presidential vote in Chicago, we determined that a 5% sampling of precincts (2,709) would require 135⁴ precincts to be audited (100% count) and similarly 120 precincts (5% of 2,402) in Suburban Cook County.⁵

Focusing on a national or statewide election, however, obscures some substantial jurisdictional problems that will become readily apparent in looking at voter distribution in Congressional races for 2004. The Chicago area has eleven Congressional Districts, 1st through 10th and the 13th. An examination of the geographic boundaries immediately reveals that no single district lies wholly within a single election jurisdiction:

ELECTION JURISDICTIONS BY CONGRESSIONAL DISTRICT					
Congressional District	City of Chicago	Cook County	DuPage County	Lake County	McHenry County
1st					
2nd					
3rd					
4th					
5th					
6th					
7th					
8th					
9th					
10th					
13th					

¹ A Survey of Sampling Methods, www.lootingofamerica.com/Sampling_Methods_201.pdf

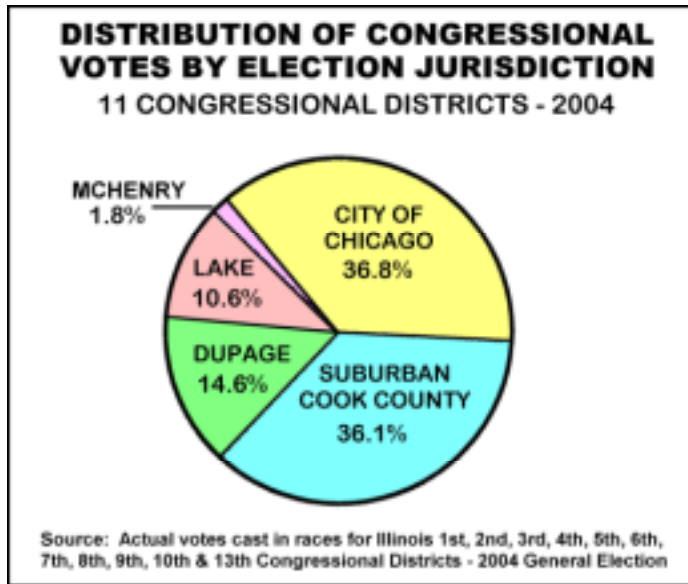
² *Ibid*, Appendix A

³ *Ibid*, Appendix B

⁴ *Ibid*, See Appendix C

⁵ *Ibid*, See Appendix D

Therefore, sampling of any Congressional election to detect miscounted precincts would require the cooperation of at least two and in one case three, separate election jurisdictions. A 5% sampling in any given jurisdiction would not suffice.



This graph shows the distribution of votes for the combined eleven Congressional Districts by election jurisdiction, based on the 2,523,907 votes cast in these eleven races in the 2004 General Election.⁶

Because this graph shows the aggregate voting in all eleven districts, it tends to understate the importance of the three collar counties in the races in which they play a part. McHenry County accounted for only 1.8% of the total, but 16.9% of votes in the 8th District. Similarly, Lake County provided 54.1% of the votes in that election and 43.9% of votes in the 10th District. DuPage county accounted for the vast majority of votes in the 6th and 13th Districts with 81.0% and 79.9%, respectively.

This chart shows the distribution of votes by district for each of the eleven Illinois Congressional Districts:⁷

JURISDICTIONS BY CONGRESSIONAL DISTRICT – PCT OF VOTES					
Cong District	City of Chicago	Cook County	DuPage County	Lake County	McHenry County
1st	70.5%	29.5%			
2nd	41.9%	58.1%			
3rd	39.5%	60.5%			
4th	88.2%	11.8%			
5th	87.7%	12.3%			
6th		19.0%	81.0%		
7th	73.8%	26.2%			
8th		29.0%		54.1%	16.9%
9th	39.5%	60.5%			
10th		56.1%		43.9%	
13th		20.1%	79.9%		

Note that in only four of eleven districts does Suburban Cook County have a majority of the votes cast in any race, whereas the City of Chicago provides the majority in four as well, with DuPage County two and Lake County the other. In seven of the eleven districts, the City of Chicago and Suburban Cook County account for 100% of the votes (1st through 5th, 7th and 9th).

It becomes apparent that implementation of 5% precinct sampling for the 2006 Congressional Elections (Illinois does not elect a Senator in 2006) will require an expansion of scope to include the City of Chicago for at least seven districts and the three collar counties for the other four.

⁶ See Appendix B

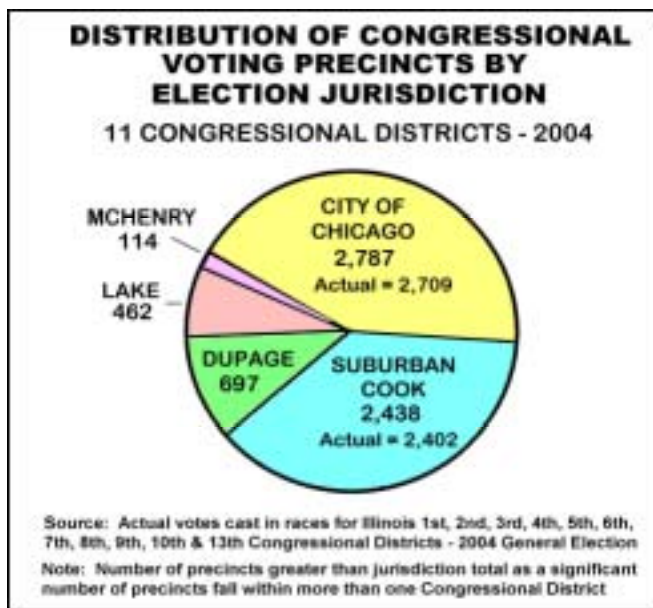
⁷ Ibid

Sampling Considerations

Inasmuch as city-wide or county-wide sampling cannot be implemented on a Congressional District basis, we need to examine the effect of smaller universes on sampling techniques when employing hypergeometric distributions.

In a state-wide election, an audit (100% hand count) of a relatively small number of precincts (135 in Chicago or 120 in Cook County) would yield a fairly high probability that at least one miscounted precinct could be detected, assuming that corruption was reasonably widespread (15% of precincts corrupt). Further, hand counting of approximately 50,000 ballots in each of the City of Chicago and Suburban Cook County would have a reasonable chance to detect error or fraud assuming that such occurred in more than a few precincts.

This methodology has a good opportunity for success because the relatively low number of voters per precinct (400). For example, 5% of the votes in an average precinct would be 20. If more than 400 precincts were corrupted by 20 votes, that would be 8,000 corrupt votes that would probably trigger a recount. However, even a relatively small level of irregularities over a large number of precincts has little opportunity of going undetected as the probability of detection approaches 100% as the percentage of corrupt precincts rises. Essentially, with a 5% sampling of precincts, the number of precincts that could be tampered with must be less than 5% to avoid detection, assuming that the precincts to be audited are truly random within the populations of 2,402 or 2,709 precincts.



This graph shows the aggregate distribution of precincts for the eleven congressional districts:

Unfortunately, Congressional Districts are not respecters of either county borders or even precinct lines. In virtually all of the election jurisdictions, congressional district lines cut through precinct borders, requiring that a significant number of precincts be counted twice, as they fall in two congressional districts.

It's for this reason that the number of precincts in Chicago and Suburban Cook County, when tabulated by district, produce a number of precincts that exceeds the actual for each division. Similar results obtain for the three collar counties as well.

The following chart details the precincts and partial precincts by Congressional District:

JURISDICTIONS BY CONGRESSIONAL DISTRICT - PRECINCTS					
Cong District	City of Chicago	Cook County	DuPage County	Lake County	McHenry County
1st	532	203			
2nd	293	381			
3rd	253	414			
4th	387	61			
5th	495	98			
6th		129	399		
7th	580	175			
8th		176		246	114
9th	247	369			
10th		344		216	
13th		88	298		
Totals	2787	2438	697	462	114

Probability - Using Hypergeometric Distributions

The use of Hypergeometric distribution is simply a mathematical approach to solving what is known in statistics and probability as the “urn problem.” Assume that you have an urn filled with 100 marbles, 50 white (correctly counted precincts) and 50 black marbles (miscounted precincts). If you get to take one marble out each turn, and you get five turns (5% sample), what are the odds that you will pick at least one black marble? The first turn, the odds are exactly one in two (50-50). The odds are not the same on each turn, however, depending on which color marble is drawn the first time. Assuming you draw a white marble the first time, then the odds of drawing a black marble on the second turn are slightly higher, because the urn now contains 49 white marbles and 50 black marbles. The probabilities for each subsequent turn change depending on what color marble is drawn on each preceding turn. Probability theory just strings these sets of probabilities for each draw (turn) and yields an overall value for drawing at least one black marble in five turns. [For those who are interested, the probability is .9719 or 97.2%.]

Intuitively, we recognize that as the number of black marbles decreases in the original mix, the chances of drawing a black marble decrease. In fact, if the original mix is 75 white marbles and 25 black ones, the probability of drawing a black marble in five turns drops to .7708 (77.1%).

Similarly, increasing the number of draws (turns) will increase the odds of drawing at least one black marble. In the 50 black, 50 white example above, doubling the number of turns to ten increases the probability of drawing at least one black marble to .9994 or success 99.9% of the time. Hypergeometric distribution allows us to calculate the probability of success for a variety of situations with different mixes of black and white marbles and a variety of times we’re allowed to draw from the urn.

Increasing the number of marbles in the urn substantial increases the possibility of finding a black marble because there are more black marbles, and you get more draws. For example, increasing the number of marbles to 200 (100 of each color), produces a probability of drawing at least one black marble from .9719 (97.2%) to .9992 (99.9%).

While this discussion may seem somewhat arcane, there is a strong correlation between the sampled universe of precincts audited in a 5% sample and the probability of detecting a miscounted (corrupt) precinct. For example, in a 5% county-wide sample of Suburban Cook County in the race for president, we would audit 120 precincts, requiring a 100% hand count of approximately 50,400 ballots. Such an audit sampling would have 99.82% probability of detecting at least one corrupt precinct if 5% or more (again 120) precincts were miscounted.⁸ Hypergeometric distribution, as we have seen above, becomes less efficient in terms of finding miscounted precincts as the universe of precincts becomes smaller.

For example, in a universe of 200 precincts, (similar to the Lake County results in the 8th and 10th Congressional Districts) the probability of detecting a miscounted precinct with a 5% audit with similar probability (99.79%) exists only if at least 45% of precincts are corrupt. When we look at the results for the 8th District in McHenry County and the 4th and 5th Districts in Suburban Cook County, 61 and 98 precincts respectively, the probability of detecting a corrupt precinct with a 5% audit is \leq than 99% even if more than 50% of precincts are corrupt.⁹ This problem also occurs in the City of Chicago for the 129 and 88 precincts voting in the 6th and 13th Congressional Districts.

Effect of Precinct Distribution on the 2006 Congressional Races

In examining the 2004 General Election results, we find that the largest number of precincts within a single jurisdiction is 580 (City of Chicago – 7th Congressional District); with the lowest, 61¹⁰ (Suburban Cook County – 4th Congressional District). Therefore, the problem is to determine the appropriate sample

⁸ A Survey of Sampling Methods, www.lootingofamerica.com/Sampling_Methods_201.pdf, Appendix D

⁹ See Appendix D, Page 1. This appendix includes charts for all precincts from 100 through 800 precincts in 100 precinct increments.

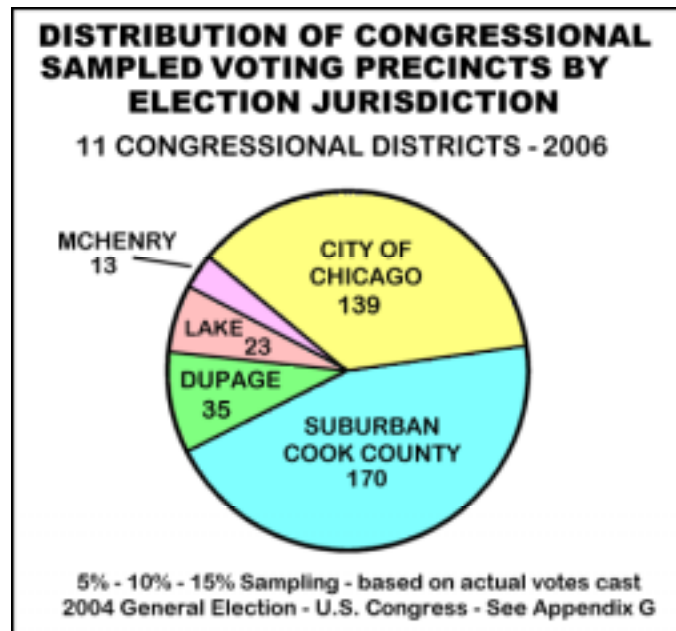
¹⁰ See Appendix C

for each Congressional District by election jurisdiction. Our objective is to find a reasonable number of precincts to audit in each race by jurisdiction. Why is this necessary? Because we believe that there is a strong argument that the precincts in each election jurisdiction form a separate sampling universe. Each jurisdiction operates under somewhat different rules and policies with respect to selecting precinct boundaries, hours of voting, methods of balloting, mechanical/electrical voting machines and methods of central tabulation.

Therefore, each Congressional District does not constitute a single universe for sampling purposes, but rather two or three separate universes. For example, the 1st Congressional District is two universes of 532 (City of Chicago) precincts and 203 (Cook County) precincts rather than a single 735 precinct universe. Similarly, the 8th Congressional District has 536 precincts, consisting of three separate universes of 176 (Cook County), 246 (Lake County) and 114 precincts (McHenry County). The implications of this are that a 5% sample is inadequate to achieve the level of certainty of finding a miscounted precinct in the smaller universes discussed above.

Fortunately, however, there is a relatively simple solution: increase the number of audited precincts in the smaller universes. While this may seem somewhat onerous at first, the number of precincts audited does not increase that much. For example, increasing the sample size to 15% in the smallest universe (61 precincts) only requires increasing the number of precincts audited by six, from three to nine. This small change increases the probability of discovering a miscounted precinct from 87.51% to 99.88%, assuming 50% of precincts have been miscounted, a substantial gain. Based on the average precinct vote of 420, this would require counting only an additional 2,520 votes. Therefore, we recommend that in all cases where the universe of precincts is 1-100, that a 15% sample be used for auditing. There are only three such instances occurring throughout the eleven Congressional Districts. The probability of finding a miscounted precinct for each of these is attached hereto as Appendix E.

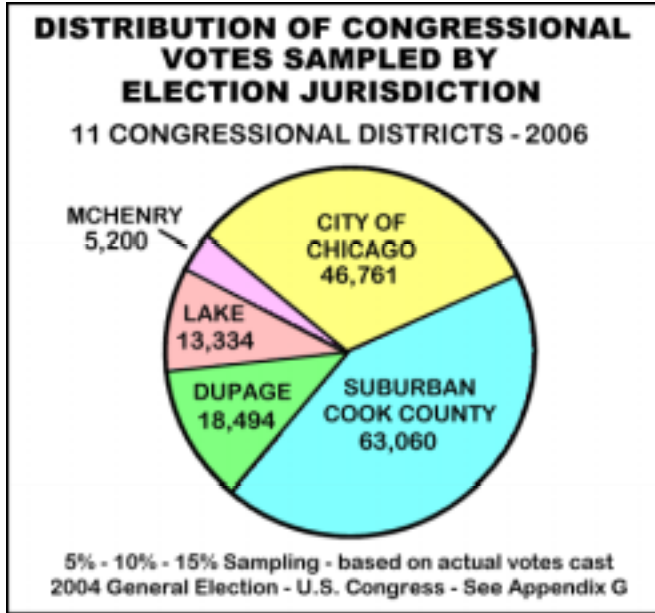
When we look at the 114 precincts in McHenry County (8th Congressional District), we find that the probability of finding a miscounted precinct with a 5% sample is only 97.15% if 50% of the precincts are audited. Probabilities drop off swiftly, with the chance of finding a miscounted precinct only 76.3% when 25% of precincts are miscounted. Doubling the number of audited precincts to 10% increases the probability of finding a miscounted precinct to 99.7% at the level of 50% miscounted precincts and 96.2% at the 25% miscount level, again substantial increases in probability at the cost of auditing an additional seven precincts, or approximately 2,800 votes. We would therefore recommend that when the universe of precincts to be audited is from 101-200, that a 10% sample be used. There are only four such instances in the eleven Congressional Districts and the probabilities of finding miscounted precincts are shown in Appendix F.



The aggregate effect of increasing the number of sampled precincts to 15% in three instances and 10% in four districts is not particularly great in that it increases the number of audited precincts by 55, from 325 to 380 (16.9%) and the total votes counted in the 100% audit of those precincts from 126,512 to 146,877, an increase of 20,365 of 16.1%.

A breakdown of audited precincts and the votes needed to complete the expanded audit is attached as Appendix G. The totals can be compared with the across-the-board 5% audit of precincts contained in Appendix C.

We suggest that the additional precincts audited significantly enhances the probability of finding a miscounted precinct without unduly increasing the effort required.



This graph shows the number of votes counted for the eleven Congressional Districts under the new audit proposal by election jurisdiction.

We believe that this approach to selecting the number of precincts to be audited can be used not only in the Congressional elections in 2006, but can be applied to any race, regardless of the number of precincts in which votes for a particular election are cast.

Thus, while a 5% sample readily suffices for county-wide or city-wide elections, increasing the sample size to 10% for races in which fewer than 200 precincts are involved is strongly indicated, as is a 15% sample when fewer than 100 precincts cast votes. Even with as few as 50 precincts, a 15% audit will detect a miscounted precinct 99.5% of the time (Assuming 50% corrupt precincts).

Over-all the hand counting of 146,877 ballots to adequately sample for miscounts represents only a very slight increase to 5.8% of the total ballots cast or precincts involved, based on results of the 2004 General Election in the five election jurisdictions surveyed.

Conclusion

Based on the foregoing, we recommend that the Ballot Integrity Project adopt the sampling methods shown in Appendix G as the methodology of selecting precincts for auditing for the 2006 Congressional Elections in the City of Chicago, Suburban Cook, DuPage, Lake and McHenry Counties.

SURVEY OF 5% PRECINCT SAMPLING - COOK COUNTY - 2006

Appendix A

Congressional Elections

Cong Dist	No Prcts	2004 Vote Totals - Cook County			County Total	No Prcts	2004 Vote Totals - Chicago			City Total	Total Votes	Total Prcts	Avg P/Prct	5% of Prcts	Vote Count
		Dem	Rep	Other			Dem	Rep	Other						
1st	203	41191	32176		73367	532	169924	5617		175541	248908	735	339	37	12445
2nd	381	111965	21476		133441	293	91105	5078		96183	229624	674	341	34	11481
3rd	414	92241	42368		134609	253	72374	15404		87778	222387	667	333	33	11119
4th	61	11590	2485	658	14733	387	92649	12939	4157	109745	124478	448	278	22	6224
5th	98	16573	8933		25506	495	140945	40280		181225	206731	593	349	30	10337
7th	175	55842	11140		66982	580	164224	24016		188240	255222	755	338	38	12761
9th	369	99860	39746		139606	247	75012	16265		91277	230883	616	375	31	11544
Totals	1701	429262	158324	658	588244	2787	806233	119599	4157	929989	1518233	4488	338	224	75912

Cong Dist	No Precincts	2004 Vote Totals - Cook County			No Prcts	2004 Vote Totals - Dupage			Total Votes	Total Prcts	Avg P/Prct	5% of Prcts	Vote Count
		Dem	Rep	Total		Dem	Rep	Total					
6th	129	22701	24837	47538	399	87769	114790	202559	250097	528	474	26	12505
13th	88	13859	28208	42067	298	55449	111563	167012	209079	386	542	19	10454
Totals	217	36560	53045	89605	697	143218	226353	369571	459176	914	502	46	22959

Cong Dist	No Prcts	2004 Vote Totals - Cook County			No Prcts	2004 Vote Totals - Lake			No Prcts	2004 Vote Totals - McHenry			Total Votes	Total Prcts	Avg P/Prct	5% of Prcts	Vote Count
		Dem	Rep	Total		Dem	Rep	Total		Dem	Rep	Total					
8th	176	43893	34356	78249	246	73419	72545	145964	114	22174	23450	45624	269837	536	503	27	13492
10th	344	51860	103509	155369	216	47358	73984	121342					276711	560	494	28	13836
Totals	520	95753	137865	233618	462	120777	146529	267306	114	22174	23450	45624	546548	1096	499	55	27327

Grand Totals											2523957	6498	388	325	126198
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NOTE: Vote Totals from 2004 General Elections

Revised: 6 Aug 2005

PERCENT OF CONGRESSIONAL VOTE BY DISTRICT - DISTRIBUTION BY ELECTION AUTHORITY											Appendix B	
Cong Dist	Total Votes	City of Chicago		S. Cook County		Dupage County		Lake County		McHenry County		Total Pct
		No	Pct	No	Pct	No	Pct	No	Pct	No	Pct	
1st	248,908	175,541	70.5%	73,367	29.5%							100.0%
2nd	229,624	96,183	41.9%	133,441	58.1%							100.0%
3rd	222,387	87,778	39.5%	134,609	60.5%							100.0%
4th	124,478	109,745	88.2%	14,733	11.8%							100.0%
5th	206,731	181,225	87.7%	25,506	12.3%							100.0%
6th	250,097			47,538	19.0%	202,559	81.0%					100.0%
7th	255,222	188,240	73.8%	66,982	26.2%							100.0%
8th	269,837			78,249	29.0%			145,964	54.1%	45,624	16.9%	100.0%
9th	230,833	91,277	39.5%	139,606	60.5%							100.0%
10th	276,711			155,369	56.1%			121,342	43.9%			100.0%
13th	209,079			42,067	20.1%	167,012	79.9%					100.0%
Totals	2,523,907	929,989	36.8%	911,467	36.1%	369,571	14.6%	267,306	10.6%	45,624	1.8%	100.0%
Vote Total from 2004 General Election											Revised: 6 Aug 2005	

5% PRECINCT SAMPLING BY CONGRESSIONAL DISTRICT

Appendix C

Cong Dist	Total Votes	Total Prnts	City of Chicago			S. Cook County			Dupage County			Lake County			McHenry County			Total Smp	Total Votes
			No	Smp	Votes	No	Smp	Votes	No	Smp	Votes	No	Smp	Votes	No	Smp	Votes		
1st	248,908	735	532	27	9017	203	10	3674										37	12,692
2nd	229,624	674	293	15	4805	381	19	6668										34	11,473
3rd	222,387	667	253	13	4390	414	21	6728										33	11,117
4th	124,478	448	387	19	5495	61	3	741										22	6,237
5th	206,731	593	495	25	9059	98	5	1279										30	10,337
6th	250,097	528				129	6	2380	399	20	10135							26	12,515
7th	255,222	755	580	29	9425	175	9	3351										38	12,776
8th	269,837	536				176	9	3916				246	12	7294	114	6	2280	27	13,490
9th	230,833	616	247	12	4570	369	18	6974										31	11,544
10th	276,711	560				344	17	7774				216	11	6070				28	13,844
13th	209,079	386				88	4	2130	298	15	8359							19	10,489
Totals	2,523,907	6498		139	46761	2,438	122	45615	697	35	18494	462	23	13364	114	6	2280	325	126,512

NOTE: Vote Totals from 2004 General Elections

Revised: 6 Aug 2005

Chance of Finding a Corrupted Precinct with 5% Audit							Chance of Finding a Corrupted Precinct with 5% Audit						
Total No of Prncts	No of Error Prnct	Pct Error Prncts	Prncts for 5% Audit	Value	Std Dev	Chance Finding an Error Prnct	Total No of Prncts	No of Error Prnct	Pct Error Prncts	Prncts for 5% Audit	Value	Std Dev	Chance Finding an Error Prnct
100	50	50.00%	5	2.50	1.12	97.19%	300	150	50.00%	15	7.50	1.94	100.00%
100	45	45.00%	5	2.25	1.11	95.38%	300	135	45.00%	15	6.75	1.93	99.99%
100	40	40.00%	5	2.00	1.10	92.75%	300	120	40.00%	15	6.00	1.90	99.96%
100	35	35.00%	5	1.75	1.07	89.03%	300	105	35.00%	15	5.25	1.85	99.87%
100	30	30.00%	5	1.50	1.02	83.92%	300	90	30.00%	15	4.50	1.77	99.59%
100	25	25.00%	5	1.25	0.97	77.08%	300	75	25.00%	15	3.75	1.68	98.82%
100	20	20.00%	5	1.00	0.89	68.07%	300	60	20.00%	15	3.00	1.55	96.79%
100	15	15.00%	5	0.75	0.80	56.43%	300	45	15.00%	15	2.25	1.38	91.81%
100	10	10.00%	5	0.50	0.67	41.62%	300	30	10.00%	15	1.50	1.16	80.22%
100	5	5.00%	5	0.25	0.49	23.04%	300	15	5.00%	15	0.75	0.84	54.55%
100	4	4.00%	5	0.20	0.44	18.81%	300	12	4.00%	15	0.60	0.76	46.60%
100	3	3.00%	5	0.15	0.38	14.40%	300	9	3.00%	15	0.45	0.66	37.38%
100	1	1.00%	5	0.05	0.22	5.00%	300	3	1.00%	15	0.15	0.39	14.31%
100	1	0.50%	5	0.03	0.16	0.00%	300	2	0.50%	15	0.08	0.27	5.00%
100	0	0.10%	5	0.01	0.07	0.00%	300	0	0.10%	15	0.02	0.12	0.00%
100	0	0.05%	5	0.00	0.05	0.00%	300	0	0.05%	15	0.01	0.09	0.00%
Chance of Finding a Corrupted Precinct with 5% Audit							Chance of Finding a Corrupted Precinct with 5% Audit						
Total No of Prncts	No of Error Prnct	Pct Error Prncts	Prncts for 5% Audit	Value	Std Dev	Chance Finding an Error Prnct	Total No of Prncts	No of Error Prnct	Pct Error Prncts	Prncts for 5% Audit	Value	Std Dev	Chance Finding an Error Prnct
200	100	50.00%	10	5.00	1.58	99.92%	400	200	50.00%	20	10.00	2.24	100.00%
200	90	45.00%	10	4.50	1.57	99.79%	400	180	45.00%	20	9.00	2.22	100.00%
200	80	40.00%	10	4.00	1.55	99.48%	400	160	40.00%	20	8.00	2.19	100.00%
200	70	35.00%	10	3.50	1.51	98.81%	400	140	35.00%	20	7.00	2.13	99.99%
200	60	30.00%	10	3.00	1.45	97.44%	400	120	30.00%	20	6.00	2.05	99.94%
200	50	25.00%	10	2.50	1.37	94.79%	400	100	25.00%	20	5.00	1.94	99.73%
200	40	20.00%	10	2.00	1.26	89.87%	400	80	20.00%	20	4.00	1.79	98.98%
200	30	15.00%	10	1.50	1.13	81.11%	400	60	15.00%	20	3.00	1.60	96.45%
200	20	10.00%	10	1.00	0.95	66.02%	400	40	10.00%	20	2.00	1.34	88.49%
200	10	5.00%	10	0.50	0.69	40.85%	400	20	5.00%	20	1.00	0.97	65.07%
200	8	4.00%	10	0.40	0.62	34.16%	400	16	4.00%	20	0.80	0.88	56.70%
200	6	3.00%	10	0.30	0.54	26.79%	400	12	3.00%	20	0.60	0.76	46.44%
200	2	1.00%	10	0.10	0.31	9.77%	400	4	1.00%	20	0.20	0.44	18.61%
200	1	0.50%	10	0.05	0.22	5.00%	400	2	0.50%	20	0.10	0.32	9.76%
200	0	0.10%	10	0.01	0.10	0.00%	400	0	0.10%	20	0.02	0.14	0.00%
200	0	0.05%	10	0.01	0.07	0.00%	400	0	0.05%	20	0.01	0.10	0.00%

Chance of Finding a Corrupted Precinct with 5% Audit							Chance of Finding a Corrupted Precinct with 5% Audit						
Total No of Prncts	No of Error Prnct	Pct Error Prncts	Prncts for 5% Audit	Value	Std Dev	Chance Finding an Error Prnct	Total No of Prncts	No of Error Prnct	Pct Error Prncts	Prncts for 5% Audit	Value	Std Dev	Chance Finding an Error Prnct
500	250	50.00%	25	12.50	2.50	100.00%	700	350	50.00%	35	17.50	2.96	100.00%
500	225	45.00%	25	11.25	2.49	100.00%	700	315	45.00%	35	15.75	2.94	100.00%
500	200	40.00%	25	10.00	2.45	100.00%	700	280	40.00%	35	14.00	2.90	100.00%
500	175	35.00%	25	8.75	2.38	100.00%	700	245	35.00%	35	12.25	2.82	100.00%
500	150	30.00%	25	7.50	2.29	99.99%	700	210	30.00%	35	10.50	2.71	100.00%
500	125	25.00%	25	6.25	2.17	99.94%	700	175	25.00%	35	8.75	2.56	100.00%
500	100	20.00%	25	5.00	2.00	99.68%	700	140	20.00%	35	7.00	2.37	99.97%
500	75	15.00%	25	3.75	1.79	98.46%	700	105	15.00%	35	5.25	2.11	99.71%
500	50	10.00%	25	2.50	1.50	93.30%	700	70	10.00%	35	3.50	1.77	97.73%
500	25	5.00%	25	1.25	1.09	73.15%	700	35	5.00%	35	1.75	1.29	84.14%
500	20	4.00%	25	1.00	0.98	64.88%	700	28	4.00%	35	1.40	1.16	76.90%
500	15	3.00%	25	0.75	0.85	54.19%	700	21	3.00%	35	1.05	1.01	66.49%
500	5	1.00%	25	0.25	0.50	22.70%	700	7	1.00%	35	0.35	0.59	30.28%
500	3	0.50%	25	0.13	0.35	9.76%	700	4	0.50%	35	0.18	0.42	14.28%
500	1	0.10%	25	0.03	0.16	0.00%	700	1	0.10%	35	0.04	0.19	0.00%
500	0	0.05%	25	0.01	0.11	0.00%	700	0	0.05%	35	0.02	0.13	0.00%
Chance of Finding a Corrupted Precinct with 5% Audit							Chance of Finding a Corrupted Precinct with 5% Audit						
Total No of Prncts	No of Error Prnct	Pct Error Prncts	Prncts for 5% Audit	Value	Std Dev	Chance Finding an Error Prnct	Total No of Prncts	No of Error Prnct	Pct Error Prncts	Prncts for 5% Audit	Value	Std Dev	Chance Finding an Error Prnct
600	300	50.00%	30	15.00	2.74	100.00%	800	400	50.00%	40	20.00	3.16	100.00%
600	270	45.00%	30	13.50	2.72	100.00%	800	360	45.00%	40	18.00	3.15	100.00%
600	240	40.00%	30	12.00	2.68	100.00%	800	320	40.00%	40	16.00	3.10	100.00%
600	210	35.00%	30	10.50	2.61	100.00%	800	280	35.00%	40	14.00	3.02	100.00%
600	180	30.00%	30	9.00	2.51	100.00%	800	240	30.00%	40	12.00	2.90	100.00%
600	150	25.00%	30	7.50	2.37	99.99%	800	200	25.00%	40	10.00	2.74	100.00%
600	120	20.00%	30	6.00	2.19	99.90%	800	160	20.00%	40	8.00	2.53	99.99%
600	90	15.00%	30	4.50	1.96	99.33%	800	120	15.00%	40	6.00	2.26	99.87%
600	60	10.00%	30	3.00	1.64	96.10%	800	80	10.00%	40	4.00	1.90	98.68%
600	30	5.00%	30	1.50	1.19	79.37%	800	40	5.00%	40	2.00	1.38	87.81%
600	24	4.00%	30	1.20	1.07	71.52%	800	32	4.00%	40	1.60	1.24	81.27%
600	18	3.00%	30	0.90	0.93	60.82%	800	24	3.00%	40	1.20	1.08	71.34%
600	6	1.00%	30	0.30	0.54	26.59%	800	8	1.00%	40	0.40	0.63	33.78%
600	3	0.50%	30	0.15	0.39	14.29%	800	4	0.50%	40	0.20	0.45	18.58%
600	1	0.10%	30	0.03	0.17	0.00%	800	1	0.10%	40	0.04	0.20	0.00%
600	0	0.05%	30	0.02	0.12	0.00%	800	0	0.05%	40	0.02	0.14	0.00%

Appendix E

Chance of Finding a Corrupted Precinct with 15% Audit							Chance of Finding a Corrupted Precinct with 15% Audit						
Total No of Prncts	No of Error Prnct	Pct Error Prncts	Prncts for 15% Audit	Value	Std Dev	Chance Finding an Error Prnct	Total No of Prncts	No of Error Prnct	Pct Error Prncts	Prncts for 5% Audit	Value	Std Dev	Chance Finding an Error Prnct
61	31	50.00%	9	4.58	1.51	99.88%	88	44	50.00%	13	6.60	1.82	100.00%
61	27	45.00%	9	4.12	1.50	99.70%	88	40	45.00%	13	5.94	1.81	99.98%
61	24	40.00%	9	3.66	1.48	99.28%	88	35	40.00%	13	5.28	1.78	99.93%
61	21	35.00%	9	3.20	1.44	98.42%	88	31	35.00%	13	4.62	1.73	99.74%
61	18	30.00%	9	2.75	1.39	96.75%	88	26	30.00%	13	3.96	1.66	99.31%
61	15	25.00%	9	2.29	1.31	93.65%	88	22	25.00%	13	3.30	1.57	98.30%
61	12	20.00%	9	1.83	1.21	88.15%	88	18	20.00%	13	2.64	1.45	95.16%
61	9	15.00%	9	1.37	1.08	78.78%	88	13	15.00%	13	1.98	1.30	89.46%
61	6	10.00%	9	0.92	0.91	63.33%	88	9	10.00%	13	1.32	1.09	73.75%
61	3	5.00%	9	0.46	0.66	38.59%	88	4	5.00%	13	0.66	0.79	47.88%
61	2	4.00%	9	0.37	0.59	27.54%	88	4	4.00%	13	0.53	0.71	38.47%
61	2	3.00%	9	0.27	0.52	14.75%	88	3	3.00%	13	0.40	0.62	27.51%
61	1	1.00%	9	0.09	0.30	0.00%	88	1	1.00%	13	0.13	0.36	0.00%
61	0	0.50%	9	0.05	0.21	0.00%	88	0	0.50%	13	0.07	0.26	0.00%
61	0	0.10%	9	0.01	0.10	0.00%	88	0	0.10%	13	0.01	0.11	0.00%
61	0	0.05%	9	0.00	0.07	0.00%	88	0	0.05%	13	0.01	0.08	0.00%
Chance of Finding a Corrupted Precinct with 15% Audit							Chance of Finding a Corrupted Precinct with 15% Audit						
Total No of Prncts	No of Error Prnct	Pct Error Prncts	Prncts for 15% Audit	Value	Std Dev	Chance Finding an Error Prnct	Total No of Prncts	No of Error Prnct	Pct Error Prncts	Prncts for 15% Audit	Value	Std Dev	Chance Finding an Error Prnct
98	49	50.00%	15	7.35	1.92	100.00%							
98	44	45.00%	15	6.62	1.91	99.99%							
98	39	40.00%	15	5.88	1.88	99.96%							
98	34	35.00%	15	5.15	1.83	99.85%							
98	29	30.00%	15	4.41	1.76	99.53%							
98	25	25.00%	15	3.68	1.66	98.60%							
98	20	20.00%	15	2.94	1.53	96.19%							
98	15	15.00%	15	2.21	1.37	90.27%							
98	10	10.00%	15	1.47	1.15	76.61%							
98	5	5.00%	15	0.74	0.84	46.58%							
98	4	4.00%	15	0.59	0.75	37.35%							
98	3	3.00%	15	0.44	0.65	26.66%							
98	1	1.00%	15	0.15	0.38	0.00%							
98	0	0.50%	15	0.07	0.27	0.00%							
98	0	0.10%	15	0.01	0.12	0.00%							
98	0	0.05%	15	0.01	0.09	0.00%							

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Appendix F

Chance of Finding a Corrupted Precinct with 10% Audit							Chance of Finding a Corrupted Precinct with 10% Audit						
Total No of Prncts	No of Error Prnct	Pct Error Prncts	Prncts for 10% Audit	Value	Std Dev	Chance Finding an Error Prnct	Total No of Prncts	No of Error Prnct	Pct Error Prncts	Prncts for 10% Audit	Value	Std Dev	Chance Finding an Error Prnct
114	57	50.00%	11	5.70	1.69	99.97%	175	88	50.00%	18	8.75	2.09	100.00%
114	51	45.00%	11	5.13	1.68	99.90%	175	79	45.00%	18	7.88	2.08	100.00%
114	46	40.00%	11	4.56	1.65	99.72%	175	70	40.00%	18	7.00	2.05	99.99%
114	40	35.00%	11	3.99	1.61	99.24%	175	61	35.00%	18	6.13	2.00	99.96%
114	34	30.00%	11	3.42	1.55	98.37%	175	53	30.00%	18	5.25	1.92	99.83%
114	29	25.00%	11	2.85	1.46	96.20%	175	44	25.00%	18	4.38	1.81	99.37%
114	23	20.00%	11	2.28	1.35	91.65%	175	35	20.00%	18	3.50	1.67	98.17%
114	17	15.00%	11	1.71	1.21	84.54%	175	26	15.00%	18	2.63	1.49	94.39%
114	11	10.00%	11	1.14	1.01	69.00%	175	18	10.00%	18	1.75	1.25	83.91%
114	6	5.00%	11	0.57	0.74	40.37%	175	9	5.00%	18	0.88	0.91	56.62%
114	5	4.00%	11	0.46	0.66	33.74%	175	7	4.00%	18	0.70	0.82	51.74%
114	3	3.00%	11	0.34	0.58	26.45%	175	5	3.00%	18	0.53	0.71	40.38%
114	1	1.00%	11	0.11	0.34	9.65%	175	2	1.00%	18	0.18	0.42	9.71%
114	1	0.50%	11	0.06	0.24	0.00%	175	1	0.50%	18	0.09	0.30	0.00%
114	0	0.10%	11	0.01	0.11	0.00%	175	0	0.10%	18	0.02	0.13	0.00%
114	0	0.05%	11	0.01	0.08	0.00%	88	0	0.05%	9	0.00	0.07	0.00%
Chance of Finding a Corrupted Precinct with 10% Audit							Chance of Finding a Corrupted Precinct with 10% Audit						
Total No of Prncts	No of Error Prnct	Pct Error Prncts	Prncts for 10% Audit	Value	Std Dev	Chance Finding an Error Prnct	Total No of Prncts	No of Error Prnct	Pct Error Prncts	Prncts for 10% Audit	Value	Std Dev	Chance Finding an Error Prnct
129	65	50.00%	13	6.45	1.80	99.98%	176	88	50.00%	26	13.20	2.57	100.00%
129	58	45.00%	13	5.81	1.79	99.95%	176	79	45.00%	18	7.92	2.09	100.00%
129	52	40.00%	13	5.16	1.76	99.83%	176	70	40.00%	18	7.04	2.06	99.99%
129	45	35.00%	13	4.52	1.71	99.57%	176	62	35.00%	18	6.16	2.00	99.95%
129	39	30.00%	13	3.87	1.65	98.79%	176	53	30.00%	18	5.28	1.92	99.82%
129	32	25.00%	13	3.23	1.56	97.27%	176	44	25.00%	18	4.40	1.82	99.43%
129	26	20.00%	13	2.58	1.44	93.39%	176	35	20.00%	18	3.52	1.68	98.12%
129	19	15.00%	13	1.94	1.28	86.55%	176	26	15.00%	18	2.64	1.50	94.28%
129	13	10.00%	13	1.29	1.08	70.70%	176	18	10.00%	18	1.76	1.26	83.72%
129	6	5.00%	13	0.65	0.78	45.02%	176	9	5.00%	18	0.88	0.91	56.40%
129	5	4.00%	13	0.52	0.70	39.12%	176	7	4.00%	18	0.70	0.82	51.53%
129	4	3.00%	13	0.39	0.61	25.57%	176	5	3.00%	18	0.53	0.72	40.20%
129	1	1.00%	13	0.13	0.36	9.30%	176	2	1.00%	18	0.18	0.42	9.66%
129	1	0.50%	13	0.06	0.25	0.00%	176	1	0.50%	18	0.09	0.30	0.00%
129	0	0.10%	13	0.01	0.11	0.00%	176	0	0.10%	18	0.02	0.13	0.00%
129	0	0.05%	13	0.01	0.08	0.00%	176	0	0.05%	18	0.01	0.09	0.00%

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5% -10% - 15% - PRECINCT SAMPLING BY CONGRESSIONAL DISTRICT

Appendix G

Cong Dist	Total Votes	Total Prnts	City of Chicago			S. Cook County			Dupage County			Lake County			McHenry County			Total Smp	Total Votes
			No	Smp	Votes	No	Smp	Votes	No	Smp	Votes	No	Smp	Votes	No	Smp	Votes		
1st	248,908	735	532	27	9017	203	10	3674										37	12,692
2nd	229,624	674	293	15	4805	381	19	6668										34	11,473
3rd	222,387	667	253	13	4390	414	21	6728										33	11,117
4th	124,478	448	387	19	5495	61	9	2187										28	7,682
5th	206,731	593	495	25	9059	98	15	3915										40	12,974
6th	250,097	528				129	12	4428	399	20	10135							32	14,563
7th	255,222	755	580	29	9425	175	18	6894										47	16,319
8th	269,837	536				176	18	8010				246	12	7294	114	13	5200	43	20,504
9th	230,833	616	247	12	4570	369	18	6974										31	11,544
10th	276,711	560				344	17	7774				216	11	6070				28	13,844
13th	209,079	386				88	12	5808	298	15	8359							27	14,167
Totals	2,523,907	6498		139	46761	2,438	170	63060	697	35	18494	462	23	13364	114	13	5200	380	146,877

15% Sampling	10% Sampling
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NOTE: Vote Totals from 2004 General Elections

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