



THE LEAGUE OF WOMEN VOTERS OF SOUTH CAROLINA

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## **An Audit of the November 2, 2010 Election in Richland County**

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### **Summary**

The authors have obtained via the Freedom of Information Act the vote image file, the voting terminal log files and the log file for the program that tabulates the votes in Richland County for the November 2, 2010, election, and they have analyzed that data in an attempt to verify that the certified results of that election can be justified from the data of that election.

Our analysis has exposed a number of problem areas in the counting of votes and collection of data in Richland County by the Richland County Election Commission (RCEC), and thus we are very concerned about the process by which elections are conducted.

**Votes Not Counted:** Of primary concern is that the vote image file we obtained contains 355 votes in Ward 21 and 772 votes in Bluff precinct that appear not to have been counted in the certified results. We believe we know the cause for these errors: in Ward 21, there were two PEBs that opened and closed machines and collected votes, but only one of the two had its vote data included in the certified count. In Bluff, six of the eight iVotronic machines did not get their vote data collected until November 9, 2010, after the certification of the count had been made.

**Missing Votes:** There are two different problems with votes that were collected and counted but whose detail records did not get stored in the vote image file:

1. The data files we obtained are missing all data for the Gadsden and Riverside precincts. These are neither the first precincts in the sorted list of precincts in Richland County nor are they the last precincts. We believe that producing a complete vote image file and a complete event log should be something we could expect the RCEC to do without error.

2. The vote image file we obtained shows fewer votes in seven precincts than have been certified by the RCEC. In all cases the number of votes is such that it would appear that our vote image file is missing the entire vote data from perhaps ten individual iVotronic voting machines.

We believe it to be inexcusable that three-fourths of the votes from one precinct and half the votes from another were simply not included in the certified count. The count of total votes cast is supposed to be known at the precinct level; at some point in the process there should have been a check that votes certified matched up with votes cast on the signature book, but this was obviously not done. These two precincts stand out in sharp relief as the two precincts with the lowest official voter turnout [SCSEC] with turnout rates much below the average for the county. The red flags are present, but none seemed to be noticed.

We are also concerned about the missing data. Collecting, storing, retrieving, and managing the vote image data that justifies the certified results of the elections is done using an expensive computerized system that was evaluated by software and security experts and found to be completely unacceptable [EVEREST]. We suspect that the problem of not collecting all the data is due to a software system that is flawed in not requiring all the data to be collected. Richland County used more than 800 iVotronic machines in the November election. It would be a human error if, as seems apparent, data from some of those machines was not collected. It is also a software error in the overall system, however, if the software permits collecting votes from a particular iVotronic but does not then verify that the vote image from that machine is stored in the vote image file. Poll workers and other election officials should be informed that machines known to be in use were not accounted for in the vote image file after the polls closed.

Our final point of concern is this: The authors of this report have not routinely served as poll workers or supervisors (Dr. Hare served once in 2006; the others have never served in this capacity.), do not have access to iVotronic manuals or to the procedure document or to the full range of data collected in Richland County from the November 2, 2010, election. That we, as complete amateurs, could perform in a matter of a few hours a consistency check on such data as we happened to get by FOIA and determine that a thousand votes went missing and more than 2500 additional votes were certified but are unsupported by the data suggests that there are serious flaws in the election system used in Richland County, and by extension the entire state of South Carolina.

In all, there were 1454 votes in two precincts which did not appear at all in the vote image file, 1362 votes in seven precincts for which no vote image data exists, and 1127 votes in two precincts that were cast and appear in the vote image file but that were not counted. This is a total of nearly 4000 votes either

counted but unsupported by the vote image data or supported by that data but not counted, of a total of about 120,000 votes certified in Richland County. This is not a small number, and should to be considered especially disturbing when at least three different types of errors have led to this miscount.

This report and supporting data, along with other information and data on recent elections in South Carolina, can be found at [www.scvotinginfo.com](http://www.scvotinginfo.com).

## **A Detailed Analysis**

We obtained by FOIA request the EL152 and EL155 files from Richland County. The EL152 file is the “event log” that is supposed to record all the “events” that occurred in each of the iVotronic machines for the election (events include votes cast, opening and closing the machine, collecting votes from the machine, and so forth). The EL155 file, which we will refer to as the vote image file, is a detailed file with each of the votes (in what is supposed to be a randomized order) as cast. We should have requested at that time (but did not) the EL68a and EL68ab files, which record the aggregation of data from the individual machines into the overall county totals. We have, since our analysis began, requested and received these two files.

Buell and Moore have independently written programs to parse the EL155 vote image file, Buell using the Java programming language and Moore using Perl scripts. Their results agree completely, suggesting that their conclusions are likely to be correct.

### **Votes that Were Cast but Not Counted**

We can, we believe, provide a detailed analysis of the 1127 votes that were legitimately cast in Ward 21 and in Bluff precinct and yet were not counted in the certified results. Our analysis is fairly detailed and, we believe, convincingly demonstrates a serious problem with the election system. The problem is that the software does not automatically catch errors through self-checks and thus makes it easy for the poll workers to make mistakes that lead to uncounted votes.

#### **Ward 21**

In Ward 21, the certified count is 339 votes. The vote data file, however, has 694 votes recorded, a difference of 355 votes, more than half the total.

The vote data file lists the following vote counts for the following iVotronic serial numbers:

Serial Number	Vote Count
5120652	121
5134730	101
5135715	130
5136586	104
5138357	112
5139525	126

It takes only a tiny bit of forensic accounting to notice that  $101 + 112 + 126 = 339$ ; that is, that if iVotronics numbers 5134730, 5138357, and 5139525 were included in the count and the other three machines were excluded, then the recorded count would be 339. A more detailed look shows that no other subset of the six machines yields a total of 339 votes.

How is it that three of the six machines were counted and three were omitted? To answer that, we look at the EL152 event log. What we find is not conclusive, in that we cannot prove cause and effect, but what we can see is a clear difference between the three machines whose votes appear to have been counted and the three whose votes appear to have been omitted.

The event log shows that PEB 152732 opened and closed machines 5120652, 5135715, and 5136586, with a total of 355 votes cast. PEB 153090 opened and closed machines 5134730, 5138357, and 5139525, with a total of 339 votes cast.

In Ward 21, one of two PEBs had its data collected and the other was left out. We do not know how or why this could have happened, but we suggest that it is a flaw in the software of the election system not to have had a list of PEBs to be used on election day and then not to have ensured that all those PEBs had their data collected. Again, a human error in forgetting to upload the votes from one of the PEBs should have been caught by the software of the election system, but apparently was not. Further, the use of two PEBs to open and close machines in a precinct is contrary to the standard protocol.

It is worth noting that we have considered the possibility that the three machines whose votes apparently were not counted in Ward 21 might possibly have been counted in a different precinct, or that it might have been the case that the contests in Ward 21 were identical to the contests in a neighboring precinct, and that what really happened is simply that one precinct was mislabeled as another. However, none of the individual machine counts match up with the excess of votes in other precincts, and a look at the contests shows that the Ward 21 contests cannot be identical to those of other precincts.

## Bluff Precinct

In Bluff precinct, there were 254 votes certified and 1026 cast, with a difference of 772 votes not counted. The analysis here is a little more complicated, but the eventual conclusion is quite similar. Our vote image file by machine yields the following totals.

Serial Number	Vote Count
5121076	133
5131255	133
5133311	121
5135064	115
5136068	136
5137738	128
5137832	139
5138461	121

There are several ways to get two machines' counts to add to 254. This could be 133 + 121 (in four different ways) or 115+139. To determine the likely combination, we turn once again to the EL152 event log, and once again we can separate the a total that was recorded from a total not recorded based on PEBs, and in this case also on some odd timestamps in the system.

We note that the machines 5131255 (133) and 5133311 (121) total to 254 votes, the number certified. The event logs show what is different between these two machines and the other six in Bluff. We present below an excerpt of the event logs for machines 5121076 and 5131255.

5121076	153424	SUP	11/02/2010	17:56:20	0001510	vote_cast_by_voter
5121076	152523	SUP	11/02/2010	18:41:19	0001519	vote_cancelled_other_reason
5121076	152523	SUP	11/02/2010	18:42:49	0001519	vote_cancelled_other_reason
5121076	152523	SUP	11/02/2010	18:43:13	0001649	term_entered_service_menus
5121076	152523	SUP	11/02/2010	18:43:17	0000114	select_setup_configuration_menu
5121076	152523	SUP	11/02/2010	18:43:17	0000301	start_override_password_procedure
5121076	152523	SUP	11/02/2010	18:43:37	0000116	select_configure_terminal
5121076	152523	SUP	11/02/2010	18:43:41	0000117	select_set_time_and_date
5121076	152523	SUP	11/02/2010	19:43:42	0001656	set_terminal_date_andor_time
5121076	152523	SUP	11/02/2010	19:43:58	0001650	term_exited_service_menus
5121076	152523	SUP	11/02/2010	19:44:21	0001633	terminal_shutdown
5121076	152523	SUP	11/09/2010	14:30:03	0002810	terminal_time_to_close_voting
5121076	152523	SUP	11/09/2010	14:30:15	0001626	close_terminal
5121076	152523	SUP	11/09/2010	14:30:15	0002809	terminal_closing_state
5121076	152523	SUP	11/09/2010	14:30:15	0001221	collect_terminal_vote_data_to_peb
5121076	152523	SUP	11/09/2010	14:30:44	0001303	transfer_peb_vote_data_to_terminal
5121076	152523	SUP	11/09/2010	14:30:51	0001208	merge_terminal_peb_vote_data
5121076	152523	SUP	11/09/2010	14:30:54	0002802	terminal_open_state
5121076	152523	SUP	11/09/2010	14:30:54	0002803	terminal_closed_state
5121076	152523	SUP	11/09/2010	14:30:54	0002809	terminal_closing_state
5121076	152523	SUP	11/09/2010	14:30:58	0001210	transfer_terminal_vote_data_to_peb
5121076	152523	SUP	11/09/2010	14:31:24	0001211	terminal_votes_to_peb_successful
5121076	152523	SUP	11/09/2010	14:31:24	0001214	transfer_terminal_writein_data_to_peb
5121076	152523	SUP	11/09/2010	14:31:36	0001215	terminal_write_in_data_to_peb_successful
5121076	152523	SUP	11/09/2010	14:31:36	0001222	terminal_vote_collection_successful
5121076	152523	SUP	11/09/2010	14:31:36	0002803	terminal_closed_state
5121076	152523	SUP	11/09/2010	14:31:36	0001673	terminal_closed
5121076	152523	SUP	11/09/2010	14:31:42	0001401	copy_terminal_flash_audit_data_to_cf
5121076	152523	SUP	11/09/2010	14:31:42	0001400	verify_terminal_flash_audit_data
5121076	152523	SUP	11/09/2010	14:31:50	0001416	copy_audit_data_from_tf_1_to_cf5131255 152604
SUP	11/02/2010		17:54:06		0001510	vote_cast_by_voter

5131255	152604	SUP	11/02/2010	18:00:52	0001510	vote_cast_by_voter
5131255	152604	SUP	11/02/2010	18:04:28	0001510	vote_cast_by_voter
5131255	152523	SUP	11/02/2010	18:57:57	0001519	vote_cancelled_other_reason
5131255	0	UNK	11/02/2010	18:58:15	0002400	peb_access_failed
5131255	0	UNK	11/02/2010	18:58:15	0002400	peb_access_failed
5131255	152523	SUP	11/02/2010	18:58:46	0001519	vote_cancelled_other_reason
5131255	152523	SUP	11/02/2010	19:00:06	0001519	vote_cancelled_other_reason
5131255	152523	SUP	11/02/2010	19:00:32	0002810	terminal_time_to_close_voting
5131255	152523	SUP	11/02/2010	19:00:57	0001626	close_terminal
5131255	152523	SUP	11/02/2010	19:00:57	0002809	terminal_closing_state
5131255	152523	SUP	11/02/2010	19:00:57	0001221	collect_terminal_vote_data_to_peb
5131255	152523	SUP	11/02/2010	19:01:17	0001303	transfer_peb_vote_data_to_terminal
5131255	152523	SUP	11/02/2010	19:01:24	0001208	merge_terminal_peb_vote_data
5131255	152523	SUP	11/02/2010	19:01:25	0002802	terminal_open_state
5131255	152523	SUP	11/02/2010	19:01:25	0002803	terminal_closed_state
5131255	152523	SUP	11/02/2010	19:01:25	0002809	terminal_closing_state
5131255	152523	SUP	11/02/2010	19:01:29	0001210	transfer_terminal_vote_data_to_peb
5131255	152523	SUP	11/02/2010	19:01:53	0001211	terminal_votes_to_peb_successful
5131255	152523	SUP	11/02/2010	19:01:53	0001214	transfer_terminal_writein_data_to_peb
5131255	152523	SUP	11/02/2010	19:02:04	0001215	terminal_write_in_data_to_peb_successful
5131255	152523	SUP	11/02/2010	19:02:04	0001222	terminal_vote_collection_successful
5131255	152523	SUP	11/02/2010	19:02:04	0002803	terminal_closed_state
5131255	152523	SUP	11/02/2010	19:02:04	0001673	terminal_closed
5131255	152523	SUP	11/02/2010	19:02:10	0001401	copy_terminal_flash_audit_data_to_cf
5131255	152523	SUP	11/02/2010	19:02:10	0001400	verify_terminal_flash_audit_data
5131255	152523	SUP	11/02/2010	19:02:17	0001416	copy_audit_data_from_tf_1_to_cf

The timestamps for the events on machines 5133311 and 5131255 are all 11/02/2010, as they should be. The timestamps for the other six machines in Bluff show that their votes were apparently not collected until a week later, after the count was certified.

We believe this represents again not just a human error in not closing the machines and collecting the votes, but a software error in not detecting the fact that machines known to be in use had not had their votes collected. In the Richland County offices, Buell saw that the paper tapes produced at the end of the day clearly indicated that no votes were collected from the six machines in question.

We also note that at least some simple timestamp errors do not seem to cause problems in the collection of votes. For example, machine 5132640, used in precinct 370 (Trenholm Road), did not seem to cause problems when its date was set to 11/2/2006 for the duration of the November 2, 2010, election; the date was set to 11/02/2010 at closing time. Further, there were 14 votes cast in Blythewood #2 that showed both date and time values of 00:00:00. The date was then set on this machine and events were logged with what appear to be correct dates. Finally, machine 5122674 appears to have run most of the day with its date set to November 3, then reset to November 2 during the day, and 5123503 ran all day with the date set to November 3.

### Missing Precincts

In totaling votes and comparing data, the second problem we encountered is that Gadsden and Riverside precincts (numbers 327 and 362, respectively) are entirely missing from both the event log and the vote image file. Our EL152 event log lists 803 iVotronic machines used in the election, and our EL155 vote image file lists 801 machines. Two machines (5125831 and 5127640) appear in the event log but were obviously not functioning properly and recorded no

votes. This accounts for the difference between 801 and 803 machines. Thus, there is no record in the event log or in the vote image file of the 1049 votes certified in Gadsden precinct or the 405 votes certified in Riverside precinct.

We are concerned about why this data would not have automatically been included in the vote image file. We do not understand why the software system would not have insisted that the precinct data was stored in the vote image file, and so we must assume that it exists but was not retrieved for one reason or another. This clearly represents a flaw in either the software or in the system that relies on the software.

### **Certified Votes with No Vote Image Data**

In seven precincts, there are more votes certified than we have votes for in the vote image file. Specifically, the following table shows the certified counts, the counts justified by the vote image file, and in the third column the excess of certified votes over the number in the vote image file.

Number	Name	EL155 Count	Certified Count	Overage
122	Ward 22	519	638	119
316	Eastover	661	1172	511
319	Fairlawn	1156	1284	128
322	N Forest Acres	518	646	128
332	Harbison 1	762	878	116
355	Pine Lakes	868	1124	256
374	Westminster	543	647	104

The vote image file shows that most iVotronic machines in Richland County recorded between about 100 and 150 votes, although there were a few machines with far fewer or far more. It is not unrealistic to suggest, therefore, that perhaps the data from one machine is missing in each of precincts 122, 319, 322, 332, and 374, perhaps two machines in precinct 355, and maybe four machines in precinct 316.

Regardless of what happened, what is clear is that the vote image file does not support the certified counts of a total of 1362 votes spread over seven precincts.

We do not understand either how it could be that ten of about 800 machines were skipped in producing the vote image file in response to our FOIA request, or how it could be that software that was properly written would have permitted certifying the vote counts in these seven precincts and not throw error conditions or force the operators to correct their errors.

## Conclusions

We are not suggesting or making accusations of fraud, conspiracy, or similar deliberate attempts to corrupt the vote in Richland County. **What we feel we can justifiably say, however, is that the election system (hardware, software, and procedures) has failed.** Software that is not written to perform obvious checks and balances to anticipate and check for the errors likely to be made by fallible (and mostly volunteer) poll workers at the end of a long election day is unacceptable, and it is a software failure that such checks and balances apparently do not exist in the election system used in South Carolina.

What we have done is really no more sophisticated than totaling a spreadsheet across rows and down columns and then totaling the row sums and column sums to get a grand total in the bottom right corner. From the event log we can get (or should be able to get, if the logs are complete) a list of machines used and a count of votes cast per machine. From the vote image file we can get detailed counts by precinct, machine, ballot image, and candidate. If the problems we have observed in Richland County can be exposed as easily as this, by citizen observers without access to hardware, software, or procedures manuals, then we suggest that the system has failed and that post-election audits such as ours should be mandated. If the software as written and in use will not find these errors, then software should be written and used that will find these errors.



**References**

EVEREST: "EVEREST: Evaluation and Validation of Election-Related Equipment, Standards and Testing," report delivered December 7, 2007, to the Secretary of State of Ohio.

SCSEC:

<http://www.enr-scvotes.org/SC/Richland/19117/40467/en/vt.html>,

web page showing voter turnout in Richland County, last accessed 7 February 2011.