

**BRENNAN
CENTER
FOR JUSTICE**

Council Board of Elections and Ethics Investigation Special Committee

Council of the District of Columbia

Statement of

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The Brennan Center for Justice thanks the Council Board of Elections and Ethics Investigation Subcommittee of the District of Columbia and Chairwoman Mary M. Cheh for holding this hearing. We appreciate the opportunity to share with you the results of our extensive studies on voting systems and best practices. We hope that this information will be helpful in the coming weeks, as Washington D.C. prepares for what will undoubtedly be a high-turnout election, after a primary that has shaken the confidence of many voters in the integrity of the City's voting systems.

THE BRENNAN CENTER'S WORK ON VOTING SYSTEM SECURITY

The Brennan Center for Justice is a nonpartisan think tank and advocacy organization that focuses on democracy and justice. For the last four years, in collaboration with the nation's leading technologists, election experts, security professionals, and usability and accessibility experts, I have led the Brennan Center's Voting Technology Project and worked to make the country's voting systems as secure, reliable and accurate as possible. From 2004 to 2006, I chaired the Brennan Center Task Force on Voting System Security, which conducted the first systematic analysis of voting system security. I am also lead author of the nation's first comprehensive and empirical review of electronic voting systems entitled *The Machinery of Democracy: Voting System Security, Accessibility, Usability and Cost*.¹ In 2007, I co-authored a book on voting system security, *The Machinery of Democracy: Protecting Elections in an Electronic World*,² as well as a report of the Brennan Center and the Samuelson Clinic at the University of California, Berkeley School of Law on post-election audits entitled *Post Election Audits: Restoring Trust in Elections*.³

¹ Lawrence Norden *et al.*, *THE MACHINERY OF DEMOCRACY: VOTING SYSTEM SECURITY, ACCESSIBILITY, USABILITY AND COST* (Brennan Center for Justice ed., 2006).

² Lawrence Norden and Eric Lazarus, *THE MACHINERY OF DEMOCRACY: PROTECTING ELECTIONS IN AN ELECTRONIC WORLD* (Academy Chicago 2007).

³ Lawrence Norden *et al.*, *POST ELECTION AUDITS: RESTORING TRUST IN ELECTIONS* (Brennan Center for Justice ed., 2007).

RESTORING CONFIDENCE IN WASHINGTON, D.C.'S ELECTIONS

Initial unofficial results released by the D.C. Board of Elections and Ethics (the “D.C. Board”) on September 9, 2008 were apparently incorrect, with thousands of extra write-in votes and “overvotes” recorded.⁴ The D.C. Board insists that the final unofficial results were correct.⁵ Since the problems in initial vote totals were discovered, Sequoia Voting Systems and the D.C. Board have blamed the miscount on problems uploading information from a single cartridge.⁶ Sequoia has suggested that the problem was caused by poll workers, or by a static or electrical discharge.⁷ The D.C. Board’s conclusion about the cause of the problem has been inconclusive.⁸

Regardless of whether the explanations provided by Sequoia and the D.C. Board are correct, many voters in Washington, D.C. are likely to be skeptical, and want reassurance that similar problems will not disrupt a future election. There are at least three things the Board can do to address these concerns.

1. **Appoint an Independent Investigator to Examine Technical Problems**

So far, the only investigations into the problems on September 9, 2008 have been conducted by Sequoia, the voting system vendor, and the D.C. Board’s technology staff.⁹ Many voters are likely to be skeptical that these parties are disinterested investigators.

In fact, the history of recent investigations of machine malfunctions in other jurisdictions suggests that such skepticism would not be unfounded. For instance, after the March primary in Butler County, Ohio, election officials discovered that their tally server failed to properly process memory cards and tabulate votes from county voting machines.¹⁰ After conducting its own analysis, the voting system vendor Premier Voting Solutions

⁴ Nikita Stewart & Elissa Silverman, *Primary Vote Still Doesn’t Add Up*, WASHINGTON POST, Sept. 22, 2008 at B01.

⁵ News Release, D.C. Board of Elections and Ethics, *Analysis of the Unofficial Election Night Results from the September 9, 2008 District of Columbia Congressional and Council Primary Election* (Sept. 10, 2008).

⁶ News Release, D.C. Board of Elections & Ethics, *Analysis of the Unofficial Election Night Results from the September 9, 2008 District of Columbia Congressional and Council Primary Election* (Sept. 10, 2008); Sequoia Voting Systems, *Report to the District of Columbia Board of Elections & Ethics* (Sept. 22, 2008) [hereinafter “Sequoia Report”].

⁷ Nikita Stewart, *Voting Database Is Fine, Firm Says*, WASHINGTON POST, Sept. 12, 2008 at B01.

⁸ District of Columbia Board of Elections & Ethics, *Internal Review Committee’s Investigative Report into Election Night Results Summary Reporting Irregularities During the September 9, 2008 District of Columbia Congressional and Council Primary Election* (Oct. 1, 2008), *available at* http://www.dcboee.org/pdf_files/nr_172.pdf [hereinafter “D.C. Board Investigative Report”]; Editorial, *D.C.’s Primary Mystery*, WASHINGTON POST, Oct. 2, 2008 at A22.

⁹ Sequoia Report, *supra* note 6; D.C. Board Investigative Report, *supra* note 8.

¹⁰ Editorial, *Dropped, Then Caught*, COLUMBUS DISPATCH, Aug. 24, 2008; Letter from David Byrd, President, Premier Election Solutions, to Jennifer Brunner, Ohio Secretary of State (Aug. 19, 2008) (on file with the author).

concluded that the problem was *not* caused by any flaw in its software, but by the County's use of another company's anti-virus software.¹¹

In early August, the Ohio Secretary of State, in conjunction with Butler County election officials and observers from Premier, conducted a simulation to test Premier's conclusions about the failure. They found that the anti-virus software was not the cause of the problems. Following this study, on August 19, 2008, Premier wrote to the Ohio Secretary of State conceding that the errors were probably caused by a logic error in Premier's software.¹²

Ultimately, the public should not have to trust that those who may have been responsible for the problems on Election Day will adequately investigate machine failures. When a mysterious technical problem arises, the vendor should not lead the investigation.

Instead, an independent investigator should take the lead in determining what went wrong. This is exactly what was done during the controversy over 18,000 lost votes in Congressional District 13 in Sarasota County, Florida in 2006, and in a current controversy over voting machine problems in New Jersey.¹³

2. Review Logic & Accuracy Testing and Ballot Accounting Practices

The public explanations for the Election Day problems on September 9, 2008 have been insufficient to determine exactly what went wrong; therefore, it is impossible to say what steps might have prevented the initial miscount. However, most technical problems with voting systems can be caught through thorough pre-election (sometimes called "logic and accuracy") testing before the election begins, and good post-election canvassing (sometimes called "ballot accounting and reconciliation") after the polls have closed.

The District of Columbia has fairly detailed requirements for both pre-election testing and post-election canvassing.¹⁴ It is difficult to know what is actually done in practice. As it happens, the Brennan Center is in the midst of conducting a survey of the post-election canvass of all 50 states and the District of Columbia. We have received responses to our questions regarding post-election canvass practices from all jurisdictions *with the exception of the District*.

There are a number of models or "best practice" recommendations for both pre-election testing and post-election canvasses. It would probably be useful for the Board of Elections to review best practice recommendations made by Professor Doug Jones and

¹¹ Letter from David Byrd, *supra* note 10.

¹² *Id.*

¹³ Carol J. Williams, *Much Ado About Fla. E-Voting*, LOS ANGELES TIMES, Nov. 16, 2006, at A18; Rob Amen, *CMU Professor Investigates Vote*, PITTSBURGH TRIBUNE REVIEW, Jan. 9, 2007; Anita Kumar, *Jennings Has Another Loss at Voting Machines*, ST. PETERSBURG TIMES, Feb. 24, 2007; Diane C. Walsh, *Experts To Test Machines at 'Rock' State Police Ewing Site Called Ideal, Secure Spot*, TIMES OF TRENTON, May 17, 2008 at A01; Diane C. Walsh, *Voting Machine Test Results Will Be Released To The Public*, NEWARK STAR-LEDGER, June 21, 2008 at 8.

¹⁴ D.C. MUN. REGS. tit. 3, § 800-803 (2008).

John Washburn for pre-election testing, to ensure that they are, in fact, taking all reasonable steps to catch technical problems before an election begins.¹⁵ Similarly, we recommend that the Board review the Brennan Center’s recently released checklist (the “Brennan Center checklist”) for ballot accounting and reconciliation, after polls have closed. It is annexed to my testimony as Exhibit A.

There are no statutory requirements for some of the recommendations made in the Brennan Center checklist. For instance, officials do not appear to be statutorily required to reconcile the number of ballots cast with the number of voters signed in at the precinct level. This step is critical to early detection of a problem with in-precinct voting machines.

3. Conduct Post-Election Audits of Voter Verified Paper Ballots; Establish Clear Procedures for the Audit Before the Election

One of the most important measures for increasing security and reliability of voting systems (as well as public confidence in them) is to conduct post-election audits of voter verified paper records, comparing these records to the electronic tallies provided by the voting machines. Post-election audits can serve several useful purposes, including: creating an appropriate level of public confidence in the results of an election; deterring fraud against the voting system; detecting large scale, systemic errors; providing feedback that will allow jurisdictions to improve voting technology and election administration in future years; and confirming, to a high level of confidence, that a complete manual recount would not change the outcome of the race.

Of course, this kind of post-election audit can only be effective if there is a voter verified paper record to compare to the electronic record. Many voters in Washington, D.C. vote on paperless touch-screen machines. Post-election audits cannot be used on these machines to verify that they are working properly and accurately recording every vote. Nevertheless, the Brennan Center urges the D.C. Board to join 19 states this November and conduct post-election audits on the optical scan machines that read paper ballots, as an extra measure to ensure that these machines are working properly.¹⁶ This should increase voter confidence in the optical scan machines and allow the Board to improve election administration and use of these machines in the future.

If the D.C. Board does conduct a post-election audit in November, it must improve the procedures it employed when auditing the September 9 primary. The D.C. Board’s “Final Report for the Congressional and City Council Primary Post Election Audit” (the

¹⁵ Douglas W. Jones, Testing Voting Systems, <http://www.cs.uiowa.edu/~jones/voting/testing.shtml>; John Washburn, Testing Voting Machinery, <http://www.washburnresearch.org/archive/TestingGuidelines/TestingVotingMachinery.html>.

¹⁶ These states are: Alaska, Arizona, California, Colorado, Connecticut, Florida, Hawaii, Illinois, Kentucky, Minnesota, Missouri, Nevada, New Mexico, North Carolina, Ohio, Oregon, Pennsylvania, West Virginia, and Wisconsin.

“Audit Report”) raises a number of concerns about the way that audit was conducted.¹⁷ Below are some problems we see with the Audit Report.

a. The Audit Report cannot be reconciled with the official election result;. All Paper Ballots Should Be Included in the Audit

The total votes listed in the Audit Report by candidate and precinct is frequently less than the total votes listed in the official results. For instance, in precinct 21, in the contest for the Democratic candidate for the United States House of Representatives, the final election result shows Eleanor Holmes Norton received 183 regular votes, plus 6 write-ins, for a total of 189 votes. The Audit Report shows Congresswoman Norton receiving 76 votes on the “Edge” touchscreen machine, 101 votes on the optical scan machine, plus 6 write-in votes, for a total of 182 votes. It is likely that this 7 vote discrepancy can be attributed to unaudited provisional or absentee ballots, but that is not clear from reviewing the Audit Report. In any case, provisional and absentee ballots should be included in any audit.

b. Potential Systemic Problems Identified in the Audit Should Be Investigated

The Audit Report notes that in one of the audited precincts “the Statehood Green ballots could not be read by the machine because of the ballot header,” with no further explanation.¹⁸ We are very concerned that there does not appear to have been a more widespread investigation of this problem. All we know from the Audit Report is that in 25% of the precincts audited, no votes were recorded in the Statehood Green primaries. When an audit shows that a large percentage of votes may have been miscounted as a result of a systemic error, it is imperative that the problem be thoroughly investigated and all votes accounted for.

It is important that the public is provided with the full results of such investigation and notified of steps that have been put in place to ensure that it does not happen again. The State Green primary was not highly contested and received little public scrutiny. But a failure to investigate and fully address the problem could mean a much bigger problem in a future election. It is not difficult to imagine how much more problematic this situation might have been if it involved Democratic party primary ballots. Why was this problem not discovered in pre-election testing? If the ballots were not counted at all, why were they not rejected by the scanners as blank ballots?

As noted in “Principles and Best Practices for Post-Election Audits,”¹⁹ a set of best practices for post-election audits endorsed by a number of voting integrity groups, including the Brennan Center, “audit protocols must clearly state” ahead of time under

¹⁷ D.C. Board of Elections & Ethics, Final Report for the Congressional and Council Primary Post Election Audit 1 (Sept. 24, 2008), *available at* http://www.dcboee.org/pdf_files/nr_169.pdf [hereinafter “Audit Report”]

¹⁸ *Id.* at 1.

¹⁹ ElectionAudits.org, Principles and Best Practices for Post-Election Audits (Sept. 2008), *available at* http://electionaudits.org/files/best%20practices%20final_0.pdf.

what circumstances officials must “audit additional machines.” “Such factors might include the number of discrepancies and their distribution across the sample.” For instance, in Minnesota, if a discrepancy greater than 1/2 of 1% is identified in the audit of any particular contest, three more precincts in that jurisdiction and county must be audited within 2 days. If the expanded audit reveals a discrepancy greater than 1/2 of 1%, the review must expand to include the entire County. If the County-wide review reveals a discrepancy, and the number of voters in that county comprise at least 10% of voters for the affected race, a race-wide hand count must take place.²⁰

c. Update Official Totals When Audit Shows Machine Count Was Incorrect

There were a number of instances where the audit showed that the machine totals were incorrect. It is unclear from the Audit Report why this happened, although there is a note on the first page that in precincts 21 and 22, some voters had used pencils with erasers. The implication is that eraser marks caused overvotes.²¹

Not all discrepancies found in post-election audits should lead to further investigation. As already stated, the circumstances under which further investigation is mandated should be spelled out clearly, before the election. Nevertheless, whenever discrepancies are found, official vote totals should be updated.

d. Always Audit Precincts that Appear to Produce Anomalous Results

We are troubled by reports that the D.C. Board did not originally audit Precinct 141; this is the precinct that both Sequoia and the Board concluded contained the cartridge that caused the miscount. In addition to selecting some number of precincts randomly, Boards of Election should always audit precincts that they conclude appear to have produced anomalous results.

RECOMMENDATIONS FOR POST-ELECTION AUDITS IN NOVEMBER

In *Post-Election Audits: Restoring Trust in Elections*, the Brennan Center teamed with the Samuelson Law, Technology & Public Policy Clinic at Boalt Hall School of Law (UC Berkeley), as well as several election officials and leading academics (collectively, the “Audit Group”) to make several recommendations for conducting post-election audits. Many of these recommendations were echoed in “Principles and Best Practices for Post-Election Audits,” which is annexed to this testimony as Appendix B.

We urge the D.C. Board to review both documents in establishing a post-election audit protocol for November. In particular, we recommend that the D.C. Board adopt the following steps:

- **Use Transparent and Random Selection Processes for All Auditing Procedures.** Audits are much more likely to prevent fraud, and produce greater

²⁰ MINN. STAT. § 206.89 (2007).

²¹ Audit Report, *supra* note 17 at 1.

voter confidence in the results, if the ballots, machines or precincts to be audited are chosen in a truly random and transparent manner.

- **Allow the Losing Candidate To Select Precinct(s) or Machine(s) To Be Audited.** In addition to conducting random audits, jurisdictions should allow a losing candidate to pick at least one precinct to be audited. This would serve two purposes: first, it would give greater assurance to the losing “side” that the losing candidate actually lost; second, it would make it much more likely that anomalous results suggesting a programming error or miscount were reviewed.
- **Implement Effective Procedures for Addressing Evidence of Fraud or Error.** If audits are to have a real deterrent effect and catch widespread, systemic problems, jurisdictions must adopt clear procedures for dealing with audit discrepancies when they are found. Detection of fraud will not prevent attacks from succeeding without an appropriate response. Such procedures should also ensure that outcome-changing errors are not ignored.
- **Encourage Rigorous Chain of Custody Practices.** Audits of voter-verified paper records will serve to deter attacks and identify problems only if states have implemented solid chain of custody and physical security practices that will allow them to make an accurate comparison of paper and electronic records.
- **Record and Publicly Release Numbers of Spoiled Ballots, Cancellations, Over-votes and Under-votes.** Audits that record the number of over-votes, under-votes, blank votes and spoiled ballots (including in the case of DREs, cancellations) could be extremely helpful in uncovering software attacks and software bugs and point to problems in ballot design and instructions.
- **Audit Entire System, Not Just the Machines.** History has shown that incorrect vote totals often result from mistakes when machine totals are aggregated at the tally server. Accordingly, good audit protocols will mandate that the entire system — from early and absentee ballots, to provisional ballots, to aggregation at the tally server — be audited for accuracy.

CONCLUSION

Occasional mistakes and anomalies in some elections are unavoidable. When these problems occur, the best course is to conduct a careful, public and independent investigation, and to adopt new protocols to ensure that bigger failures do not occur in the future. The steps we have recommended in this testimony — an independent investigation of the problems on September 9, 2008, a review of the District’s pre-election testing and post-election canvass, and the institution of clear policies for post-election audits — should go a long way toward both improving elections in the District and restoring public confidence in the system.

Appendix A

Ballot Accounting Checklist

These recommendations represent a minimum of what elections officials should do to account for all ballots and votes cast on Election Day. Election officials should establish similar procedures for early and absentee ballots.

At the polling place:

Account for all ballots, votes, and voters

Before the polls open:

- Count and record the total number and type (*e.g.*, regular, emergency, provisional) of blank ballots received by the polling place. If multiple styles of ballots are used, each style should be accounted for separately.
- Print a “zero tape” from each machine that shows that all counters are zeroed.
- Check all ballot boxes, including those for optical scanners, to make sure they are empty.

After the polls close:

- Count and record the total number of votes cast as shown on the summary tapes printed from voting machines at the close of polls, and retain these ballots and summary tapes (*e.g.*, voter-verified paper records, vote total tapes, and optical scan ballots).
- If using optical scanners, check auxiliary bins to make sure they contain no voted ballots.
- Count and record the total number of provisional ballots cast.
- Count and record the total number of spoiled ballots.
- Count and record the total number of unused ballots. If multiple styles of ballots are used, each style should be accounted for separately.
- If using touchscreens, count and record the total number of emergency paper ballots issued.
- If applicable, count and record the total number of hand-delivered absentee ballots.
- Count and record the total number of voters who signed in at the polling place. Account for voters who voted provisionally separately from voters who voted on a standard ballot.

- If possible, count and record the number of voters who signed in but left the polling place without voting.
- Post copies of paper records of vote totals logged on each machine at the polling place. If possible, include numbers of abstentions and overvotes in each race.

Reconcile vote and ballot totals and address discrepancies

- Compare the total number of votes cast to the total number of voters who signed in. Explain and address any discrepancies.
- For both regular and emergency paper ballots, compare the number of voted, spoiled, and unused paper ballots with the number of ballots sent to the polling place. Explain and address any discrepancies.
- Compare digital vote tallies from voting machines to vote total tapes. Notify county and state officials of any discrepancies. If using optical scanners, flag ballots that should be re-counted on the central tabulator.
- If your precinct has an “accumulator” that totals memory cards for each machine, compare the total tapes from each machine to the total tapes from this accumulator.
- Seal, sign, and return packages of used and unused ballots.
- Deliver official, sealed information packets containing all audit information (poll books, paper trails, paper ballots, vote total tapes, provisional ballots, emergency paper ballots, unused ballots, and memory cards) to the central count location.

At the county level:

Reconcile redundancies

- Review status reports from the electronic tally server to ensure that all memory cards have been read.
- Compare electronic tally server totals to vote total tapes generated from each voting machine.
- Account for additional ballots that may not be included in vote total tapes, such as provisional ballots, emergency paper ballots, absentee/mail-in ballots, or early voting ballots.
- Reconcile the total number of voters who signed in with the total number of votes recorded in the county.
- Re-check reconciliations performed at the polling places and investigate/resolve any discrepancies.

Make all results public

- Publish results of ballot, machine total, and memory card reconciliations.

Appendix B



Principles and Best Practices for Post-Election Audits

ElectionAudits.org
September 2008

Endorsed by the following organizations: Brennan Center for Justice, Citizens for Election Integrity Minnesota, Coloradoans for Voting Integrity, Common Cause, CTVotersCount.org, Florida Voters Coalition, Iowans for Voting Integrity, Michigan Election Reform Alliance, Verified Voting, Citizens for Election Integrity Massachusetts.

Statistical portions, principles 5-7 and their best practices, endorsed by the American Statistical Association.

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These principles were written to guide the design of high-quality post-election audits. They were developed by an ad hoc group comprising many stakeholders, including election officials, public advocates, computer scientists, statisticians, political scientists and legislators.

* affiliations for identification purposes only

Principles and Best Practices for Post-Election Audits



Why Audit Election Results:

No voting system is perfect. Nearly all US elections today are counted using electronic voting systems. Such voting systems have produced result-changing errors through problems with hardware, software, and procedures.^[1] Errors can also occur in hand counting of ballots or in the compiling of results. Even serious error can go undetected if results are not audited effectively.

[1] For example, in Pottawattamie County, Iowa, in the June 2006 primary election for County Recorder, the original optical scan count showed challenger Oscar Duran defeating the incumbent, John Sciortino. A hand count showed that Sciortino actually had won handily; the scanners had been misprogrammed. In Napa County, California, after the March 2004 primary, the 1% manual tally discovered that the optical scanners had been miscalibrated and were failing to detect the dye-based ink commonly used in gel pens. The ensuing recount recovered almost 6700 votes (but no outcomes changed).

Well-designed and properly performed post-election audits can significantly mitigate the threat of error, and should be considered integral to any vote counting system. A post-election audit in this document refers to hand-counting votes on paper records and comparing those counts to the corresponding vote counts originally reported, as a check on the accuracy of election results, and resolving discrepancies using accurate hand counts of the paper records as the benchmark. Such audits are arguably the most economical component of a quality voting system, adding a very small cost^[2] for a large set of benefits.

The benefits of such audits include:

- Revealing when recounts are necessary to verify election outcomes
- Finding error whether accidental or intentional
- Deterring fraud
- Providing for continuous improvement in the conduct of elections
- Promoting public confidence in elections

[2] For instance, in Minnesota after the 2006 general election, the cost of the wages for election judges (pollworkers) to count votes has been estimated at \$24,500 to \$27,000 statewide - 9 to 10 cents per hand-counted vote, and about 1.2 cents per voter in the election (<http://www.ceimn.org/files/CEIMNAuditReport2006.pdf>). While audit costs will vary depending on the scope of the audits and other considerations, they can be expected to be a small fraction of election administration costs.



Post-election audits differ from recounts. Post-election audits routinely check voting system performance in contests,^[3] regardless of how close margins of victory appear to be. Recounts repeat ballot counting in special circumstances, such as when preliminary results show a close margin of victory. Post-election audits that detect errors can lead to a full recount. When an audited contest is also recounted, duplicate work can be avoided (see Best Practices 9a).

Voting systems should have reliable audit records. Best effort audits should be performed even if the technology does not support optimal audits, or even if the laws do not permit optimal remedies.^[4]

No single model for post-election audits is best for all states. Election traditions, laws, administrative structure and voting systems vary widely. Nonetheless, there are guiding principles that apply across all states. As states develop their own audit models, the public should have the opportunity to help shape those regulations.

[3] We will use “contest” to refer to any ballot item (such as an election to public office or a ballot initiative) - not to a challenge to the results, as in some states.

[4] The proposal of best practices for auditing a given system does not imply an endorsement of the system.

Principles:

- 1. TRANSPARENCY:** Elections belong to the public. The public must be allowed to observe, verify, and point out procedural problems in all phases of the audit without interfering with the process.
- 2. INDEPENDENCE:** The authority and regulation of post-election audits should be independent of officials who conduct the elections. The actual work of post-election audits may be best performed by the officials who conduct the elections.
- 3. PAPER RECORDS:** Ideally, post-election audits use hand-to-eye counts of voter-marked, voter-verified paper ballots. Where such paper ballots are not available, other forms of voter-verifiable paper records should be used.
- 4. CHAIN OF CUSTODY & BALLOT ACCOUNTING:** Robust ballot accounting and secure chain of custody of election materials and equipment are prerequisites for effective post-election audits.
- 5. RISK-LIMITING AUDITS:** Post-election audits reduce the risk of confirming an incorrect outcome. Audits designed explicitly to limit such risk (risk-limiting audits) have advantages over fixed-percentage or tiered audits, which often count fewer or more ballots than necessary to confirm the outcome.
- 6. ADDRESSING DISCREPANCIES and CONTINUING THE AUDIT:** When discrepancies are found, additional counting and/or other investigation may be necessary to determine the election outcome or to find the cause of the discrepancies.
- 7. COMPREHENSIVE:** All jurisdictions and all ballot types, including absentee, mail-in and accepted provisional ballots, should be subject to the selection process.
- 8. ADDITIONAL TARGETED SAMPLES:** Including a limited number of additional targeted samples of ballots can increase audit effectiveness and public confidence. Such samples may be selected by candidates, issue committees, parties, election administrators, or others as provided by regulation.
- 9. BINDING ON OFFICIAL RESULTS:** Post-election audits must be completed prior to finalizing official election results and must either verify the outcome or, through a 100% recount, correct the outcome.

Best Practices:



1. TRANSPARENCY:

Elections belong to the public. The public must be allowed to observe, verify, and point out procedural mistakes in all phases of the audit without interfering with the process. The following conditions must be met:

- a. Detailed auditing procedures are developed well in advance of elections, with reasonable opportunities for public comment. These include procedures for selecting audit units,^[5] sorting the paper records and counting the votes, and determining when more units need to be audited and when the audit can end. There is adequate notice to allow the public to witness and verify each phase of the audit.
- b. The public is given sufficient access to witness and verify the random selection of the audit as well as the manual count with reasonable opportunities for public comment. Election officials have the authority to prevent the public from hampering the proceedings.
- c. Final results are reported to the public immediately and posted on the Web. The results include an analysis of all discrepancies as well as recommendations for improvement. The data on the frequency and source of discrepancies can provide jurisdictions with benchmarks for improvement in future elections.^[6]
- d. Ideally, a public archive of the audit documents, reports and results is maintained indefinitely in the case of electronic records and for at least two years in the case of paper records.

[5] In post-election audits, each ballot (or paper record) is assigned to an audit unit - a group of paper records from a precinct, counting machine, or batch of ballots. On batches, see the discussion in Best Practice 5e.

[6] In addition to the number of miscounts per machine and the analysis of the source of these discrepancies, it is important to collect and report the number of spoiled ballots, canceled VVPATs, unreadable VVPATs, overvotes, undervotes and voter-mismarked paper ballots (for instance, if the candidate's name is circled but the oval is left blank).

2. INDEPENDENCE:

The authority and regulation of post-election audits should be independent of officials who conduct the elections. The actual work of post-election audits may be best performed by the officials who conduct the elections and their designees.

- a. The independence of authority and regulation may be satisfied from resources inside or outside state government.
- b. The actual work of post-election audits—i.e. the handling and counting of ballots and reporting the results—may be best performed by the officials who conduct the elections.

3. PAPER RECORDS:

Ideally, post-election audits use hand-to-eye counts of voter-marked, voter-verified paper ballots. Where such paper ballots are not available, other forms of voter-verifiable paper records should be used.

- a. The paper records must be easy to read and handle.
- b. The paper records must reliably reflect the intent of the voters. Care must be taken to urge voters to confirm the record of their votes.

4. CHAIN OF CUSTODY & BALLOT ACCOUNTING:

Robust ballot accounting and secure chain of custody of election materials and equipment are prerequisites for good post-election audits. The following conditions must be met:

- a. There are strict written accounting procedures for paper records to prevent the addition, subtraction, substitution, or alteration of paper records.
- b. To safeguard the ballots and audit records from loss and tampering, paper records and electronic equipment are fully secured^[7] at all times when a breach could adversely affect the integrity of the records including from the time the votes are cast until all audit or recount activity is completed and election results are finalized.^[8]
- c. The audit begins as soon as possible after the random selection of audit units, which commences as soon as possible after the initial tallies recorded by the voting system are reported. (In some circumstances the audit may be conducted in phases as discussed in Best Practice 5e.)
- d. The secrecy of the ballot is preserved; the order of the votes cast is never compared to the order in which the voters signed in.
- e. There is a reconciliation to ensure that all votes from all audit units are correctly tabulated in the election totals.

[7] Procedures regulating access to ballots and equipment could include requiring signatures for access and documenting the reason for it, preventing access by a single person, requiring that access be observed by members of opposing parties, or the use of surveillance cameras to guard storage areas.

[8] This includes the expiration of all legal recourse to challenge or correct the election.

5. RISK-LIMITING AUDITS:

Post-election audits reduce the risk of confirming an incorrect outcome. Audits designed explicitly to limit such risk (risk-limiting audits) have advantages over fixed-percentage or tiered audits, which often count fewer or more ballots than necessary to confirm the outcome.

- a. Risk-limiting audits have a large, pre-determined minimum chance of leading to a full recount whenever a full recount would show a different outcome.^{[9][10]} (Correct preliminary outcomes are never overturned.^[11]) After any audit, this chance should be calculated and published as part of the audit results to promote continuous improvement.

margin of victory and other factors; these other factors may include the number of ballots in each precinct and the overall number of ballots in the contests.^[13] In general, smaller margins of victory and smaller contest require auditing a larger percentage of the audit units.

- b. Audit units (precincts, machines, batches of paper records) should be selected using appropriate random sampling methods.^[12] In a risk-limiting audit, the sample size will depend on the

continued on following page

[9] “Outcome” refers to which candidates or ballot propositions won or lost, not necessarily a specific vote tally. Here we refer to the outcome as “correct” or “incorrect” depending on whether it corresponds with what would be the outcome from a complete manual recount. Note that the outcome from a complete manual recount may not always match the will of the voters. To ensure that outcomes reflect the will of the voters, additional conditions must be met including rigorous ballot accounting, accurate registration data, elimination of unreasonable delays at the polls, good ballot design, and controls on chain of custody for all election equipment and materials.

[10] Fixed-percentage samples are inadequate for risk-limiting audits, because the audit size needed to verify an election outcome depends on the apparent margin of victory, as well as the number of audit units and the amount of error each audit unit can harbor. However, auditing some minimum percentage of votes or audit units regardless of jurisdictional size or election margin may be useful to monitor election accuracy. Generally, requiring a smaller chance of error (e.g. 1% versus 5%) will entail auditing more ballots.

[11] If audit results indicate that the initial outcome is incorrect, ultimately a full recount would be required to determine the final outcome. Preliminary outcomes cannot be overturned based on audit samples alone.

[12] In the selection, some units may be weighted more than others based on their size and the amount of error they could harbor. Random sampling is unnecessary if all audit units will be manually counted, or if so many audit units are counted that the remaining units cannot change the outcome.

[13] Discrepancies found during the audit can also affect the sample size, as discussed in 6a.

5. RISK-LIMITING AUDITS: *continued*

- c. To reduce the burden of counting ballots while still auditing a variety of contests, it may be appropriate to use different rules for auditing some contests than others. For example, it may be appropriate to allow more risk for non-statewide contests.^[14] Jurisdictions may require audits in some contests and randomly select others to be audited, so that every contest has some possibility of being audited. For smaller contests, it may also be appropriate to use alternative audit methods such as targeted sampling (see Best Practice 8) or random sampling based on a fixed number or percentage of audit units.
- d. The selected audit units must be fully and manually counted.^[15] For each selected audit unit, the audit must compare vote count subtotals from the preliminary reported election results with hand-to-eye counts of the corresponding paper records.
- e. For efficiency, large groups of ballots can be divided into batches, each comprising an audit unit. In this case, the subtotals for each batch must be reported prior to the audit as part of the election results. For instance, absentee ballots (if not sorted and counted by precinct) can be divided into batches.

[14] All else being equal, contests spanning fewer audit units - for instance, local contests as opposed to statewide contests - require proportionally larger audits to ensure that the chance of confirming an outcome that is incorrect is low.

[15] “Manual counting” or “hand counting” refers to human visual inspection of paper records to interpret voter intent, followed by a tabulation of the individual vote interpretations. Only the tabulation portion is sometimes assisted by independent and well-trusted equipment such as calculators and spreadsheets. All hand counts should be done blind to the expected result.

6. ADDRESSING DISCREPANCIES and CONTINUING THE AUDIT:

When discrepancies are found, additional counting and/or other investigation may be necessary to determine the election outcome or to find the cause of the discrepancies.

- a. Audit protocols must clearly state what will result in counting more audit units. Such factors might include the number of discrepancies and their distribution across the sample. Protocols must also specify the method to determine how many additional audit units will be selected and under what circumstances a full recount will be conducted. For a risk-limiting audit, the decision of whether to count more audit units is based on a calculation of the risk; the number of additionally selected audit units depends crucially on the discrepancies that have been uncovered.
- b. The plan for continuing the audit must ensure that all stages in counting take place before reporting final results. Moreover, the plan should aim to control the cost of post-election audits while achieving any specified risk limit.

7. COMPREHENSIVE:

All jurisdictions and all ballot types, including absentee, mail-in and accepted provisional ballots, should be subject to the selection process.

- a. Ballots from different jurisdictions and ballot types can be divided into distinct groups that are audited in separate phases. In each phase, the random selection of units to audit must not commence until preliminary results for each audit unit in that group have been reported to the public.
- b. All types of ballots, even those used by few voters, should be subject to the selection process.^[16] These might include overseas or military ballots, faxed ballots, telephone ballots, ballots transmitted over the Internet, ballots cast through accessible interfaces “voter-verified paper audit trail” ballot images, and ballots cast using any other future technology.^[17]

[16] When auditing less common ballot types or very small precincts, care must be taken to preserve voter anonymity and the secrecy of the individual voter’s ballot. Also, it may be possible to confirm the election outcome without sampling some types of ballots, if these types do not contain enough ballots to alter the outcome (see footnote 12). However, for fairness and to provide valuable information about the quality of the election process, all ballot types should be routinely audited.

[17] In all cases, voter-verified paper ballots or records must be available for the audit. Auditability – the ability to conduct reliable and efficient audits – should be a crucial criterion when selecting voting technologies.

8. ADDITIONAL TARGETED SAMPLES:

Including a limited number of additional targeted samples of ballots can increase audit effectiveness and public confidence. Such samples may be selected by candidates, issue committees, parties, election administrators, or others as provided by regulation.

- a. This type of sample can be used either in conjunction with a random audit, or by itself for a contest not required by regulation to be audited using a random method.^[18]
- b. Targeted audit units might be chosen based on such factors as major election day problems or preliminary results that deviate significantly from historical voting patterns.

9. BINDING ON OFFICIAL RESULTS:

Post-election audits must be completed prior to finalizing official election results and must either verify the outcome or, through a 100% recount, correct the outcome.

- a. The audit procedures and timing must be integrated with recount law. For each contest, an audit unit normally should be counted only once, even if it is included in both an audit and a recount. If there are unexplained discrepancies in the vote count, a manual count may need to be repeated to reduce the likelihood of a counting error.

[18] One way to contain the cost of targeted samples is to require that the requesting candidate or group pay for the additional ballots to be audited. Such a law was passed in Minnesota in the 2008 legislative session; under this law, the requesting candidate would be refunded by the jurisdiction conducting the recount if the recount leads to the initial result being overturned.



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