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The Honorable Wayne W. Williams
Colorado Secretary of State
1700 Broadway, Suite 200
Denver CO 80290

Re: Comments submitted by Clerk and Recorder Klotz

Dear Secretary Williams:

I write to correct some assertions in Clerk and Recorder Klotz's comments on the draft regulations regarding what risk-limiting audits accomplish, how they accomplish that goal, how they are conducted, and how much work they require, and to apologize for my role in creating the confusion that led to those comments.

The defining characteristic of a risk-limiting audit is that it has a known minimum chance of correcting the electoral outcome if that outcome is wrong.¹ The maximum chance that the audit will not correct the outcome if the outcome is wrong is the *risk limit*.

Clerk and Recorder Klotz argues that Colorado's previous audit meets the definition of a risk-limiting audit. Colorado's previous audit law is indeed a risk-limiting audit—but with a risk limit of 100%: It is known to have a minimum chance of zero of correcting incorrect outcomes.² Colorado's previous audit was not designed to detect incorrect outcomes and correct them; it was just a crude spot check of some aspects of voting equipment function. (Indeed, most existing audit laws are designed this way, which is why risk-limiting audits are an improvement over previous methods.)

Clerk and Recorder Klotz asserts that Colorado's previous audit provides 99% confidence in election outcomes, so risk-limiting audits with a risk limit of 5% would provide a lower level of assurance. He is mistaken: Colorado's previous audit provides zero statistical confidence in election outcomes.³ Again, Colorado's previous audit was not designed to correct wrong electoral outcomes; it was just a spot check of machine function, with no real statistical foundation.

Clerk and Recorder Klotz appeals to a dictionary definition of "random" rather than its meaning as a

¹"Wrong" means that a full hand count of the ballots would show a different winner or winners. Of course, if the paper trail is not trustworthy, a full hand count of the ballots might not show who really won. A risk-limiting audit checks whether the tabulation gave the correct winner, but by itself it does not check whether the votes that were tabulated are a complete and accurate record of voter intent: a *compliance audit* is required in addition.

²That is not to say that it has no value: it may catch a variety of kinds of problems, but many problems that could lead to incorrect election results cannot be detected (much less corrected) by Colorado's previous statutory audit.

³See footnote 2, *supra*.

term of art in Statistics: whether an election official knows what votes are reflected in a batch of ballots has nothing to do with whether the batch is a random sample of cast ballots. To draw a random sample requires careful planning, a source of actual randomness, and careful execution. What he describes would be considered “haphazard” rather than random.

Contrary to Clerk and Recorder Klotz’s assertion, risk-limiting audits are not based on 95% confidence intervals with a 3% margin of error. Rather, they are based on statistical tests that are sensitive to the *electoral* margins, and they are not based on confidence intervals.

Clerk and Recorder Klotz asserts that risk-limiting audits involve counting large numbers of ballots by hand, an error-prone process. While some auditing methods work that way, those are not the methods Colorado plans to use. Instead, Colorado will use *ballot-level* risk-limiting audits. Such audits require manually identifying (but not tallying) the votes on a relatively small number of individual ballots. No counting is required.

For ballot-level *comparison* audits (the most efficient kind⁴), a risk-limiting audit with a risk limit of 5% of a contest with a 10% margin of victory⁵ would require manually inspecting about 63 ballots selected at random—assuming that the manual inspection does not find any errors. For a margin of 20%, that would drop by half to 31 ballots; for a margin of 5%, it would double to 126 ballots. The general rule is that the number of randomly selected ballots to be audited is 6.3 divided by the (diluted) margin, assuming no errors are found. Risk-limiting audits give more scrutiny to closer contests, where smaller errors could have altered electoral outcomes. Ballot-polling audits, which may be useful for auditing legacy voting systems, generally require inspecting more ballots than ballot-level comparison audits require, but they still do not require counting votes, only interpreting voters’ marks. I repeat: neither ballot-level comparison risk-limiting audits nor ballot-polling risk-limiting audits requires counting votes by hand.⁶

Clerk and Recorder Klotz quotes me as saying that risk-limiting audits are not suitable for centrally counted ballots. I do not recall saying that. Modern central-count optical scan systems are the easiest vote-counting technology to audit using a risk-limiting audit, because it makes it easier to maintain the anonymity of the votes and to identify the cast vote record associated with a given ballot (and vice versa).⁷ Risk-limiting audits *do* require the local election official to keep track of cast ballots and to know in detail how the ballots are organized, which I would expect most local election officials already do.

Clerk and Recorder Klotz says that risk-limiting audits are best suited for DREs. I regret that I do not understand his argument. In my experience, performing risk-limiting audits of DREs is much more difficult and time-consuming than auditing central-count optically scanned ballots. I apologize for anything I said to create the opposite impression.

Finally, Clerk and Recorder Klotz suggests that risk-limiting audits are only popular (“shiny object with a romantically deceiving name”) because they were proposed by a professor. While I’m proud to be on the

⁴I understand that one of the criteria for certification under Colorado’s Uniform Voting System is whether the system supports ballot-level comparison audits.

⁵Technically, the relevant margin is the *diluted* margin; these expository calculations ignore undervotes, invalid ballots, and ballots that do not contain the contest(s) under audit.

⁶Technically, they require counting from zero to one (does this ballot have zero votes for this candidate, or one vote for this candidate?), but most people don’t think of that as counting.

⁷See footnote 4, *supra*.

UC Berkeley faculty, I think the reason risk-limiting audits have been endorsed by the Presidential Commission on Election Administration, the American Statistical Association, Verified Voting Foundation, the League of Women Voters, Common Cause, and other organizations concerned with election integrity, and why they have been written into law in Colorado and California, is that it's a good idea to audit elections in such a way that if the electoral result is wrong, the audit has a large, known chance of correcting the result before it becomes final. No other auditing method offers that kind of statistical quality control.

Sincerely,

A handwritten signature in black ink, appearing to read "Philip B. Stark". The signature is fluid and cursive, with a long horizontal stroke at the end.

Philip B. Stark

Professor, Department of Statistics

Associate Dean, Division of
Mathematical and Physical Sciences

Director, Statistical Computing Facility