



Report on Election Auditing
by the
Election Audits Task Force
of the
League of Women Voters of the United States
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Report on Election Auditing

Introduction

A fair and accurate election process is essential to any democracy. After the 2000 election, in which voters experienced significant problems, many people came to doubt that the process was either fair or accurate. Consequently, significant changes in voting technology and in election laws and procedures were introduced. The results have been mixed. For example, numerous reputable reports have documented security, reliability and verifiability issues with electronic voting machines. Voters and advocates have questioned both the validity of specific election results and the integrity of the entire election process. Strengthening requirements for reviews of election procedures, testing voting equipment and auditing vote results can go a long way to restoring confidence in the fairness of the voting process and accuracy of election results.

The field of election auditing is fairly new and evolving. About half of all states have laws or regulations and procedures relating to recounts of contested elections, and about one third of the states currently require election audits. Post-election audits differ from recounts. Post-election audits routinely check voting system performance in contests, 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. Anyone designing an audit system should be fully cognizant of the relationship between audit and recount procedures. It is important that recount procedures and audit procedures complement each other, rather than duplicate or contradict each other. However, to distinguish these two important procedures in this document, we will strictly separate the use of the terms “audit,” “auditing,” “audit count” or “audit counting,” and “recount” or “recounting.”

In 2006, delegates to the 2006 LWVUS Convention clarified their “Citizens’ Right to Vote” position with a resolution that affirmed that the LWVUS only supports voting systems that are designed so that:

- They employ a voter-verifiable paper ballot or other paper record, said paper being the official record of the voter’s intent; and
- The voter can verify, either by eye or with the aid of suitable devices for those who have impaired vision, that the paper ballot/record accurately reflects his or her intent; and
- Such verification takes place while the voter is still in the process of voting; and
- The vote totals can be verified by an independent hand count of the paper ballot/record; and
- Routine audits of the paper ballot/record in randomly selected audit units can be conducted in every election, and the results published by the jurisdiction.

As League members across the country researched potential local implementation of the League’s position, it became clear that requirements for election audits vary greatly among the states. Indeed, many states have no requirement for post-election review of

election results. In early 2008, League President Mary Wilson appointed an LWVUS Election Audits Task Force to provide guidance to League leaders and members about appropriate requirements for election audits. The work of the Task Force resulted in the preparation of Recommended Guidelines for Election Audits and Criteria for an Election Auditing Law. The Task Force members recognize that recounting votes may not identify problems that could affect the outcome of an election, so these Recommended Guidelines include guidelines for auditing election procedures and processes, as well as for auditing election results.

The documents produced by the Task Force represent high standards. Although fully implementing the recommendations of the Task Force should be the goal, resource limitations may necessitate prioritizing the recommended guidelines. In that case, informed judgments about the degree of risk entailed by failing to follow one or more of the recommendations will need to be made. Priorities should be set after assessing the importance of each guideline in terms of the potential risk of not performing the recommended review of procedures or verification of vote results.

This report consists of four key parts: Recommended Guidelines for Election Audits, Criteria for an Election Auditing Law, Glossary of Election Audits Terminology, and Election Audits Resources. These sections are intended to be used together in their entirety.

Recommended Guidelines for Election Audits

An election audit is a set of procedures designed to investigate whether an election was conducted properly, the voting equipment counted votes accurately, only qualified voters cast ballots in the election, and the rights of eligible citizens to vote and to experience an efficient and fair voting process were respected.

Defined in this way, the full audit process includes:

- (1) Activities typically undertaken before or between elections, such as evaluation of the following: the voter registration process, the voting machines to be used, the electronic poll books, and all procedures for running the election;
- (2) Evaluation of procedural aspects of the election, such as wait times, polling place worker performance and whether there were appropriate controls on the chain of custody for all election equipment, materials, and ballots; and
- (3) Procedures to determine the accuracy of the reported election results themselves. Properly performed audits will guard against both deliberate manipulation of the election and software, hardware or programming problems, since any of these factors could alter the election outcome.

Generally, audits can be divided into two categories: (1) reviews of processes and procedures that contribute to an orderly and fair election and (2) verification of the vote counts. The former can be conducted periodically with follow up examinations implemented to assure that flaws in the process have been corrected, or when there are significant changes in personnel, equipment or election law. Verification of vote counts should occur after every election.

This document is written from the perspective of someone reviewing the existing electoral system, such as a League member or other auditor, not from the perspective of an elections official per se. Thus, many of the procedures described below (such as appropriate monitoring of sensitive election procedures or appropriate training for poll workers) should be done in all elections and races. But auditing of these procedures can be conducted periodically with follow up examinations as needed, rather than for every election and race. The goal of the procedural part of the audit is to ensure that the election is being conducted and verified appropriately.

Many of the procedural and process guidelines have been taken from “Safeguarding the Vote” published by the League of Women Voters of the United States Education Fund in July 2004, <http://www.lwv.org/AM/Template.cfm?Section=VoterInformation2&TEMPLATE=/CM/ContentDisplay.cfm&CONTENTID=10509>.

Many of the guidelines for post-election audits to check the accuracy of reported election results were developed by an ad hoc group comprising many stakeholders including elections officials, public advocates, computer scientists, statisticians and political scientists. The document developed by this ad hoc group can be found here: <http://www.electionaudits.org/principles>.

Guidelines for Auditing of Election Procedures and Processes

A. Transparency

1. Verify that public, bipartisan or third-party monitoring of sensitive election procedures has occurred. Examples of such procedures would be loading software, conducting logic and accuracy tests, preparing machines for delivery to polling places, and mailing and receiving absentee ballots. Determine which procedures are to be monitored. Attend some of the sessions to assure that they are open or examine sign-in sheets for sessions. Review documentation of the procedures to determine if all were open.

Goals: All sensitive procedures should be open to monitoring as described.

Performance measure: Percentage of sensitive election procedures open to public, bipartisan and third party monitoring.

2. Verify tracking and documentation of all procedures, from the testing of machines to the handling of ballots, by reviewing tracking and documentation reports. Such tracking is essential to proper election monitoring.

Performance measure: Percentage of process documentation that is available to the public and easily accessible.

3. Verify that there is transparency in the operation and management of voting systems from the highest levels of government down to the polling place. Elections officials should take steps to assure voters that not just the voting systems, but also the procedures leading up to Election Day, are fully open and accountable. This would at least involve public testing of voting and tabulating systems, the use of open bidding for procurement, and a clear chain of custody for all ballots through the completion of the election and audit. Review tracking and documentation reports for openness of operation and management of voting systems. Examine chain of custody for all ballots. All contracts and agreements between state or locality and voting system vendors should be open to the public and easily accessible. The public should be informed of initial costs for machines and other voting related materials, maintenance costs, warranties and vendor liability.

Goals: All elections should be conducted in a way that is open and transparent. Chain of custody procedures should be clearly documented and demonstrably followed. Any questionable outcomes, such as evidence of missing ballots, should be investigated immediately. Elections officials and vendors should be held accountable for serious election-related problems.

Performance measures: Percentage of processes open to the public. Percentage of processes documented. Percentage of ballots accounted for.

B. Testing

1. Verify that there is uniform, public testing of all elements of the voting systems by observing the testing process and by examining testing records for completeness of the testing procedures. Every voting machine and poll book should be tested. The tests should include logic and accuracy testing for electronic poll books and electronic and optical scan voting systems, testing to ensure that the proper ballot has been printed or correctly loaded into the system, and verification that the ballot definition file is correct. Verify that a sufficient number of paper and optical scan ballots have been correctly distributed to polling places. Review records of paper ballot distribution to polling places.

Performance measures: Percentage of voting machine tests for logic and accuracy and for mechanical and technical problems performed in public. Verification that every observed voting system problem has been dealt with, either by fixing the problem prior to any voting or by replacing the failed component with one that has passed all of the logic and accuracy tests. Verify that appropriate tests were applied. (For a description of appropriate tests, see the resource list). Verify that all polling places have received a sufficient number of correct paper ballots.

2. Verify that the electronic and optical scan machines (hardware and software) used are the same as the systems that were certified by observing the verification process or by examining documentation for the verification process. This can be done using a

digital signature, or other specific technical methods such as "cryptographic hash," or complete binary images. The details are beyond the scope of this report.

Goal: Only machines that have been demonstrated to contain certified software should be used in any election.

Performance measure: Percentage of machines validation-tested before and after the election.

3. Verify that all voting systems, including machines and electronic poll books, have been tested for usability by average voters, voters with disabilities and poll workers. Some tests, especially those of electronic poll books, should be conducted under Election Day type conditions to check for system overload.

Goals: The design of all voting systems, electronic poll book systems and general ballot layouts should be usability tested far ahead of any use in an election. All systems should be easily usable by all poll workers and voters, including voters with disabilities. There should be no confusion about how to set up or vote on the machines. The ballots should be easily understandable. If average voters require a long time to vote, either because of the system or the ballot, then elections officials should compensate by providing back-up paper ballots.

C. Physical Protection of Voting Systems

1. Determine that there is restricted physical access to all components of voting systems prior to, during and after the election. "Components of voting systems" include ballots, optical scanners, voting machines, electronic poll books, and precinct registers or physically vulnerable records. Review and observe controls over physical access to voting system components, including the manner in which voting systems and ballots are secured when they are stored prior to the election, manner in which they are secured during delivery to the poll worker's home or the polling place, and manner in which they are secured at the polling place prior to and during the election. All physical components should be inventoried and accounted for. Access to voting systems and poll books should be restricted prior to the election. Audit trails should be maintained that record who has had access to ballots and election related systems, as well as why that access was required. Machines and ballots that are delivered to a poll worker's home or to a polling place prior to an election or that are used for early voting should be securely stored when they are not being used. Access throughout the entire process – including storage, delivery to the poll worker's home or the polling place, storage at those locations, early voting and Election Day voting – should be carefully documented.

Goal: 100 percent compliance with all stated requirements above: Anything less than 100 percent of components restricted, documented and accounted for creates the risk of interference or fraud.

Performance measures: Percentage of voting system components with restricted physical access. Percentage of physical components inventoried and accounted for. Percentage of machines and/or ballots delivered in advance that are securely stored and accounted for.

2. Verify that voting systems are maintained and operated in isolation from networks and the Internet by reviewing system components to assure that they are isolated from networks and the Internet. Electronic poll books may be an exception to this rule.

Goal: There should be no wireless component in any voting system, so that Internet access is not a possibility. Testing agencies should examine the physical components of the voting systems to determine that Internet access is impossible.

Performance measure: Percentage of voting system components that is isolated from networks and the Internet.

D. Education and Training

1. Verify that there is an adequate program to educate voters on the use of all voting equipment both in advance of the election and in the polling place on Election Day, by reviewing documentation of educational activities prior to Election Day and availability of assistance on Election Day. Educational materials should be tested using inexperienced voters. If the voters appear confused after exposure to the educational material, the material should be modified and retested until novice voters are able to understand the voting process after exposure to the educational materials.

Performance measures: Number of educational sessions, news articles and other educational activities prior to Election Day. Percentage of polling places with voter assistance available. Number and percentage of tested voters able to vote correctly after the final training session.

2. Verify that adequate training has been provided for all Election Day workers and election monitors and auditors by reviewing manuals and class outlines to assure that training is consistent with state and federal law, as well as with local procedures. Review requirements for election workers to attend training. Calculate the percentage of workers who actually received training prior to Election Day. Attend sufficient classes to determine that classes are consistent with manuals and class outlines. Evaluate quality of training. Test poll workers after training session to see how well they understood the material.

Goal: All workers, monitors and auditors should be well-trained and able to demonstrate their knowledge of the relevant aspects of the election system.

Performance measures: Percentage of Election Day workers who received training prior to Election Day. Include polling place workers (election judges), central election location workers, employed or contracted technical workers, election monitors and *auditors*. (If possible, calculate percentage for each group)

separately.) Percentage of poll workers who attain an acceptable level of understanding after training.

E. Polling Place Procedures Prior to Voting

1. Determine that there are sufficient poll workers, voting machines, poll books, privacy booths, paper ballots, provisional ballots and other supplies in each polling place, by calculating their ratios to registered voters. Determine reasons for significant deviations from the average and from state established norms. If the number of voting machines or ballots appears to be inadequate, determine that emergency backup paper ballots are available. Verify that procedures are in place to also provide emergency backup paper ballots in the event of a machine failure, long waits because of the time required to vote, or an unusually large turnout.

Goals: No polling place should run out of paper ballots, and no voter should be required to wait in line longer than a reasonable period of time to vote, say thirty minutes.

Performance measures: Ratios of poll workers, poll books, voting machines, privacy booths, paper ballots, provisional ballots and other supplies to registered voters. Percentage of precincts that reported sufficient machines or paper ballots. Length of time to check in to vote and length of time to reach voting machines - measurement could be taken at prescribed intervals or exiting voters could be asked to record times.

2. Determine that there is adequate technical support for poll workers on Election Day, as well as an adequate number of back-up machines, poll books, and emergency paper ballots in the case of machine failures or bottlenecks.
3. **Early voting** (that is, voting at a polling place on days before the actual Election Day, sometimes in special locations to facilitate voting): If a jurisdiction has early voting, it should test machines and procedures in operation before each day of early voting.

Goals: Procedures should be carefully and thoroughly checked before early voting, as they would be before Election Day itself. Any errors or problems uncovered prior to or during early voting should be documented, investigated, reported publicly and corrected.

Performance measures: Percentage of systems that functioned correctly without the need for technical assistance during early voting. Percentage of systems that were backed up overnight and the adequacy of back-up options.

F. Polling Place Procedures During Voting

1. Every polling place should maintain a log for each voting machine on which notations are made of problems reported; problems confirmed; amount of time, if any, machine is out of service; and maintenance actions taken. Election judge incident reports and reports of technicians should be examined, and corrective action taken to

prevent repeated failures. Precinct judge incident reports should be examined to determine if any precincts ran out of ballots during the day or if voters had to wait an excessively long time to vote. If either occurred, an immediate investigation should be conducted.

Performance measures: The average and longest amount of time that voters have to wait in order to vote, number of systems that required technical assistance, adequacy of backup options and speed with which information about failures is made public.

Guidelines for Conducting an Audit of Election Results

After an election has taken place, an important component of the audit is to check the election results; uncover and report discrepancies due to error, malfunction or fraud; and provide data to inform continuous process improvement. The post-election audit process should cover selected races and ballot questions in all elections - primary, general and special; federal, state, county and local.

Although the actual verification takes place after the election, major aspects of the process need to be set up in advance. Thus, there are two phases of "post-election audits," as described below:

A. In advance of the election

The entire audit process should be set up to be transparent and publicly observable with clear written procedures.

1. Selecting Audit Units

The method for randomly selecting the audit units and the assumptions behind that method should be clearly defined well in advance of each election.

Audit units may be precincts, machines or batches of votes (as in absentee ballots). Decisions about what constitutes an audit unit should be made in advance of an election.

Some considerations concerning that decision:

- The total number of audit units to sample will be similar, whether machines or precincts are used. If there is more than one machine per precinct, then the number of votes to count in an audit for equivalent precision may be considerably lower if audit units are defined as machines.
- The statistical process of deciding how many audit units to audit is simpler if the number of votes is similar between audit units. In many jurisdictions, machines may be fairly similar in vote count, but precincts may differ more widely due to varying numbers of machines per precinct.
- On the other hand, much election data is recorded and officially tallied by precinct. Keeping track of votes by machine may add a layer of complexity, and a potential for error, to the reporting process.

- Note that whichever method is chosen, all votes should be included, even if this means that some, like absentee ballots and provisional ballots, are included in separate audit units of their own.

The process of determining these methods should be public, and there should be public opportunities for comment on the methodology.

2. “Risk Limiting” Audits and Statistical Considerations

Statistical principles must play a key role in deciding how many audit units are chosen. Best practices say to use a "risk-limiting" approach in which all decisions are made in such a way as to minimize the risk of confirming an outcome that is, in fact, wrong.

Key to economical and effective auditing is a focus on statistical accuracy. Very close results (for example, within 0.5 percent) are the most easily affected by small problems or manipulation and, in some jurisdictions, will automatically trigger a complete recount. Audits should be designed and implemented so that there is great confidence that any significant error would be detected. There should be only a small, predetermined chance of confirming an incorrect outcome, typically somewhere between 1 percent and 5 percent. With all else being equal, the probability of detecting a significant error increases with the number of audit units sampled.

The number of units to audit should be a function of the margin of victory, the distribution of votes between audit units (for example whether there are large and small audit units in the same race) and the total number of audit units in the race. Fixed percentage audits include insufficient audit units for the desired accuracy in small or close races and unnecessarily many audit units for landslide or large races. (See - “Statistics Can Help Ensure Accurate Elections.” AMSTAT NEWS, Copyright 2008, American Statistical Association.

<http://www.amstat.org/publications/amsn/index.cfm?fuseaction=pres062007>).

Tiered audits, in which a specific percentage of audit units are chosen based on the margin, represent an improvement over fixed audits, but are still not efficient statistically. Note that it may be necessary to use a less than maximally efficient statistical method in order to ensure that the method used is understandable and transparent to officials and the public.

It will sometimes be necessary to perform the audit in phases, since absentee ballots and provisional ballots may not be in hand and ready to count until several days after the election. If results from later phases decrease the overall reported margin of victory, then additional audit units may need to be selected and counted to satisfy the statistical model and ensure a small enough chance of error.

Note that "outcome" refers to which candidates or ballot measures have won or lost, not necessarily a specific vote tally. By "correct," we mean that the outcome

from a complete recount would match the preliminary reported outcome for a particular contest.

3. Escalation Protocols

Escalation protocols (that is, what actions to take when discrepancies are found between an audit count and preliminary announced results) must be clearly defined in advance and developed to be consistent with the risk-limiting principle.

Some considerations:

- Since minor discrepancies are almost inevitable, deciding to escalate the audit to a higher level because of very small and explainable discrepancies (such as a mark not made properly on an Optical Scan ballot) will escalate many audits, even though the election outcome is not in doubt.
- It is possible to set criteria for how big a discrepancy should be before escalation takes place. Although this can prevent needless escalation, it adds a layer of complexity and may be difficult to explain to the public, especially if statistical criteria, rather than a simple rule, determines the decision.
- Simple rules are easy to explain and follow, but not maximally efficient. For example, one could decide to take further samples anytime a discrepancy in any audit unit would, if found in most audit units, overturn the election. A rule like this is easy to explain and follow, but is actually quite liberal: A discrepancy found in, say, one of 50 audit units is very unlikely to be found in the majority of the remaining units.
- When non-trivial discrepancies are found, should the escalation be by selecting additional samples or by recounting the entire race? If the criterion for escalation is set high enough that it would not be attained by minor errors, one might opt for a full recount when significant discrepancies (hopefully rare) are found. This is, again, a simple rule that is easy to explain and follow.
- On the other hand, there are statistical guidelines using risk-limiting principles for escalating the audit in steps that can reduce the burden of counting (while adding complexity and sampling steps).

Whatever decision is made, the protocol should specify the method to determine how many additional audit units will be selected and under what circumstances a full recount will be conducted. Follow up should be required to determine the causes of all discrepancies between audit counts and the original ballot counts. If the causes are learned, then they may also influence the decision as to how to proceed.

While difficult to define fully in advance, consideration should also be given to the kinds of discrepancies that would lead to an audit of the processes involved in the entire system. If fraud is suspected, all evidence should be referred to law enforcement.

B. After the Election

1. Basic Checks at All Polling Places

Basic checks of totals, problem ballots and provisional ballots should routinely be performed at all polling places.

Every polling place should report the machine count and check the total number of ballots cast against the number of registered voters who signed in at the polls. In addition, every polling place should report the number of spoiled ballots (or spoiled voter verifiable paper audit trails (VVPATs) in the case of electronic voting) as well as the number of provisional ballots and the number of absentee ballots that were hand delivered to the polling place. All of this information should be made publicly available on Election Night. If Voter Authority Cards are issued for each voter, these cards should be retained and counted as well. This includes comparing the total number of ballots cast with the number of voters processed on an electronic or paper poll book. Any discrepancies between the number of voters processed and the number of ballots cast should be made publicly available and investigated immediately (starting the next day).

Performance measure: The percentage of polling places in which the number of normal plus provisional ballots cast equals the number of voters.

2. Accounting for Provisional Ballots

Assure that all provisional ballots are accounted for by comparing the number of provisional ballots sent to a polling place with the number of provisional ballots voted by voters and the number of spoiled provisional ballots. The sum of the number of used, spoiled and remaining ballots should equal the total sent to the polling place. Publicly issue report of discrepancies.

Performance measure: The percentage of polling places in which the number of provisional ballots voted plus the number spoiled plus the number remaining equals the number of provisional ballots sent to the polling place.

3. Approval or Disapproval of Provisional Ballots

Assure that all provisional ballots are approved or disapproved for statutorily acceptable reasons by reviewing the report of the number of provisional ballots accepted and number of provisional ballots not accepted and reasons for non-acceptance for compliance with state and federal law after the canvass of provisional ballots has been completed.

Performance measure: The percentage of provisional ballots that were correctly approved or disapproved.

4. Accounting for Absentee Ballots

Ensure that all absentee ballots are accounted for by comparing the number of absentee ballots issued with the number of absentee ballots received and the number

of provisional ballots voted because the voter came to the polls but the official records indicated that an absentee ballot had been sent. Because absentee ballots are issued from the central election office, the comparison should take place at the central election office. State laws vary greatly on this subject, but ensure that no voter had his or her vote counted twice. If double voting is found, law enforcement may need to be brought in. The comparison may be made in batches representing precincts or election districts. Determine that a report of discrepancies has been publicly issued.

Goal: The number of absentee ballots returned should not be greater than the number sent out; all signatures should match the signatures in registration records; and all signatures that do not match are followed up. There should be no instances of double voting: any that is found should be properly investigated.

5. Starting and Completing Audits

The audit process should begin as soon as possible after the initial tallies recorded by the voting system are reported. The audit should be completed prior to declaration of the final official results, and the audit should confirm the outcome or lead to a recount that determines the outcome.

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 a recount procedure confirms the original election results, no additional audit counting is necessary. If there are unexplained discrepancies in the vote count, however, an audit count may need to be repeated to reduce the likelihood of a counting error. In other words, one cannot simply take the first audit count as being "correct." An unexplained discrepancy suggests that one of the compared counts is wrong, but does not demonstrate which one. Note that a well-conducted, transparent hand count of paper ballots almost always uncovers a few additional votes where the voter intent is clear, but the votes were not detected by a machine count. This is to be expected.

6. Using Paper Records

Audits must use voter verifiable paper audit trails (VVPATs), paper ballots that have been hand counted, and/or optical scan ballots. Even without paper records, an audit of procedures should still be conducted.

Ideally, post-election audits use hand-to-eye counts of voter-marked optical scan ballots or VVPATs, including those produced by ballot generating devices or ballot marking devices. Where such paper ballots are not available, other forms of voter-verifiable paper records should be used.

- a. The paper records should be easy to read and handle.
- b. The paper records should reliably reflect the intent of the voters. Care should be taken to urge voters to confirm the record of their votes and to make sure that the paper records are properly printed.

The count based on paper ballots/records verifiable by the voter will determine the outcome, except in special circumstances when there is persuasive evidence that the paper ballots/records were compromised. One example of compromised paper records are DRE machine VVPAT print outs that are defective, blank, torn or unreadable for some other reason. Examples of problems with paper ballots include ballots that are included in the original vote count but are destroyed after the close of the election, or ballots that are missing from election materials transported from precinct to central office and cannot be located as securely intact. In such instances, to avoid disenfranchising voters who have cast legitimate ballots, electronic ballot totals may be included in the overall vote totals, but those precincts should not be selected for audit. The decision about which person or entity has the authority to make such a determination about compromised ballots/records should be included in audit legislation or regulations.

7. Including All Ballots

Audits should incorporate totals from all jurisdictions and all ballot types including those cast at early voting sites and on Election Day at the polls, absentee, mail-in and accepted provisional ballots.

Ballots from different jurisdictions and ballot types can be grouped and audited in separate phases. But, for each group, the selection of units to count should not commence until preliminary results for all units in that group are reported to the public.

Although the randomly selected audit units are often naturally defined, like audit units for individual machines or precincts, sometimes audit units must be defined as a "batch" or group of ballots. Auditing using batches is necessary both for early voting using DREs and central counting using optical scanners. The reason to use batches for DREs is that the ballots cannot be sorted into precincts without cutting the VVPAT tapes. The reason to use batches for central count optical scanners is that, in many cases, it is impractical to sort by precinct, especially when a large portion of the vote is received by mail or through early voting.

In early voting or voting in vote centers, many precincts and different contests may be recorded on a single DRE and run together on a single VVPAT printout, with other votes in the same contests on other DREs and VVPAT rolls. The same would be true for optical scan machines used in early voting or vote centers, when the machines print vote total receipts. In these situations the ballots should not be sorted into precincts because that would require cutting the VVPAT or vote total receipt printout into unmanageable pieces. Likewise, in some jurisdictions mail-in ballots and early voting may be counted and read centrally, without being sorted by precinct.

It is critically important that each such batch correspond to a distinct reported total from the counting machines. If, for example, the DRE can report vote totals

in sets of 200 votes, and if those same 200-vote batches can be identified in the paper record and physically grouped, this would be an appropriate audit unit. Unfortunately, many voting systems currently only report tallies by precinct, making it difficult to audit by batch.

It is important to remember that only some races (usually specified in state law) will be subject to audit, so that not all votes on every ballot will be counted in an audit. For example, if the Governor's race is audited, only the ballots cast for that contest will be counted in the audit. Therefore, the multiple ballots that are configured for different races can all be counted together, since the Governor's race is on every ballot.

A significant barrier for conducting audits today is getting accurate, timely preliminary results with the necessary details for conducting an audit. Because the voting machines have no consistent, comprehensive, easy to extract data format, preliminary election results for conducting audits are typically extracted with ad-hoc software or even by hand from printouts -- a costly, time consuming process subject to error. Improved support in voting systems for reporting in standard machine-readable formats such as EML (Election Markup Language) would make auditing significantly easier and cheaper.

8. Random Selection of Audit Units

There should be a statistically based random selection of audit units (precincts, machines, batches of paper records), and the selected units should be fully counted for an audit.

The audit units should be chosen on the basis of a statistical method that considers such factors as the number of ballots in each audit unit, the number of audit units from which the sample is to be taken, and the margin of victory in the audited contest.

9. Transparency

The process of counting and comparing should be done publicly, and should begin as soon as possible after the random selection of audit units.

The time and the place of the audit counting and the random selection of units should be announced before either begins. The random selection process and the audit counting should be publicly observable.

Qualitative measures: Determine the specific process and time line used. Did the audit process get under way promptly after random selection? How was access by the public ensured? Did the public or candidate representatives actually observe? (It is not necessarily a failure of the process if the public does not choose to observe).

10. Selective Audits

In addition to the random audits described in these guidelines, selective auditing could be conducted: Candidates, parties, issue committees, election administrators or others as provided by regulation should be allowed to select a limited number of additional audit units or a limited number of total ballots to supplement the randomly chosen audit units.

Such selective auditing draws on the detailed political knowledge of candidates and others to detect discrepancies from normal voting patterns. This can increase audit effectiveness and public confidence.

- 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.
- b. Selective audit units might be chosen based on such factors as major Election Day problems or preliminary results that deviate significantly from historical voting patterns. It would especially help prevent malicious behavior that manipulates a small number of large precincts in the hope of not being caught by the random audit.

As with any vote verification audit step, there should be specific guidelines as to what will happen if a discrepancy is found. The cause of the discrepancy should be sought, and unless explained fully in a way that ensures the integrity of the rest of the votes, additional auditing of votes will generally be necessary.

Some considerations in selective auditing:

- One way to contain the cost of selective auditing is to require that the requesting candidate or group pay for the additional ballots to be audited. If discrepancies are found that lead to the initial result being overturned, then the requester would be reimbursed. Such a law was passed in Minnesota in the 2008 legislative session. This method could sometimes lead to a likely problem audit unit not being investigated because the candidate was unable to pay for an audit count and elections officials didn't choose to investigate on their own. It also sets a fairly high standard for reimbursement.
- A variant would be to reimburse the requester if a significant discrepancy (as defined in advance) was detected in any of the audit units requested. This seems fairer -- after all, identification of a significant discrepancy in a single audit unit is an important contribution, even if it does not eventually lead to the election being overturned. A third option is to allow the candidates or parties to select a small number of units to audit without charge. This option is subject to abuse, because there is no cost to candidates, but may pay off by ensuring that any discrepancies are properly investigated.
- If there is a fixed number of such discretionary audits, it is important to specify in advance who has the right to request them. You don't want to have a party leader request three, only to have the candidate complaining that the wrong ones were audited.

11. Regulation of Audits

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/is best performed by the officials who conduct the elections, with appropriate oversight.

"Authority and regulation" includes all of the decision-making and procedural components of the audit other than the mechanical processes of audit counting per se. An independent body or board should, for example, decide how many units to sample, and take charge of making the selections. In the event of any discrepancy between counts, that same board will decide how to proceed. Election officials perform only the mechanical side of the audit, under the oversight of the independent board.

The independent board should consist of professionals (auditors, statisticians, etc.) who do not have official ties to political parties or candidates. It should be responsible for establishing rules and procedures for audits.

12. Ballot Secrecy

The secrecy of the ballot must be preserved; the order of the votes cast should never be compared to the order in which the voters signed in.

13. Maintenance of Records

A public archive of the audit documents, reports and results should be maintained for at least 22 months (the current Federal requirement for retention of election records) and, in the case of electronic records, indefinitely. Consideration should be given to placing the software, all types of firmware, and ballot definition files used in each election into escrow so that they will be available for post-election audits.

C. How to Do the Audit Counting

Manual counts, properly done with carefully designed protocols and transparency, are currently the preferred and accepted procedure for election audit counts. Benefits of hand audit counts include full transparency (the public can observe the entire process) and the ability to identify voter intent on improperly marked ballots. A manual audit count can also detect programming errors or other problems such as incorrectly calibrated voting equipment or poorly printed ballots that may distort the results. Furthermore, manual audit counts, which detect a large number of ballots marked incorrectly by voters, could identify a need for better voter education on how to correctly mark a paper ballot.

An audit count that simply repeated the original counting procedure, whether electronically or by hand, would add little value to the election-validation process. There are important differences between an audit count and an original Election Day count, whatever the voting method. Certainly, a manual count of VVPATs is entirely different from the electronic tallying done by DRE machines. But even where voters create original ballots, such as optically scanned ballots, manual audit counting procedures deploy different protocols from Election Day electronic tallies. Visual

inspection of each optically scanned ballot can result in a more accurate determination of voter intent than an electronic tally. When an optical scanner is unable to interpret marks outside the valid marking area, the scanner will determine that the ballot contains an “undervote.” However, in the vast majority of cases voter intent is clear to the human eye. As a result, vote totals typically rise when there is a hand recount of an optical scan machine generated tally.

A manual audit count also satisfies the important computer science principle of “software independence,” so that as part of a risk-limiting audit, it should prevent an undetected error in the software from changing the outcome of an election.

Some researchers are exploring the possibility of using machine-assisted audits, combined with manual audit counts that check on the accuracy and reliability of the machines.¹ In theory, such audit counts would best be done with different machines and more rigorous procedures from those used for Election Day counts. The advantage of such an approach would be the ability to rapidly check a larger number of audit units than could be tested for a given amount of funding with a hand audit count. There may be times when available resources allow one of two things: (1) a small hand count, probably inadequate for the precision needed or (2) a somewhat larger, quicker count done by machine (with appropriate double checks as noted above). In such cases, it would be necessary to weigh the risk of undetected machine errors and the known problem of mismarked ballots that are likely to be missed in a machine-assisted count against the value of being able to review a larger number of ballots.

If it is contemplated that the audit process could cause a delay in the certification of election results, particularly in instances of legislatively mandated deadlines for certifying election results, states should recognize the potential conflict and adjust election calendars accordingly.

Because the cost of an adequate hand audit count is ordinarily a small part of the cost of running an election, we do not recommend any alternative method at this time.

Some very good and specific manual methods for counting ballots exist, such as having counters from different parties each count without knowing the total. If they agree with each other and the total, the result is certified. If not, they count again. Alternatively, ballots can be counted into piles, which are counted by at least two people with the results being totaled at the end. See the Resources list for some links to specific methods in current use.

¹ Machine-Assisted Election Auditing, Calandrino, Halderman, and Felten, Proc. of the 2007 USENIX/ACCURATE Electronic Voting Technology Workshop (EVT'07), August 2007.

D. Reporting Guidelines

1. Audit Report

After the audit, the probability that fraud or error of sufficient magnitude to alter the electoral outcome would have been detected in each contest should be calculated and publicized to promote continuous improvement.

2. Audit Results

All final results, along with a disclosure of all discrepancies, should be reported to the public and available indefinitely in a public archive.

Criteria for an Election Auditing Law

An election audit is a set of procedures designed to demonstrate to candidates and the public that the election was conducted accurately, that voting equipment counted votes properly, that only qualified voters cast ballots in the election, and that the right of eligible citizens to vote and to experience an efficient and fair voting process, were respected.

Defined in this way, the full audit process includes:

- (1) Activities typically undertaken before or between elections, such as evaluation of the following: the voter registration process, the voting machines to be used, the electronic poll books and all procedures for running the election;
- (2) Evaluation of procedural aspects of the election, such as wait times, polling place worker performance and whether there were appropriate controls on the chain of custody for all election equipment, materials and ballots; and
- (3) Procedures to determine the accuracy of the reported election results themselves. Properly performed audits will guard against both deliberate manipulation of the election and software or programming problems, since any of these factors could alter an outcome.

The following are criteria that can be used to analyze proposed legislation or to help in the development of new legislation. A well-formulated election auditing law will include as many as possible of these provisions. Further detail, guidelines and explanations are cross-referenced to this report's section on "Recommended Guidelines for Election Audits".

A. Process Audits

1. **There should be periodic reviews or audits of election processes and procedures.** These audits should relate to such topics as voting systems security and testing, allocation of voting machines and personnel, training of election personnel, procedures for early voting, provisional voting and absentee voting, and chain of custody for all types of ballots. Ballots should be laid out or produced in such a way that voters can easily verify them. (See page 5, section on Guidelines for Auditing of Election Procedures and Processes.)
2. All processes and procedures must be documented in order to maintain audit trails. (See page 5, section A-2.)

B. Post-Election Audits

1. **Paper ballots or voter verifiable paper audit trails (VVPATs) must be used in the audit.** These would include ballots produced by DREs, ballot marking devices, optical scanning machines and hand marking. Even without paper records, an audit of procedures should still be conducted. (See page 14, section B-6.)
2. **The post-election audit process should cover selected races and ballot measures in all elections** – primary, general and special elections; federal, state, county and

local. (See page 10, introduction to section on Guidelines for Conducting an Audit of Election Results.)

3. **Audits should be completed prior to certification of the vote counts.** The count, based on paper ballots/records that are verifiable by the voter or directly created by the voter, will determine the outcome except in special circumstances where there is persuasive evidence that the paper ballots/records were compromised. (See page 14, section B-5.)
4. **There should be an independent audit board that is appointed by state official(s) not involved in the administration or conduct of elections.** (See page 18, section B-11.) The audit board should:
 - a) Consist of professionals (auditors, statisticians, etc.) who do not have official ties to political parties or candidates;
 - b) Be responsible for establishing rules and procedures for audits;
 - c) Be responsible for general oversight of audits; and
 - d) Make decisions regarding the need for expansion of certain audits to larger samples and the need to adjust vote counts as a result of audit.The actual work of post-election audits may be best performed by the officials who conduct the elections under the supervision of the independent audit board.
5. **Audits and development of audit protocols should be open to the public at both state and local levels.** Results of audits should be announced publicly and should contain reconciliations with original tallies, over and under votes, blank ballots, spoiled ballots, etc. (See page 5, section A; page 10, section A; page 16, section B-9; and page 20, section D.)
6. **Statistical principles must play a key role in deciding how many audit units are selected for audit.** The number of units to audit should be chosen so as to ensure there is only a small predetermined chance of confirming an incorrect outcome. To accomplish this aim, it is critical that the number of units audited be tied to the closeness of the race (closer races calling for a larger number of units to be audited). Also, best practices emphasize the *number*, not the percentage, of units to be audited. There should then be a random selection of units and the selected units should be fully recounted. (See page 11, section A-2, and page 16, section B-8.)
7. **Escalation protocols (i.e., what actions to take when discrepancies are found between an audit count and the announced preliminary results) must be clearly defined in advance.** In general, these must be statistically based, and should be designed to ensure that a sufficient number of audit units are counted so as to have only a small predetermined chance that the process will confirm an incorrect outcome. In some cases this will require a complete recount of the entire race – election procedures should be clear in advance about the conditions under which this will occur. (See page 11, section A-2.)

8. **Making available a Discretionary Partial Audit (in which a losing candidate chooses a limited number of audit units to be manually audited) may increase public confidence in the election result.** Requesting candidates may be required to pay for the additional units to be audited unless the initial results are overturned. (See page 17, section B-10.)
9. **Audit procedures should cover absentee, overseas and provisional ballots as well as those cast in person.** Where early voting is allowed, special procedures should be developed for auditing ballots cast at early voting centers. (See page 15, section B-7.)
10. **Follow up should be required to determine the causes of all discrepancies between audit counts and the original ballot counts.** (See page 12, section A-3.)
11. **All voting system software, including all types of firmware, should be available for post-election audit if other causes of discrepancies have not been found.** (See page 18, section B-13.)
12. **The secrecy of the ballot must be preserved.** It should never be possible to determine the identity of the voter for any vote cast. (See page 18, section B-12.)
13. **Election records for all elections should be maintained for at least as long as required by Federal law (22 months at the present time).** (See page 18, section B-13.)

Glossary of Election Audits Terminology

Absentee ballots: Originally this term referred to ballots submitted by individuals who were unable to go to the polls on election day, due to travel, business, illness or other reasons. Today, in some jurisdictions, no reason for voting "absentee" is required, and *absentee ballots* have come to mean ballots submitted outside of the polling place, often days in advance of the *election*, without respect to whether or not the individual could have voted at the polls.

Accessibility: In the context of voting, *accessibility* is a measure of the ease of use of a *voting system* for people with disabilities.

Audit unit: In order to conduct a proper audit, votes must be recorded and organized in sets that can be sampled. In many jurisdictions, votes are recorded and organized by precinct or by individual machine. Either of these could be an "*audit unit*." In other settings, or where *absentee ballots* are involved, some method of batching votes into groups that can be handled and verified as a "unit" is required as well.

Ballot definition file: In order to interpret an *optical scan* ballot or properly categorize touches on the screen of a *direct electronic recording* device, the machine has to have a complete set of information about what every place on the ballot or screen means, and exactly how to tally it. This kind of information constitutes the *ballot definition file*. If mistakes are made in the *ballot definition files*, votes could be incorrectly attributed to the wrong candidates or *race* results.

Ballot Generating and Ballot Marking Devices: These devices generate or mark paper ballots. They differ from *voter verifiable paper audit trails* (VVPATs) in that a VVPAT is intended only as an auditable ballot or record of the vote. A VVPAT is not generally counted except as part of an audit. Note the distinction between a ballot (actually counted in the *election*) and an audit trail (available to count but not necessarily used unless selected for audit). Both *ballot generating* and *ballot marking devices* are intended to allow people with disabilities, especially voters with vision impairment or significant physical limitations, to produce paper ballots that can be counted and audited. Thus:

Ballot generating device: A *ballot generating device* allows a voter to make selections electronically and then prints a paper ballot (typically one that can be read by a scanner) that represents those selections.

Ballot marking device: A *ballot marking device* allows a voter to make selections electronically, after which a paper ballot (typically one that can be read by a scanner) that has been inserted into the machine is marked to represent those selections.

Ballot measure: A question for public vote other than for a candidate for office.

Chain of custody: The procedure by which public records, documents or other items (like vote counts or ballots) are recorded and passed along from the point of origin until final destination. There must be records and protocols for transferring these records from one official to another.

Direct recording electronic (DRE) device: A computerized voting machine that records votes in its computer's memory.

Discretionary partial audit: This refers to the option for a candidate or party (usually on the losing side) to have *audit units* of their choice counted. The idea is to take advantage of the awareness of candidates of typical voting patterns to help identify

possible problems or *audit units* with unusual voting patterns. Also called challenge audit, selective audit and free audit.

Election: As used in this context, an "*election*" refers to the entire set of *races* and *ballot measures* that are decided together during one period of voting. Thus, even if every *election* is audited, not every *race* may be included.

Election audit: The general term for all aspects of an election review, from "*process audit*" activities to check the process, to "*post-election audit*" activities to verify the actual results.

Escalation protocol: A set of guidelines for further actions to take when discrepancies are found between an audit count and preliminary announced results. These protocols should be guided by valid statistical methods, which may allow an election *outcome* to be confirmed without a full *recount*.

Executable files: The computer files that contain the computer readable program instructions, usually in a form not easily readable or modifiable by people.

Firmware: Defined in two different ways. Sometimes refers to programs embedded in read-only memory, hence not able to be modified, or otherwise requiring special procedures to modify. In elections contexts, the term has come to be used for all software run at the precinct level, as distinct from "software," which is any program run centrally. At one time the precinct level programs were read-only and unalterable, but this has changed, and the concept of *firmware* as not being subject to modification has been lost.

Fixed percentage audit: In a *fixed percentage audit*, the number of *audit units* to sample is a percentage of the total number, sometimes determined by the margin of victory. Generally this is not as effective as a statistically based *risk limiting audit*.

Metadata: Information that facilitates use or interpretation of other data. For example, in order to interpret the marks on an *optical scan* ballot or the electronic choices made on a *direct electronic recording* device, the machine needs information about where and how each *race* and candidate is coded (the *ballot definition file*). In this context, a *ballot definition file* is thus an example of *metadata* that enables interpretation and tallying of the actual physical or electronic entries by the voter.

Optical scan system: A method of voting in which the voter marks the ballot to fill in a small area or connects a broken arrow on the ballot to indicate a selection. The selections are then read optically and counted electronically by a computer-based system.

Central-count: Some optically scanned ballots are delivered to a central location and read there. Precinct information may not be retained. Typically, the voter is not provided with feedback on possible *overvotes* or *undervotes*.

Precinct-based: Optically scanned ballots may be read directly at the precinct, and a record of the results determined at that level. Typically, precinct based *optical scan* machines provide feedback to the voter, warning of *overvotes* and *undervotes*, though the undervote warning is frequently disabled. (The federal Help America Vote Act (HAVA) requires that voting machines give notice of *overvotes*.)

Outcome: As used in this context, the *outcome* of an election *race* is, "Who won?" Thus, a statement that an audit is designed to verify the *outcome* does *not* mean that the exact counts, which may be wrong, have been verified. As long as the correct winner

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is declared, the "*outcome*" is said to be correct.

Overvote: Selection by the voter of more candidates in a given *race* than he or she is allowed to vote for. An example would be if the voter chooses two candidates for President. A computerized voting machine can be programmed to alert the voter to this problem in time to correct it. Since ballots with *overvotes* will necessarily be excluded from the *races* in which the *overvote* occurs, it is important that they be avoided.

Performance measure: A system of objective measurement of governmental activities to allow for benchmarking and/or for observing changes over time.

Post-election audits: An audit of the actual election results to either confirm the accuracy of the *election* or lead (perhaps through an intermediary *escalation protocol*) to a complete *recount* of the *race* being audited.

Post-election software review (audit): Review of all the computer programs that generate the *voting system* software, together with *metadata*, including *ballot definition files*. A post-election software audit is often part of a full *post-election systems review* (audit).

Post-election systems review (audit): Review of all components of election voting and tallying systems that could influence the results of an *election*, including hardware, operating system files, software *source code* files, *executable files*, *firmware* and *metadata* such as *ballot definition files*. A post-election software audit tends to be deployed when discrepancies between an audit count and a machine count cannot be explained by other auditing methods.

Process audit: A term sometimes used for audits that are not time sensitive and can take place between *elections*. This may include an analysis of the distribution of voting machines, lengths of lines at the polling places, appropriateness of the *chain of custody* for ballots and much more. The entire electoral process can be inspected top to bottom in a *process audit*.

Provisional ballot: If a voter is not on the list at the polls or otherwise not allowed to vote, but the voter believes this to be an error, federal law requires that he or she be offered a "*provisional ballot*." This allows the voter to indicate his or her choices. Later, when there is time for investigation, it will be determined if the voter indeed had the right to vote (in which case the *provisional ballot* is treated as a valid ballot) or not.

Race: A specific contest within an *election*, such as a *race* for legislator, or a *ballot measure*.

Random selection: A process for choosing a sample (as of *audit units*) by chance, that is "randomly," as opposed to selecting them according to a criterion or an individual's judgment. Randomness is used so that anyone wishing to subvert the *election* cannot know beforehand which units will be audited. Therefore, in the voting context it is crucial that the *random selection* be made after the initial tabulation.

Recount (as distinguished from an audit): As used in this context, a "*recount*" refers to the entire *race*, rather than to a selected set of *audit units*, which are merely "counted," not "recounted". A *recount* is typically used when a *race* has some specified narrow margin of votes, or when some problem is found, such that there is doubt about the *outcome*. *Recounts* determine the results of an *election*, while an audit checks *voting system* performance.

Risk limiting audit: As opposed to a *fix percentage audit*, a *risk limiting audit* attempts to determine the number of *audit units* to sample in such a way as to hold the probability of missing a problem to a small pre-determined level. Typically this involves estimating the number of units to sample, rather than the percentage of them, and will use statistical principles.

Source code: Computer programming written in a language that people can read, such as Visual Basic, Fortran, or C++. A computer program (called a compiler) translates the human-readable *source code* into the *executable files* that a computer can read directly.

Top-to-bottom review: A review of all aspects of a *voting system*, including hardware, software, documentation, usability, *accessibility*, reliability, accuracy and security.

Undervotes: The opposite of *overvotes*. The voter has not voted for the permitted number of candidates in a particular *race*. For example, suppose there are three open seats on the County Commission, but the voter only selects two. Undervoting is valid and will not invalidate any part of the ballot, but will reduce the impact of the voter's intent if he or she has not voted for all candidates of interest.

Vote center: A polling place that combines multiple precincts, sometimes called a super precinct. In some cases a *vote center* may replace traditional precinct level polling places. In other cases, *vote centers* may supplement precinct level polling places by offering voters the opportunity to vote at either a centralized location or at their regular polling place.

Voter access cards: In some jurisdictions, voters are given a generic card that can be inserted into a voting machine to allow them to vote. This is a voter access card. Typically they are not unique, and many voters use each one.

Voter authority cards: In many jurisdictions, a voter is given a card with his or her name on it after his or her name is verified as being in the official list. This card allows the individual to vote. Typically these cards are unique to the voter and can be counted after the *election* and compared with the number of voters checked in and the number of votes cast.

Voter verifiable paper audit trail (VVPAT): In a *DRE* device, the voters' choices are stored electronically, making it impossible to conduct a manual audit or *recount*. To facilitate such audits or *recounts*, the *DRE* often has a printer attached that produces a paper copy (or *voter verifiable paper audit trail*) of the voter's choices for the voter to verify, which some voters do and others do not.

Voting system: The total combination of mechanical, electromechanical or electronic equipment (including the software, *firmware* and documentation required to program, control and support the equipment) that is used to define ballots, cast and count votes, report election results and produce any audit trail, as well as any materials provided to voters.

Election Audits Resources

A. Reports

Safeguarding the Vote (July 2004). This LWVUS publication makes recommendations for election officials about the security of voting systems and about voter registration systems.

http://www.lwv.org/AM/Template.cfm?Section=Voter_Information2&TEMPLATE=/CM/ContentDisplay.cfm&CONTENTID=10509

B. Post-Election Audits

Restoring Trust in Elections (August 2007), Lawrence Norden, Aaron Burstein, Joseph Lorenzo Hall and Margaret Chen, for the Brennan Center for Justice at New York University School of Law and the Samuelson Law, Technology & Public Policy Clinics at the University of California, Berkley School of Law. The researchers convened a blue ribbon panel of statisticians, voting experts, computer scientists and several of the nation's leading election officials to develop the report. This report is limited to post-election audits of voter-verifiable paper records and includes a review of current and proposed audit models, audit best practices and directions for future work.

Executive

summary:

http://www.brennancenter.org/content/resource/post_election_audits_restoring_trust_in_elections_executive_summary/

Full report: http://brennan.3cdn.net/f1867ccc368442335b_8em6bso3r.pdf

Principles and Best Practices for Post Election Audits (July 2008). This is the most current draft; the document was developed with input from persons with experience conducting and observing post-election audits, statisticians, political scientists and elections officials. It details the principles considered central to the conduct of meaningful post-election audits and provides examples of best practices for carrying out those principles.

<http://electionaudits.org/node/18>

Evaluation of Audit Sampling Models - Final Report, Post-Election Audit Standards Working Group, California (July 2007). The Working Group was composed of experts in the fields of computer science, financial auditing, statistical analysis, election reform advocacy, and city and county government. Their charge was to examine California's four-decades-old manual audit requirement and assess how it could be strengthened and made more effective.

www.sos.ca.gov/elections/peas/final_peaswg_report.pdf

State audit laws -- key provisions and map: A summary of state audit provisions including key language from each, compiled by Verified Voting Foundation.

<http://verifiedvoting.org/audits>

Searchable database of state audit laws: An excellent resource for comparing state audit provisions, compiled by Citizens for Election Integrity Minnesota.

<http://www.ceimn.org/state-audit-legislation-reference-guide>

Report and Analysis of the 2006 Post-Election Audit of Minnesota's Voting Systems (April 2007), Citizens for Election Integrity Minnesota. This reports on Minnesota's first post-election audit includes a review of MN's Post-Election Review Law and procedural recommendations for future audits. It also includes the text of the audit law and the law describing the counting method, known as the "piling method."

<http://www.ceimn.org/files/CEIMNAuditReport2006.pdf>

Percentage-Based vs. SAFE Vote Tabulation Auditing (Feb. 2008). Explains the benefits of a statistical alternative to percentage-based sampling in post-election audits. Prepared by experts in statistics, computer science, political science and election reform.

<http://www.verifiedvotingfoundation.org/article.php?id=6483>

New Jersey Audit Law (January 2008). This law is currently the best audit provision in state statute.

http://www.njleg.state.nj.us/2006/Bills/PL07/349_.PDF

Government Auditing Standards, July, 2007 Revision. Government Accountability Office, Washington DC. This document lays out the standards for all government audits and is used by governmental audit agencies throughout the country. It covers ethical and independence issues as well as requirements for various kinds of governmental audits.

<http://www.gao.gov/htext/d07731g.html>

Connecticut Citizen Election Audit Coalition report summarizes observations of 46 citizen observers of the August 2008 primary.

<http://www.ctelectionaudit.org/PressReleaseD.htm>

C. Government Service Efforts and Performance Reports

A Guide to Understanding, Governmental Accounting Standards Board, CT, August 2003. A handbook that explains the use of performance measures and gives examples of how to use them.

www.seagov.org/sea_gasb_project/suggested_criteria_report.pdf

D. Sample Procedures for Hand Counting Ballots:

Minnesota: <https://www.revisor.leg.state.mn.us/statutes/?id=204C.21>

California: http://josephhall.org/procedures/ca_tally_procedures-2008.pdf

New Hampshire: http://www.sos.nh.gov/FINAL_percent20EPM_percent208-30-2006.pdf
(beginning on page 144)

E. Websites

ElectionAudits.org: Sponsored by the Brennan Center for Justice, Citizens for Election Integrity Minnesota, Common Cause, Florida Voters Coalition and Verified Voting Foundation, this site is the clearinghouse for election audit information. Created after the nation's first summit conference on election audits in Minnesota in 2007, this site

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contains video presentations from speakers and panels at that conference, a searchable database of state-based audit laws and numerous resources about post-election auditing.

<http://www.electionaudits.org>

Verified Voting: Users can find a guide to state audit provisions and legislation. Research papers and news articles of interest to the audit community are also regularly posted at the site.

<http://www.verifiedvoting.org>

2008 USENIX/ACCURATE Electronic Voting Technology Workshop: Some interesting papers related to auditing and auditability.

<http://www.usenix.org/events/evt08/tech/>

Humboldt County Election Transparency Project: The basic idea behind the first-of-its-kind transparency project is fairly simple: Every ballot cast in an election is passed through an optical scanner after being officially counted and the images are then placed online and available for download. This effort uncovered two counting errors in the November 2008 county election tallies, one involving nearly 200 ballots caused by a software glitch and another involving 57 twice-counted ballots.

<http://www.humtp.com/index.html>

F. Other Resources

Developing an Audit Trail. This is one of the U.S. Election Assistance Commission's Best Practices guides; it includes sample checklists and details of documentation required to develop an audit trail.

http://www.eac.gov/election/quick-start-management-guides/election/quick-start-management-guides/docs/developing-an-audit-trail/attachment_download/file

The Election Center. Election Preparation Checklists. Detailed checklists for various aspects of election management, including Ballot Security, Polling Place Operations, Voting Systems and Recount Procedures.

<http://www.electioncenter.org/checklists.html>

Collaborative Public Audit of the November 2006 General Election in Cuyahoga County, Ohio.

http://urban.csuohio.edu/cei/public_monitor/cuyahoga_2006_audit_rpt.pdf