SYLLABUS

This syllabus is not part of the opinion of the Court. It has been prepared by the Office of the Clerk for the convenience of the reader. It has been neither reviewed nor approved by the Court. In the interest of brevity, portions of an opinion may not have been summarized.

State v. Eileen Cassidy (A-58-16) (078390)

Argued September 12, 2018 -- Decided November 13, 2018

TIMPONE, J., writing for the Court.

The Court considers the admissibility of breath test results produced by Alcotest machines not calibrated using a thermometer that produces temperature measurements traceable to the standards set by the National Institute of Standards and Technology (NIST).

In 2000, the State began using the Alcotest, a product of Draeger Safety Diagnostics Inc. (Draeger), to conduct breath tests. The Alcotest machine analyzes breath samples, producing blood alcohol concentration readings used to determine whether a driver's blood alcohol content is above the legal limit. In 2004, Dr. Thomas A. Brettell developed the current calibration protocol while he was director of the State's Office of Forensic Sciences (OFS). In 2008, the Court found results from Alcotest machines calibrated pursuant to Dr. Brettel's protocol sufficiently reliable to be admissible in drunk-driving cases to establish a defendant's guilt or innocence for drunk driving. State v. Chun, 194 N.J. 54, 65 (2008). The Court also required that the devices be recalibrated semi-annually to help ensure accurate measurements. Id. at 153.

During the calibration process, simulator solutions are heated to about 34 degrees Celsius, the generally accepted temperature for human breath. It is essential that the temperature of the solution be accurate in order for the Alcotest's blood alcohol content readings to be correct. The Alcotest's calibration procedure requires the test coordinator to insert a thermometer that produces NIST-traceable temperature measurements into the simulator solution used to calibrate the Alcotest and confirm that the calibration unit heated the solution to a temperature within 0.2 degrees of 34 degrees Celsius. When a thermometer's temperature measurements are "traceable" to the standard measurements of the NIST, those measurements are generally accepted as accurate by the scientific community. There are two other temperature probes used during the calibration procedure. Unlike the NIST-traceable thermometer, they are manufactured and calibrated by Draeger.

Marc W. Dennis, a coordinator in the New Jersey State Police's Alcohol Drug Testing Unit, was tasked with performing the semi-annual calibrations on Alcotest instruments used in Middlesex, Monmouth, Ocean, Somerset, and Union Counties. He is charged with neglecting to take required measurements and having falsely certified that he followed the calibration procedures. Dennis was indicted in 2016 for failing to use a NIST-traceable thermometer to measure the temperature of simulator solutions used to calibrate

Alcotest devices. When Dennis was criminally charged, the Attorney General's Office notified the Administrative Office of the Courts that evidential breath samples from 20,667 people were procured using Alcotest machines calibrated by Dennis.

Defendant Eileen Cassidy, now deceased, pleaded guilty in municipal court to driving under the influence based solely on Alcotest results showing her blood alcohol level had exceeded the legal limit. Upon learning that the results of her test were among those called into question by Dennis's alleged falsifications, she moved to withdraw her guilty plea. The Attorney General moved for direct certification. The Court granted the motion and remanded the case to retired Appellate Division Presiding Judge Joseph F. Lisa as Special Master to determine whether "the failure to test the simulator solutions with the NIST-traceable digital thermometer before calibrating an Alcotest machine [would] undermine or call into question the scientific reliability of breath tests subsequently performed on the Alcotest machine." 230 N.J. 232, 232-33 (2017).

After an extensive evidentiary hearing, the Special Master issued a 198-page report in which he concluded that failure to use a thermometer that produces NIST-traceable temperature readings in the calibration process undermines the reliability of the Alcotest and that the State failed to carry its burden of proving by clear and convincing evidence that the Alcotest was scientifically reliable without a NIST-traceable temperature check. The Special Master's report is appended to the Court's opinion.

HELD: The Special Master's findings are supported by substantial credible evidence in the record, and the Court adopts them. Breath test results produced by Alcotest machines not calibrated using a NIST-traceable thermometer are inadmissible.

1. This case is justiciable despite defendant's passing. The Court will entertain a case that has become moot when the issue is of significant public importance and is likely to recur. The reliability and admissibility of thousands of breath samples, often used as the sole evidence to support a conviction, is of significant public importance. (pp. 9-10)

2. Scientific test results are admissible in a criminal trial only when the technique is shown to be generally accepted as reliable within the relevant scientific community. Chun, 194 N.J. at 91. Although the Court recently adopted the factors identified in Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579, 593-95 (1993), and a methodology-based approach for determining scientific reliability in certain areas of civil law, the Court has not altered its adherence to the general acceptance test for reliability in criminal matters. The proponent of the technique has the burden to clearly establish general acceptance and may do so using (1) expert testimony, (2) scientific and legal writings, and (3) judicial opinions. The party proffering the evidence need not show infallibility of the technique nor unanimity of its acceptance in the scientific community. (pp. 10-11)

3. Of the State's witnesses, the Special Master found only the testimony of Dr. Brettell worthy of substantial weight; he found defendant's expert credible. The Court defers to and adopts the Special Master's detailed credibility findings. (p. 12)

4. Based on the credible testimony, the Special Master determined that accurate temperature readings of the simulator solutions are "the foundation upon which the entire calibration process is built." The Special Master found NIST traceability "essential" to confidence in the Alcotest's results and that the two Draeger-manufactured probes were not NIST-traceable and were insufficient substitutes for the use of a NIST-traceable thermometer. The Special Master also found it particularly significant that the NIST-traceable thermometer was the only temperature measuring device used in the calibration process that was independent from the Alcotest and not manufactured and calibrated by Draeger. The Special Master found it "extremely important and persuasive" that current protocol treats the failure to achieve an in-range temperature reading using the NIST-traceable thermometer as an event of sufficient magnitude to abort a calibration. The Special Master reasoned that such facts clearly cut against the State's argument that the use of the thermometer is an unnecessary redundancy. Further, the Special Master rejected the State's theory that ten simultaneous failures would need to occur for the certainty of Alcotest results to be compromised, finding instead that the evidence showed that three relatively minor errors could cause undetected miscalibrations. The Special Master determined that the State had not shown that other states' practices revealed general acceptance of the reliability of Alcotest results without the use of a NIST-traceable thermometer. Because the Special Master's findings are supported by substantial credible evidence in the record, the Court adopts them. (pp. 13-17)

5. Applying the general acceptance standard to the Special Master's findings, the Court holds that the State failed to carry its burden and affirms the Special Master's conclusion. Temperature measurements that are NIST-traceable are generally accepted as reliable by the scientific community. Part of that reliability lies in the fact that the level of uncertainty of each temperature measurement is known. The two Draeger-manufactured probes fail to meet the NIST's standards and the measure of uncertainty in their temperature readings is unknown. The Court does not accept the State's contention that the risk of miscalibration is infinitesimal due to the numerous other fail-safes in the calibration procedure. As Dr. Brettell testified, it was that very fear of a laboratory bias that led him to include the NIST-traceable thermometer in the calibration procedure. (pp. 18-19)

6. The Court orders the State to notify all affected defendants of its decision that breath test results produced by Alcotest machines not calibrated using a NIST-traceable thermometer are inadmissible and commends to the State that it require the manual recording of the NIST-traceable readings going forward. Further, the Court lifts the stay on all pending cases so that deliberations may commence on whether and how those cases should proceed. For those cases already decided, affected defendants may now seek appropriate relief. Because the State waited approximately a year to notify the affected defendants, the Court relaxes the five-year time bar, R. 7:10-2(b)(2), in the interests of justice. The Court asks the Director of the Administrative Office of the Courts to monitor these cases and recommend how best to administer them in the event any special measures are needed. Finally, as to defendant Cassidy, the Court exercises its original jurisdiction and vacates her conviction. (pp. 19-20)

CHIEF JUSTICE RABNER and JUSTICES LaVECCHIA, ALBIN, PATTERSON, FERNANDEZ-VINA, and SOLOMON join in JUSTICE TIMPONE's opinion.

SUPREME COURT OF NEW JERSEY

A-58 September Term 2016

078390

State of New Jersey,

Plaintiff-Appellant,

v.

Eileen Cassidy,

Defendant-Respondent.

On appeal from the Spring Lake Municipal Court, Monmouth County.

Remanded	Special Master Report
April 7, 2017	May 4, 2018
Argued	**Decided**
September 12, 2018	November 13, 2018

Robyn B. Mitchell, Deputy Attorney General, argued the cause for appellant (Gurbir S. Grewal, Attorney General, attorney; Sarah C. Hunt and Sarah Lichter, Deputy Attorneys General, of counsel and on the briefs).

Michael R. Hobbie argued the cause for respondent (Hobbie, Corrigan & Bertucio, attorneys; Michael R. Hobbie and Elyse S. Schindel, of counsel and on the briefs).

Jeffrey E. Gold argued the cause for amicus curiae New Jersey State Bar Association (New Jersey State Bar Association, attorneys; John E. Keefe, Jr., President, of counsel and on the brief, and Jeffrey E. Gold, Arnold N. Fishman, and Miles S. Winder III, on the briefs).

Matthew W. Reisig, participating attorney (Reisig Criminal Defense & DWI Law, attorneys; Matthew W. Reisig, of counsel and on the briefs, and Jeffrey Zajac, on the briefs).

John Menzel, participating attorney (John Menzel, J.D., on the briefs).

Evan M. Levow, participating attorney, submitted a brief (Levow DWI Law, attorneys).

JUSTICE TIMPONE delivered the opinion of the Court.

The case before us concerns New Jersey law enforcement's use of the Alcotest 7110 MKIII-C (Alcotest) to obtain breath samples from drivers suspected of driving under the influence of alcohol. The Alcotest machine analyzes breath samples, producing blood alcohol concentration readings used to determine whether a driver's blood alcohol content is above the legal limit. In 2008, we found Alcotest results admissible in drunk-driving cases to establish a defendant's guilt or innocence for drunk driving. State v. Chun, 194 N.J. 54, 65 (2008). We also required that the devices be recalibrated semi-annually to help ensure accurate measurements. Id. at 153.

Confidence in the reliability of instruments of technology used as evidence is of paramount importance. Unfortunately, alleged human failings have cast doubt on the calibration process. Marc W. Dennis, a coordinator in the New Jersey State Police's Alcohol Drug Testing Unit, was tasked with performing the semi-annual calibrations on Alcotest instruments used in Middlesex, Monmouth, Ocean, Somerset, and Union Counties. He is charged with neglecting to take required measurements and having falsely certified that he followed the calibration procedures. Dennis was indicted in 2016 for failing to use a thermometer that produces temperature measurements traceable to the standards set by the National Institute of Standards and Technology (NIST) to measure the temperature of simulator solutions used to calibrate Alcotest devices. When Dennis was criminally charged, the Attorney General's Office notified the Administrative Office of the Courts that evidential breath samples from 20,667 people were procured using Alcotest machines calibrated by Dennis.

Defendant Eileen Cassidy, now deceased, pleaded guilty in municipal court to driving under the influence based solely on Alcotest results showing her blood alcohol level had exceeded the legal limit. Upon learning that the results of her test were among those called into question by Dennis's alleged falsifications, she moved to withdraw her guilty plea. The Attorney General

moved for direct certification. We granted the motion because the central issue of this case is typical to the large number of defendants affected by Dennis's alleged misconduct. We remanded the case to retired Appellate Division Presiding Judge Joseph F. Lisa as Special Master to determine whether "the failure to test the simulator solutions with the NIST-traceable digital thermometer before calibrating an Alcotest machine [would] undermine or call into question the scientific reliability of breath tests subsequently performed on the Alcotest machine." 230 N.J. 232, 232-33 (2017).

On May 4, 2018, after an extensive evidentiary hearing, the Special Master issued a 198-page report in which he concluded that failure to use a thermometer that produces NIST-traceable temperature readings in the calibration process undermines the reliability of the Alcotest. We now adopt the Special Master's findings because they are supported by substantial credible evidence in the record, see Chun, 194 N.J. at 93, and we append his report to this opinion.

I.

We briefly highlight the following facts from the record and commend a review of the Special Master's comprehensive report for the finer details. We rely heavily on the Special Master's report.

In 2000, the State began using the Alcotest, a product of Draeger Safety Diagnostics Inc. (Draeger), to conduct breath tests. In 2004, Dr. Thomas A. Brettell developed the current calibration protocol while he was director of the State's Office of Forensic Sciences (OFS), and we deemed the Alcotest sufficiently reliable as calibrated pursuant to Dr. Brettell's protocol. Chun, 194 N.J. at 148. As this Court ordered in Chun, N.J.A.C. 13:51-4.3(a) requires the semi-annual calibration of approved instruments used to test the alcohol content of breath samples. Id. at 153. The regulation, however, does not specify a calibration procedure.

During the calibration process, simulator solutions containing varying concentrations of ethanol are used to calibrate the Alcotest and confirm the accuracy of its blood alcohol content readings. The simulator solutions are poured into calibration units, which are glass containers that house a heating component. The calibration units heat the solutions to about 34 degrees Celsius, the generally accepted temperature for human breath, creating a vapor. The vapor is a proxy for human breath. It is essential that the temperature of the solution be accurate in order for the Alcotest's blood alcohol content readings to be correct. The Alcotest's calibration procedure requires the test coordinator to insert a thermometer that produces NIST-traceable temperature measurements into the simulator solution used to

calibrate the Alcotest and confirm that the calibration unit heated the solution to a temperature within 0.2 degrees of 34 degrees Celsius. The NIST is the federal agency responsible for maintaining and promoting consistent units of measurement. When a thermometer's temperature measurements are "traceable" to the standard measurements of the NIST, those measurements are generally accepted as accurate by the scientific community.

There are two other temperature probes used during the calibration procedure. Unlike the NIST-traceable thermometer, both of those probes are manufactured and calibrated by Draeger. The first is the "black key probe," which plugs into the Alcotest device and allows the coordinator to access the calibration function. That probe is used to measure each simulator solution's temperature during a series of control tests. The second is the "agency's probe," which also plugs into the Alcotest and is used to measure the temperature of the simulator solution used in the final test to confirm that the Alcotest was calibrated correctly.

After the Special Master observed State Trooper David Klimik demonstrate an Alcotest calibration for him and heard testimony from five expert witnesses, including Dr. Brettell, the Special Master issued his report. In it the Special Master found the State failed to carry its burden of proving by clear and convincing evidence that the Alcotest was scientifically reliable

without a NIST-traceable temperature check. Infra at ___ (slip op. at 197-98). The Special Master stated the record "raise[d] substantial doubts about the scientific reliability of breath test results produced by Alcotest devices calibrated without the use of a NIST-traceable thermometer." Infra at ___ (slip op. at 185). He rejected the State's contention that the Alcotest itself contains so many redundancies and fail-safes that the use of a NIST-traceable thermometer is merely a supplementary check above and beyond the threshold of sufficient reliability. Infra at ___ (slip op. at 189-90). The Special Master determined that, without the NIST-traceable temperature measurement, the risk of undetected miscalibrations was "reasonably plausible" and would lead to "some number of undetected miscalibrations" among the roughly 1200 tests performed annually. Infra at ___ (slip op. at 194-96).

II.

A.

The State challenges the Special Master's findings, asserting that it met its burden of demonstrating by clear and convincing evidence that the Alcotest is generally accepted as reliable even when a NIST-traceable thermometer is not used in the calibration process. The State points to the testimony of Dr. Brettell that the black key probe and agency's probe are so comprehensive that the reliability of breath test results will not be reduced without the use of a

NIST-traceable thermometer. It also highlights the fact that no other state using the Alcotest requires the use of a NIST-traceable thermometer in the calibration process. The State urges us to find that the Special Master held it to a standard far exceeding its evidentiary burden.

The State further asks this Court to reject the Special Master's findings that the black key and agency's probes' temperature readings are not NIST-traceable, arguing that question was not within the scope of the remand.

B.

Defendant asks us to adopt the Special Master's findings and contends the use of a NIST-traceable thermometer is essential because miscalibrations leading to inaccurate breath test readings could otherwise occur. Defendant stresses that the black key and agency's temperature probes do not produce NIST-traceable temperature readings and the use of an independent thermometer is the only way to verify the solutions' temperatures during the calibration process.

C.

Amicus curiae the New Jersey State Bar Association agrees with the Special Master's findings and conclusions. It asserts that the fundamental problem with skipping the NIST-traceable measurement is not that it introduces uncertainty, but that it introduces an unquantifiable amount of

uncertainty. In the State Bar Association's view, the Special Master affirmed this Court's assumption in Chun that NIST-traceable temperature measurements are integral to the reliability of the Alcotest.

D.

Participating attorney John Menzel, who represented the respondents in Chun, asks us to adopt the Special Master's findings, but notes the Special Master applied a more general clear and convincing evidence standard rather than the stricter general acceptance standard.

III.

As a preliminary matter, we hold this case is justiciable despite defendant's passing. As this Court explained in State v. Gartland, we "will entertain a case that has become moot when the issue is of significant public importance and is likely to recur." 149 N.J. 456, 464 (1997).

We granted the State's application for direct certification from the municipal court because of the far-reaching implications of this case. The pivotal issue is whether the Alcotest is sufficiently reliable absent the use of a NIST-traceable thermometer in its calibration. Defendant's case is emblematic of each case, pending or closed, in which the State used or seeks to use one of the 20,667 breath samples called into question by Dennis's alleged misconduct. The reliability -- and, consequently the admissibility, see

Romano v. Kimmelman, 96 N.J. 66, 80 (1984) -- of thousands of breath samples, often used as the sole evidence to support a conviction, is undeniably of significant public importance.

IV.

Generally, the Court will defer to a special master's credibility findings regarding the testimony of expert witnesses, but we owe no deference to a special master's legal conclusions. State v. Henderson, 208 N.J. 208, 247 (2011). The Court also accepts the fact findings of a special master to the extent they are supported by "substantial credible evidence in the record." Chun, 194 N.J. at 93.

A.

Scientific test results are admissible in a criminal trial only when the technique is shown to be generally accepted as reliable within the relevant scientific community. Id. at 91. The general acceptance standard is commonly known as the Frye standard. See State v. J.L.G., 234 N.J. 265, 280 (2018).

Although this Court recently adopted the factors identified in Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579, 593-95 (1993), and a methodology-based approach for determining scientific reliability in certain areas of civil law, we have not altered our adherence to the general acceptance

test for reliability in criminal matters. In re Accutane Litig., 234 N.J. 340, 398-99 (2018); J.L.G., 234 N.J. at 280.

"Proof of general acceptance within a scientific community can be elusive," and "[s]atisfying the test involves more than simply counting how many scientists accept the reliability of the proffered [technique]." State v. Harvey, 151 N.J. 117, 171 (1997). General acceptance "entails the strict application of the scientific method, which requires an extraordinarily high level of proof based on prolonged, controlled, consistent, and validated experience." Ibid. (quoting Rubanick v. Witco Chem. Corp., 125 N.J. 421, 436 (1991)). The proponent of the technique has the burden to "clearly establish" general acceptance, State v. Johnson, 42 N.J. 146, 171 (1964), and may do so using "(1) expert testimony, (2) scientific and legal writings, and (3) judicial opinions," State v. Cavallo, 88 N.J. 508, 521 (1982) (quoting Paul C. Giannelli, The Admissibility of Novel Scientific Evidence: Frye v. United States, a Half-Century Later, 80 Colum. L. Rev. 1197, 1215 (1980)).

To be clear, the party proffering the evidence need not show infallibility of the technique nor unanimity of its acceptance in the scientific community. Chun, 194 N.J. at 91-92; Harvey, 151 N.J. at 171; Johnson, 42 N.J. at 171.

B.

The State had the burden to clearly establish that the Alcotest is sufficiently reliable under the general acceptance standard without the use of a NIST-traceable thermometer in the calibration process. The State contends it carried that burden by showing the use of a NIST-traceable thermometer is unnecessary to ensure the accuracy of the temperature of the simulator solution used to calibrate the Alcotest. According to the State, the temperature of the solutions can be indirectly verified by the two Draeger-manufactured probes, which were themselves checked against NIST-traceable temperature measurements at the time they were calibrated. We disagree.

We begin with a brief review of the Special Master's credibility determinations. The State proffered four witnesses in addition to Trooper Klimik, who demonstrated and answered questions about the calibration process. Of those four witnesses, the Special Master found only the testimony of Dr. Brettell, who "was qualified in this proceeding to render expert opinions in the fields of forensic chemistry, forensic toxicology, scientific measuring, and breath testing," worthy of substantial weight. Infra at ___ (slip op. at 53-55). As for defendant's expert, Dr. Andreas Stolz, the Special Master found him credible. Infra at ___ (slip op. at 78). We defer to and adopt the Special Master's detailed credibility findings. See Henderson, 208 N.J. at 247.

Based on the credible testimony, the Special Master determined that accurate temperature readings of the simulator solutions are "the foundation upon which the entire calibration process is built." Infra at ___ (slip op. at 190). The Special Master found NIST traceability "essential" to confidence in the Alcotest's results. Ibid. And, after considering the NIST's standards for traceability, the Special Master found that the black key and agency's probes were not NIST-traceable and were insufficient substitutes for the use of a NIST-traceable thermometer. Infra at ___ (slip op. at 187-88).

Dr. Stolz testified that accurate temperature readings of the simulator solutions were critical to the accuracy of the Alcotest. He opined that if the temperature of the simulator solution was off by a single degree, and that error went undetected, the Alcotest's blood alcohol measurements would be off by seven percent. That is, a breath sample with an actual alcohol concentration of .075%, could be read as .082%. Clearly, the accuracy of the temperature of the simulator solutions used to calibrate the Alcotest is critically important to the fidelity of its readings.

The Special Master reproduced the standards for NIST-traceability in his report and detailed Draeger's process for calibrating the black key and agency's temperature probes. Infra at ___ (slip op. at 87-99). The Special Master's detailed description of that process need not be reprinted here; it is

sufficient to note that Draeger's process does not meet the NIST's standards for an unbroken chain of measurement comparisons or for estimating the overall degree of uncertainty of the comparison measurements. The Special Master concluded the black key and agency's temperature probes are not NIST-traceable. The Special Master's findings that the probes are not NIST-traceable did not exceed the scope of the remand and are supported by substantial credible evidence in the record. We see no reason to question the Special Master's determination.

As the Special Master observed, the Draeger temperature probes do not produce NIST-traceable measurements, in part, because the level of uncertainty in those measurements is unknown. Infra at ___ (slip op. at 96). Both Dr. Brettell and Dr. Stolz acknowledged there is some amount of uncertainty in every temperature measurement. Dr. Stolz explained that it is not such uncertainty itself that is problematic; rather, for a measurement to be scientifically reliable, the amount of uncertainty must be known so the error rate of a given temperature measurement can be determined. Dr. Stolz testified that it is not knowing the level of uncertainty in a given measurement that makes the measurement scientifically unreliable.

Dr. Brettell likewise stressed the importance of NIST-traceable measurements. He acknowledged the scientific reliability of the Alcotest was

reduced absent the use of a NIST-traceable thermometer. He agreed with Dr. Stolz that, without the use of a NIST-traceable thermometer, there was an unquantifiable amount of uncertainty in the Alcotest's measurements. Dr. Brettell conceded: "Collectively, [the steps in the calibration process] are requirements that would be necessary for calibrating the instrument . . . ." The Special Master asked: "To ensure scientific reliability?" Dr. Brettell answered: "Yes."

The Special Master also found it particularly significant that the NIST-traceable thermometer was the only temperature measuring device used in the calibration process that was independent from the Alcotest and not manufactured and calibrated by Draeger. See infra at ___ (slip op. at 125-41, 180, 190-91). Dr. Stolz explained that if Draeger accidently used the wrong temperature in calibrating the calibration units and the probes, then the temperature variance would go undetected and the Alcotest's readings would be factually inaccurate.

Dr. Brettell testified he included the use of a NIST-traceable thermometer to independently verify the temperature of the solutions in light of the legal significance of the Alcotest. He explained that

> if you put everything into Draeger's hands as far as certifying the solutions, the instrument, the calibrating unit and everything else, what if -- what if there is a

> bias or an error in Draeger's laboratory? What impact would that have on the breath test program in New Jersey? And so as far as the risk assessment, I took every step I could to independently test as much as I could of this program independently of Draeger to make sure that if that happened, we have a good chance of stopping it before it proliferated out.

The Special Master found it "extremely important and persuasive" that current protocol treats the failure to achieve an in-range temperature reading using the NIST-traceable thermometer as an event of sufficient magnitude to abort a calibration. Infra at ___ (slip op. at 187). The Special Master reasoned that such facts clearly cut against the State's argument that the use of the thermometer is an unnecessary redundancy. Infra at ___ (slip op. at 189-90).

Further, the Special Master rejected the State's theory that ten simultaneous failures would need to occur for the certainty of Alcotest results to be compromised, finding instead that the evidence showed that three relatively minor errors could cause undetected miscalibrations. Infra at ___ (slip op. at 130, 183). Though the Special Master found that it would not be common for the three errors to occur simultaneously, he found that they were "plausible, evidence-based occurrences." Infra at ___ (slip op. at 183-84). The Special Master's main concern was that miscalibrations could go undetected without the use of a NIST-traceable thermometer and the State had "failed to quantify the magnitude of the reduced scientific reliability" of the

calibration process when no NIST-traceable device is used. Infra at ___ (slip op. at 184).

The State disputed the need for the use of a NIST-traceable thermometer, noting that New Jersey is the only jurisdiction using the Alcotest that mandates the thermometer's use in the calibration process. The Special Master rejected that claim because "uncontroverted evidence established that the instrument was highly customized for each jurisdiction." Infra at ___ (slip op. at 162-63). That customization complicates comparative analysis of the states' processes because not enough states use the Alcotest to establish general acceptance and because, even among those states that do use the Alcotest, New Jersey "was possibly the most substantial user of the instrument." Infra at ___ (slip op. at 169-70). The Special Master determined that the State had not shown New Jersey to be an outlier or that other states' practices revealed general acceptance of the reliability of Alcotest results without the use of a NIST-traceable thermometer. Infra at ___ (slip op. at 170).

We owe a great debt to the Special Master for his diligence and insightfulness so evident in his extensive and thorough report. Because his findings are supported by substantial credible evidence in the record, we adopt them.

Applying the general acceptance standard to the Special Master's findings, we hold the State failed to carry its burden and affirm the Special Master's conclusion.

Contrary to the State's contentions that the Special Master held it to a standard of infallibility, we find he did not. The State's argument that the accuracy of the simulator solutions' temperatures can be indirectly verified using the black key and agency's probe cannot overcome the fact that the temperature measurements of those probes are not NIST-traceable. Simply put, temperature measurements that are NIST-traceable are generally accepted as reliable by the scientific community. Part of that reliability lies in the fact that the level of uncertainty of each temperature measurement is known. Because the probes fail to meet the NIST's standards for traceability and the measure of uncertainty in their temperature readings is unknown, the scientific reliability of the probes' temperature measurements are left in doubt.

We do not accept the State's contention that the risk of miscalibration is infinitesimal due to the numerous other fail-safes in the calibration procedure. It is improbable such a showing could satisfy the general acceptance standard because the temperature probes used in the calibration process would still have an unknown level of measurement uncertainty and would not be traceable to the national standards. But assuming such a showing could satisfy the State's

burden, the State failed to demonstrate why we should reject the Special Master's findings, specifically his concern that a laboratory error or a confluence of multiple minor errors could lead to undetected miscalibrations. Dr. Stolz and Dr. Brettell testified that they were concerned Draeger, which calibrates the other temperature probes used in the calibration procedure, could accidentally miscalibrate all the probes due to a laboratory mistake. In fact, as Dr. Brettell testified, it was that very fear of a laboratory bias that led him to include the NIST-traceable thermometer in the calibration procedure.

V.

We order the State to notify all affected defendants of our decision that breath test results produced by Alcotest machines not calibrated using a NIST-traceable thermometer are inadmissible, so that they may take appropriate action. We further commend to the State that it require the manual recording of the NIST-traceable readings going forward as a check against negligent performances of this integral human test.

Further, we lift the stay on all pending cases so that deliberations may commence on whether and how those cases should proceed. For those cases already decided, affected defendants may now seek appropriate relief. Because the State waited approximately a year to notify the affected defendants, we relax the five-year time bar, R. 7:10-2(b)(2), in the interests of

justice. We ask the Director of the Administrative Office of the Courts to monitor these cases and recommend how best to administer them in the event any special measures are needed. Finally, as to defendant Cassidy, we exercise our original jurisdiction and vacate her conviction.

CHIEF JUSTICE RABNER and JUSTICES LaVECCHIA, ALBIN, PATTERSON, FERNANDEZ-VINA, and SOLOMON join in JUSTICE TIMPONE's opinion.

APPENDIX

SUPREME COURT OF NEW JERSEY
M-244/245/246 September Term 2016
078390

STATE OF NEW JERSEY,

Plaintiff-Movant,

v.

EILEEN CASSIDY,

Defendant-Respondent.

REPORT OF FINDINGS OF FACTS AND CONCLUSIONS OF REMAND COURT

On remand from the Supreme Court of New Jersey: April 7, 2017

Findings and Conclusions Submitted to Supreme Court: May 4, 2018

Robert H. Czepiel, Jr., Supervising Deputy Attorney General, Robyn B. Mitchell, Deputy Attorney General, Jamie A. Gallagher, Deputy Attorney General, appeared on behalf of plaintiff-movant State of New Jersey (Gurbir S. Grewal, Attorney General, attorney).

Michael R. Hobbie and Elyse S. Schindel appeared on behalf of defendant-respondent Eileen Cassidy (Hobbie, Corrigan & Bertuccio, attorneys).

Sharon A. Balsamo (New Jersey State Bar Association), Arnold N. Fishman (Fishman & Fishman), Miles S. Winder, III (Carl Taylor Law, LLC), Jeffrey E. Gold and Zachary I. Hashmi (Gold & Hashmi, P.C.,) appeared on behalf of amicus curiae New Jersey State Bar Association.

Matthew W. Riesig appeared as a Participating Attorney.

John Menzel appeared as a Participating Attorney.

Samuel Louis Sachs appeared as a Participating Attorney.[1]

LISA, P.J.A.D. (retired and temporarily assigned on recall), SPECIAL MASTER

TABLE OF CONTENTS

[1] Due to health issues, Mr. Sachs only appeared in the initial stages of the remand proceeding.

I. INTRODUCTION

This report deals with the scientific reliability of breath test readings used for evidential purposes in DWI cases. For many years, such readings have been admissible in evidence only if the State proves, among other things, that the breath testing device which produced the reading was in good working order. That proof is accomplished, in large part, by the production of a certification by a State Police coordinator who performed the most recent calibration of the breath testing device. Such calibrations are required at intervals not to exceed six months, and the coordinator's certification must attest to the fact that all steps in the calibration process were performed according to the authorized procedure.

The breath testing device presently in use in New Jersey is the Alcotest 7110 MKIII-C (the Alcotest, the 7110, or the instrument). One of the mandatory steps in the authorized calibration procedure requires coordinators to measure the temperature of the simulator solutions used in the calibration process with a thermometer that produces temperature measurements traceable to the National Institute of Standards and Technology (NIST). If the NIST-traceable thermometer does not produce temperature readings for all simulator solutions

that are within the required range, the coordinator is not permitted to proceed further with the calibration process.

The State alleges that one coordinator failed to perform this step in calibrating three Alcotest 7110 instruments, but he signed certifications falsely attesting that he performed all required steps, including use of the NIST-traceable thermometer. The State determined that over 20,000 evidential breath samples were taken using breath testing devices calibrated by that coordinator over the course of several years.

The State made an application directly to the Supreme Court, elaborating on the information discussed above and asserting that failure to perform the NIST-traceable thermometer step would not undermine or call into question the scientific reliability of breath test results from those devices, notwithstanding that the step is mandatory and legally required as a prerequisite to admission in evidence of breath test results. Because of the multitude of cases potentially affected, all of which would contain a common issue, the State asked the Court to appoint a Special Master to deal with that issue in a single proceeding.

The Court granted the State's request and issued an order on April 7, 2017 appointing me as the Special Master, directing that I conduct an evidentiary hearing and, after hearing the

arguments of the parties, make findings of fact and conclusions of law to be submitted in a written report upon the following question:

> Does the failure to test the simulator solutions with the NIST-traceable digital thermometer before calibrating an Alcotest machine undermine or call into question the scientific reliability of breath tests subsequently performed on the Alcotest machine?
>
> [Appendix I.]

For the reasons set forth in this report, I answer that question in the affirmative.

II. BACKGROUND

A. Legal and factual background of breath testing in New Jersey.

For over fifty years, the results of evidentiary breath-testing instruments have been used to establish the blood alcohol concentration (BAC) of individuals who have operated motor vehicles in violation of N.J.S.A. 39:4-50. State v. Miller, 64 N.J. Super. 262, 268 (App. Div. 1960) (holding that "[t]he Drunkometer is sufficiently established and accepted as a scientifically reliable and accurate device for determining the alcoholic content of the blood to admit testimony of the reading obtained upon a properly conducted test"). Breath testing "has the advantage" over blood testing "of prompt and easy

administration by non-medically trained personnel and with relatively inexpensive equipment." State v. Johnson, 42 N.J. 146, 170 (1964) (referencing the drunkometer, the alcometer, the breathalyzer, the drunkotester and the intoximeter and noting that "[a]ll are now generally scientifically recognized as sufficiently reliable").

Proof that the breath-testing instrument used was in good working order has always been a key foundational requirement of admissibility. See, e.g., Miller, 64 N.J. Super. at 270 (setting aside conviction for lack of foundational proof and holding that "[a]s a minimum . . . the State should prove (unless such proof is waived) that the operator was qualified, that the machine and its components were in proper condition, and that the test was properly administered"). In Johnson, the Supreme Court cautioned:

> It is, of course, most essential, in view of the heavy impact the result can have, that proper administration of the test be clearly established before the reading is admitted in evidence. This includes full proof that the equipment was in proper order, the operator qualified and the test given correctly.
>
> [Johnson, 42 N.J. at 171 (emphasis added).]

In 1984, the Supreme Court rejected an argument that certain breathalyzer models were insufficiently reliable due to potential radio frequency interference (rfi) affecting breath

test results. Romano v. Kimmelman, 96 N.J. 66, 72 (1984). The Romano Court held that breathalyzers continued to be "scientifically reliable and accurate devices for determining the concentration of blood alcohol" and that "[s]uch scientific reliability shall be the subject of judicial notice in the trial of all cases under N.J.S.A. 39:4-50." Ibid. The Court explained that breathalyzer test results were admissible where the State established that "(1) the equipment was in proper order – that it was periodically inspected in accordance with accepted procedures; (2) the operator was qualified to administer the instrument – that these qualifications as a breathalyzer operator were properly certified; and (3) the test was given correctly – that it was administered in accordance with the official instructions for the use of the instrument." Id. at 81. The State bore the burden of establishing these conditions of admissibility by clear and convincing evidence. Id. at 89-91.

The Romano Court noted that, "under the most unusual circumstances, which are highly unlikely to occur," rfi could interfere with breath test results, but it held that various procedures and precautions, including continuing "the current practice of banning hand-held transmitters from any area in

close proximity to the breathalyzer instrument," sufficiently safeguarded against rfi. Id. at 72-73, 83-83.

The Court rejected another challenge to the scientific reliability of the breathalyzer in State v. Downie, 117 N.J. 450 (1990). There, the defendants asserted that "because people have broadly divergent ratios of breath alcohol relative to blood alcohol, the 2100:1 partition ratio" used by the breathalyzer was inaccurate and rendered its test results scientifically unreliable. Id. at 451-52. The Court rejected this argument and found that "breathalyzer testing is a practical and reasonably accurate way of fulfilling the Legislature's intent to punish drunk drivers." Id. at 452.

For decades, New Jersey used breathalyzer instruments, but those devices would eventually "become technologically outdated, with the result that replacement parts are no longer available and the machines themselves, when they fail, cannot be repaired or replaced with like equipment." State v. Chun, 194 N.J. 54, 64 (2008). "Faced with an increasingly difficult situation, the Attorney General's office began to consider alternate devices to use for breath-testing purposes." Ibid.

To replace the breathalyzer, the Attorney General's office selected the Alcotest 7110. Ibid. The Alcotest is a breath-testing instrument, manufactured and marketed by Draeger Safety

Diagnostics Inc. (Draeger). The Alcotest was approved as a method of chemical breath testing by the Attorney General pursuant to N.J.A.C. 13:51-3.5 and was first utilized in New Jersey in December 2000 as part of a year-long pilot project in Pennsauken, Camden County. See State v. Foley, 370 N.J. Super. 341, 345 (Law Div. 2003).

The scientific reliability of the Alcotest was addressed by the Law Division judge in Foley, following an application by the Camden County Prosecutor for a consolidated joint proof hearing as to numerous cases pending in Pennsauken. Ibid. On December 12, 2003, the Foley court found that "[t]he reportable readings produced by the 7110 within the established tolerances are scientifically accurate and reliable and therefore will be admitted into evidence without the need for expert testimony," with the qualification that "no person who delivers a breath sample of at least .5 liters may be charged with refusal." Id. at 359. The Foley court focused primarily on (1) the "infrared (IR) absorption analysis and electrochemical (EC) cell technology analysis" used by the instrument to measure ethanol in a breath sample, and (2) the "breath testing sequence" used by the police when administering a breath test to an individual subject. The Foley court did not discuss the process involved in placing an instrument into service or performing periodic

calibration checks, and it is not clear whether any information on this issue was presented to the court.

Following the Foley decision, the Alcotest instrument was utilized county-wide in Middlesex County and in some municipalities in other counties, and Draeger created revised firmware[2] for use in the instrument. Chun, 194 N.J. at 66. When twenty defendants charged in various Middlesex County municipalities with driving while intoxicated challenged the admissibility of the Alcotest results in their respective proceedings, (1) the Law Division consolidated the matters and denied the State's motion to recognize Foley as binding authority, (2) the Appellate Division granted the State's motion for leave to appeal, and (3) the Supreme Court certified the pending appeal pursuant to Rule 2:12-1. Id. at 67.

By order dated December 14, 2005, the Supreme Court remanded the Chun matter to a Special Master, retired Appellate Division Presiding Judge Michael Patrick King, to conduct a plenary hearing on the reliability of Alcotest breath instruments. Ibid. Judge King heard testimony over the course of four months and, on February 13, 2007, issued a report

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[2] Brian Shaffer, a technical specialist at Draeger, testified that "firmware" is "software that is employed to run on a specific hardware" as opposed to "many different types of hardware" (9T58).

concluding that the Alcotest is generally scientifically reliable, but recommending that several changes be incorporated (King SMR).[3] Id. at 69. Following a remand and additional hearings to address firmware-related evidence that was not before the Special Master in the original hearings, Judge King issued a supplemental report on November 8, 2007, making some further recommendations but concluding that the additional evidence presented did not alter his finding that the Alcotest is scientifically reliable (King SMR II). Id. at 70. The firmware being utilized at the time of the Chun decision was "New Jersey Firmware version 3.11." Id. at 82. That same firmware version is being utilized today (10T129).[4]

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[3] Judge King's initial report can be found at State v. Chun, 2007 N.J.LEXIS 39 (Feb. 13, 2007); however, the pagination of the online version differs from the original report. The cites herein are to the original.

[4] Pb = State's Proposed Findings of Fact and Conclusions of Law
Db = Defendant's Proposed Findings of Fact and Conclusions of Law
Rb = Reisig's letter joining defendant's filing
Ab = New Jersey Bar Association's Proposed Findings of Fact and Conclusions of Law
Mb = Menzel's Proposed Findings of Fact and Conclusions of Law
1T = transcript of July 13, 2017 conference
2T = transcript of August 17, 2017 conference
3T = transcript of September 19, 2017 conference
4T = transcript of October 12, 2017 conference
5T = transcript of November 2, 2017 conference
6T = transcript of December 14, 2017 demonstration
7T = transcript of January 3, 2018 hearing

On March 17, 2008, adopting most but not all of Judge King's recommendations, the Supreme Court held, "We have no doubt that the device, with the safeguards we have required, is sufficiently scientifically reliable that its reports may be admitted in evidence." Id. at 148.

The dispute in Chun centered primarily on the defense position that the scientific theory behind all breath test results was flawed, so the Alcotest could not accurately determine BAC even if functioning properly (King SMR at 204-05;213-22). In addition, the defendants raised concerns that the source code underlying the Alcotest firmware was unnecessarily complex, contained numerous errors, and had not

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8T = transcript of January 5, 2018 hearing
9T = transcript of January 8, 2018 hearing
10T = transcript of January 9, 2018 hearing
11T = transcript of January 10, 2018 hearing
12T = transcript of January 11, 2018 hearing
13T = transcript of January 16, 2018 hearing
14T = transcript of January 17, 2018 hearing
15T = transcript of January 18, 2018 hearing
16T = transcript of January 22, 2018 hearing
17T = transcript of January 24, 2018 hearing
18T = transcript of January 30, 2018 hearing
19T = transcript of March 22, 2018 oral argument

been developed in accordance with any recognized standards (King SMR II at 36-52).

Evidence regarding the process central to the current dispute, namely the semi-annual calibration check process, was presented to Judge King during the Chun hearings, but it was not litigated in detail and the defendants did not dispute the sufficiency of that process as described by State witnesses.[5] Dr. Thomas A. Brettell, Director of the Office of Forensic Sciences for the New Jersey State Police (OFS) from 2001 to March 2007, testified in the Chun hearings that he was involved in selecting the Alcotest device over other devices, and he "set up the policies and procedures on the instrument" (Chun 34T14-34T16;36T69;36T76;41T60;52T42).[6] He testified that his "recommendations for the calibration testing and checking linearity, that's all part of the quality control program" (Chun 44T81).

No written calibration check procedure was made part of the record in Chun, although Brettell testified generally about the

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[5] Because the calibration check procedures are at the center of the issue before me, specifically whether skipping a step in those procedures undermines or calls into question the scientific reliability of later breath tests performed on the instrument, a detailed description of those procedures is included in Section II(C).

[6] "Chun" transcript cites refer to the transcripts listed in Appendix A to the King SMR.

procedure and Kevin M. Flanagan, a Sergeant with the New Jersey State Police (NJSP) who trained and supervised the coordinators at the time of the Chun hearings, testified about the procedures in more detail (Chun 36T72-36T73;52T6-52T11;54T20-54T29;55T64-55T68;57T5-57T6; King SMR at 45).

Both Brettell and Flanagan testified generally regarding the use of the Ertco-Hart digital thermometer in the calibration check process. Brettell noted that the Ertco-Hart thermometer is a "NIST traceable thermometer" used only by coordinators (Chun 36T72-36T73). Flanagan testified that the Ertco-Hart thermometer is an "[e]xternal device that is used" by the coordinators "just corroborating temperature of the simulator prior to it being used on the Alcotest" (Chun 57T5). He testified that the thermometer is "NIST traceable" and the "[c]alibration is checked by Draeger" (Chun 57T5). Brettell acknowledged that the annual calibration certificate for the Ertco-Hart thermometer was one of the "fairly fundamental documents that give information as to the accuracy as defined by New Jersey for each of these units" (Chun 36T73).

Thus, the calibration check process that Brettell developed well prior to the 2006 hearings in Chun became part of the Special Master's recommendation and was adopted by the Supreme Court almost without alteration, except that the calibration

check had to be performed once every six months instead of once a year.

Notwithstanding the absence of dispute regarding the sufficiency of the State's calibration check procedures, the Chun Court clearly regarded the process as critical. The Court noted that its determination of scientific reliability of the Alcotest was "grounded, in part, on our expectation that there will be proof that the particular device" used in a subject's breath test "was in good working order." Id. at 134. The lion's share of that proof comes from documents related to the calibration check process.

The Chun Court noted:

> Calibration of the machines involves attaching the machine to an external simulator which uses a variety of solutions of known alcohol concentrations to create vapors that approximate human breath. By exposing the IR and EC mechanisms to these differing concentrations, and by analyzing the device's ability to identify accurately each of those samples within the acceptable range of tolerance, referred to as a linearity test, the coordinator is able to ensure that the machine is correctly calibrated.
>
> [Id. at 84.]

The foundational documents that the Chun Court held "need to be entered into evidence" in each case to demonstrate the good working order of the instrument are the "most recent

calibration report prior to a defendant's test . . . and the credentials of the coordinator who performed the calibration," together with the most recent new standard solution report prior to a defendant's test, and the certificate of analysis of the 0.10 simulator solution used in a defendant's control tests (key foundational documents). Id. at 145. The Court also identified nine other categories of foundational documents that must be produced in discovery because they "are part and parcel of ensuring that the machine is in good working order," although their admission is not routinely required (discovery foundational documents). Id. at 135, 144-45. All but one of the discovery foundational documents are certificates attesting to the accuracy of equipment or solutions used during the calibration check process. Ibid. The other discovery foundational document is the new standard solution report generated at the end of the calibration check process. Ibid.[7] Thus, documents generated by or related to the calibration check process are essential in establishing the good working order of the Alcotest.

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[7] In some cases, this report might be the "most recent new standard solution report prior to a defendant's test" and, thus, a key foundational document rather than a discovery foundational document.

A few years after Chun, in State v. Holland, 422 N.J. Super. 185 (App. Div. 2011) (Holland I), and State v. Holland, 423 N.J. Super. 309 (App. Div. 2011) (Holland II), the Appellate Division addressed the State's change from the Ertco-Hart thermometer to a thermometer manufactured by Control Company.

Evidence in this case shows that, in December 2008, the OFS evaluated the requirements for a thermometer to use in the calibration check process. A December 23, 2008 memo from Dr. Howard J. Baum, then-Director of the OFS and a witness in both Holland and this case, stated:

> Calibration of the Alcotest 7110 MKIII-C requires accurate temperature determination of the simulator solutions. Currently the ERTCO Hart digital thermometer is used for this purpose. However other digital thermometers will also suffice.
>
> The criteria for acceptability of the digital thermometer are as follows: (1) Traceability to a NIST (National Institute of Standards and Technology) standard; (2) Calibration of the digital thermometer by an accredited laboratory complying with ISO 9001, ISO/IEC 17025, and ANSI/NCSL Z540-1; (3) Use of the digital thermometer between the Calibration Date and the Calibration Due (Expiration) Date; (4) Resolution of at least 0.01°C; (5) Accuracy of at least ±1°C between 0.0 to 100.0°C.
>
> Since a digital thermometer from VWR (Model 61220-601) and a digital thermometer from Control Company (Model 4000) meet or exceed

> the criteria listed above, they are acceptable for temperature determination.
>
> [S-10C;D-2.]

The OFS selected a NIST-traceable digital thermometer manufactured by Control Company (CC thermometer).

In Holland, two defendants challenged the sufficiency of the State's foundational proofs as to the Alcotest instruments used in their respective breath tests because the State had provided a Control Company "Traceable Certificate of Calibration for Digital Thermometer" rather than the "Draeger Safety, Ertco-Hart Digital Temperature Measuring System Report of Calibration, NIST traceability" that was identified as a foundational document in Chun. Holland I, 422 N.J. Super. at 193-94. The Holland I court held that using a non-Ertco-Hart thermometer during the calibration process did not necessarily violate the Chun Court's strictures, and it remanded for a finding as to whether the CC thermometer was comparable to the Ertco-Hart thermometer. Id. at 200.

On remand, the Law Division judge conducted a three-day hearing and concluded that the CC thermometer was comparable in all material respects to the Ertco-Hart thermometer. Holland II, 423 N.J. Super. at 312. The Appellate Division agreed and held that the Control Company certificates produced in the defendants' cases were "facially valid and satisfie[d] the

requirements as a foundational document as required by Chun." Id. at 319.

In 2013, the Supreme Court addressed certain firmware revisions ordered in Chun that had not yet been implemented. State v. Chun, 215 N.J. 489, 492 (2013) (Chun II). As relevant here, the ordered revisions to the firmware would have included, on the documents generated during each calibration check, (1) the "serial number of the Ertco-Hart digital temperature measuring system utilized," and (2) "the temperature probe serial number and value" for both the black key and agency probe. Chun, 194 N.J. at 152. These revisions were never made to the firmware, and the Chun II Court excused the State from complying with these and other firmware revisions that had been contemplated.[8]

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[8] The record in Chun and this case establish that even though the firmware was not altered, the serial numbers for the NIST-traceable thermometer and temperature probes used during a calibration check have been recorded by hand from about April 2006 onward. On April 3, 2006, Stephen H. Monson, D.A.G., circulated a memo to the head of the ADTU entitled "Legal Advice: Alcotest 7110 MK III-C, Temperature Probe Documentation" (April 2006 memo), (1) noting that, because the instrument itself did not record and print out "the serial number and probe value of any specific probe" used, "some defense counsel" were arguing that the absence of this information was a basis "to exclude otherwise valid chemical breath test results," (2) opining that "such a claim is wholly lacking in both factual and legal merit," but (3) nevertheless recommending as "a temporary course of corrective action" that the serial numbers for the NIST –traceable thermometer and both temperature probes

B. State v. Cassidy background and procedural history.

Marc W. Dennis was a coordinator in the New Jersey State Police's Alcohol Drug Testing Unit (ADTU), and in that capacity he performed semi-annual calibrations on Alcotests over the course of seven years in municipalities in five counties, specifically Middlesex, Monmouth, Ocean, Somerset, and Union (Honig Cert. at ¶ 3).[9]

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be hand-printed on the documents generated during the calibration process (D-16).

Then, when Flanagan testified in Chun in November and December 2006, he noted the "interim policy" was to record temperature probe serial numbers by hand, and that the "intention with the next firmware upgrade" was to have the calibration records report "the probe serial number and the probe value" and "the Ertco-Hart serial number" (Chun 53T36;60T24).

On March 3, 2013, Dr. Ali M. Alaouie sent a memo to the head of the ADTU, referencing the April 2006 memo and requiring coordinators to use papers for the calibration documents with the words "Black Key Temperature Probe Serial," Digital NIST Temperature Measuring System Serial," and "Temperature Probe Serial Number" pre-printed, together with a blank on which the coordinator can record the respective serial number (D-15). The format with the pre-printed pages remains in use, as demonstrated by Klimik (S-1M).

Although the probe value does not appear on the calibration documents, the probe value for each probe is written on the Draeger certificate of accuracy for that probe, and these certificates are included in discovery materials.

[9] Certification by Elie Honig, Director of the Division of Criminal Justice, in Support of Motion for Direct Certification, Relaxation of Court Rules, Notice to the Bar, and Appointment of Special Master, dated October 17, 2016.

On September 19, 2016, Dennis was charged with violations of N.J.S.A. 2C:28-7(a)(1) (tampering with public records or information) and N.J.S.A. 2C:21-4(a) (falsifying or tampering with records) (Honig Cert. at ¶ 2;S-4;S-4A). The complaint stated that Dennis did:

> KNOWINGLY MAKE A FALSE ENTRY IN A RECORD BELONGING TO, OR RECEIVED OR KEPT BY THE GOVERNMENT FOR INFORMATION OR RECORD, THAT BEING AN ALCOTEST 7110 CALIBRATION RECORD AND CERTIFICATE REQUIRING A SIGNED TRUE STATEMENT THAT CALIBRATION CHECKS WERE PERFORMED CONSISTENT WITH THE CALIBRATION CHECK PROCEDURE FOR ALCOTEST 7110 AS ESTABLISHED BY THE CHIEF FORENSIC SCIENTIST OF THE DIVISION OF STATE POLICE, WHEN HE HAD NOT PERFORMED THE PROCEDURE CONSISTENT WITH THOSE STANDARDS, WITH THE PURPOSE TO DEFRAUD OR INJURE ANYONE, IN VIOLATION OF N.J.S.A. 2C:28-7A(1) (A THIRD DEGREE CRIME).
>
> UTTER A WRITING OR RECORD KNOWING THAT IT CONTAINED A FALSE STATEMENT OR INFORMATION WITH PURPOSE TO DECEIVE OR INJURE ANYONE OR TO CONCEAL A WRONGDOING, THAT BEING AN ALCOTEST 7110 CALIBRATION RECORD AND CERTIFICATE REQUIRING A SIGNED TRUE STATEMENT THAT CALIBRATION CHECKS WERE PERFORMED CONSISTENT WITH THE CALIBRATION CHECK PROCEDURE FOR ALCOTEST 7110 AS ESTABLISHED BY THE CHIEF FORENSIC SCIENTIST OF THE DIVISION OF STATE POLICE, WHEN HE HAD NOT PERFORMED THE PROCEDURE CONSISTENT WITH THOSE STANDARDS, IN VIOLATION OF N.J.S.A. 2C:21-4A (A FOURTH DEGREE CRIME).
>
> [Exhibit A to Honig Cert.]

Specifically, the State alleges that Dennis "failed to use the NIST-traceable digital thermometer prior to starting the

calibration" of Alcotest instruments in Asbury Park City, Long Branch City, and Marlboro Township on October 6 and 7, 2015, but that he nevertheless certified that "[p]ursuant to and consistent with the current 'Calibration Check Procedure for the Alcotest 7100MKIII-C' as established by the Chief Forensic Scientist, I performed a calibration check on the approved instrument identified on this certificate" (Honig Cert. at ¶¶ 5-6;S-4;S-4A).

Dennis was indicted on December 14, 2016, and a superseding indictment was returned on June 27, 2017, charging him with one count of third-degree tampering with public records and one count of fourth-degree falsifying records (S-4;S-4A).[10] Dennis's criminal proceeding is ongoing.

On September 8, 2016, about eleven months after Dennis allegedly failed to use the NIST-traceable digital thermometer when calibrating three specific Alcotest devices, and eleven days before he was formally charged with a crime for that failure, defendant Eileen Cassidy pled guilty in Spring Lake Municipal Court to driving under the influence (Honig Cert. at Exhibit D). Although it was not one of the three Alcotest devices giving rise to the charges against Dennis, the device on

[10] The original indictment also contained a count of second-degree official misconduct, in violation of N.J.S.A. 2C:30-2, but that count was dismissed (S-4).

which Cassidy had provided an evidential breath sample had also been calibrated by Dennis, and he certified that he had followed the established procedure in performing that calibration (Honig Cert. at Exhibit D; Appendix IV at ¶¶ 3-9).

On September 19, 2016, the same day that Dennis was criminally charged, Elie Honig, the Director of the Division of Criminal Justice of the New Jersey Attorney General's Office, wrote to the Honorable Glenn Grant, Acting Director of the Administrative Office of the Courts (AOC), advising the AOC of the charges against Dennis and the basis for them (AOC letter). Honig questioned the scientific necessity of the NIST-traceable digital thermometer step in the established procedure, but acknowledged that the step was required by the Supreme Court pursuant to Chun. Without referencing any particular case, Honig stated that "[t]he State therefore anticipates that additional legal challenges may be filed regarding the results of any Alcotest instrument that had been calibrated in the past by Dennis" as to some of the "identified 20,667 individuals who provided evidential breath samples on those instruments." Honig stated that "[g]iven potential legal challenges and the underlying scientific nature of any potential challenges" the Supreme Court should "issue a Notice to the Bar and appoint a

Special Master to handle any litigation arising from the circumstances set forth in this letter."

One week later, on September 26, 2016, based on the revelation of the criminal charges against Dennis and the AOC letter, Cassidy moved in Spring Lake Municipal Court to withdraw and vacate the guilty plea she had entered earlier that month (Honig Cert. at ¶ 12, Exhibit D).

On October 4, 2016, Judge Grant advised the State that he had reviewed the AOC letter but that a request for a special master should be made directly to the Supreme Court through "an appropriate action; for instance, direct certification."

On October 17, 2016, the State applied to the Supreme Court to (1) take direct certification of Cassidy's municipal court motion to vacate, and (2) appoint a special master. The State referenced Cassidy's specific case, but then stated:

> The State anticipates that many additional legal challenges will be filed regarding breath test results from Alcotest instruments that were calibrated by Dennis. As a coordinator for over seven years, Dennis calibrated instruments in Middlesex, Monmouth, Ocean, Somerset, and Union Counties. The State has identified 20,667 individuals who provided evidential breath samples on those instruments. Underscoring any potential legal challenge to the evidential breath samples provided will be the same scientific issue as that presented in the captioned matter: whether the failure to use a NIST-traceable digital thermometer prior to beginning the

> calibration of the Alcotest instruments undermined the scientific reliability of the instrument.

The State argued that direct certification and appointment of a special master would result in "a clear scientific ruling at the outset" that would "provide immediate guidance to municipal courts concerning the underlying scientific issue" and would "ensure predictable, uniform results throughout the State."

As to Cassidy, the State has stipulated that, on July 10, 2015, Dennis recalibrated the Alcotest 7110 on which she provided a breath sample (Appendix IV at ¶3). The State has also stipulated:

> It cannot be corroborated whether Sgt. Dennis checked the temperature of the simulator solutions with the Control Company NIST-traceable digital thermometer after allowing the simulators to heat to the required temperature prior to beginning the recalibration of Spring Lake Borough's Alcotest instrument with Serial Number ARXB-0076 as is required by the Calibration Protocol.
>
> [Appendix IV at ¶ 6.]

On October 31, 2016, Cassidy opposed direct certification and the appointment of a special master.

On November 10, 2016, the Court invited the New Jersey State Bar Association (NJSBA), the Association of Criminal Defense Lawyers of New Jersey, and four attorneys who had

represented defendants in Chun to submit a response to the State's pending motions, noting that "some of the relief requested by the State may implicate the application of certain aspects of the Court's judgment" in Chun. On January 19, 2017, the Court invited the same entities and attorneys, as well as parties in the Cassidy matter, to "submit written recommendations regarding the scope of the tasks to be performed by a special master, should the Court determine to appoint one."

On April 7, 2017, the Supreme Court largely granted the State's motion and appointed me to sit as Special Master, ordering, in pertinent part:

> ORDERED that the matter is remanded to the Special Master who will consider and decide the following question, along with any other questions that the Special Master, in his discretion, deems relevant to the undertaking: "Does the failure to test the simulator solutions with the NIST-traceable digital thermometer before calibrating an Alcotest machine undermine or call into question the scientific reliability of breath tests subsequently performed on the Alcotest machine?"
>
> [Appendix I.]

The Court also set May 8, 2017, as the deadline for all motions for participation in the remand, and it left it to me to "determine the extent of participation of any person or entity in addition to the State and defendant." I received and granted motions to participate in the remand from the NJSBA and three of

the attorneys who had been counsel in Chun, specifically Samuel Louis Sachs, Matthew W. Reisig, and John Menzel.

I held five case management conferences between July and November 2017 and addressed various motions and discovery disputes.

On July 27, 2017, the State filed a motion asking me to enter an order "directing the State to provide notice to the 20,667 individuals referenced in the State's motion to appoint a Special Master." I denied the motion as beyond the scope of the authority granted to me in the Court's order appointing me a Special Master, noting, however, that "[t]he denial of this motion in no way impairs the ability of the State, if it chooses, to identify the potentially affected individuals or to furnish them with individual notice." The State subsequently provided notice to potentially affected individuals.

On September 15, 2017, Cassidy filed a "Motion to Declare Defendant as Indigent to Enable Defendant to apply to the Office of the Public Defender for Ancillary Services for the Cost of the Fees for the Defense Experts in This Matter, Pursuant to N.J.S.A. 2A:158A-1." Four days later, Cassidy filed an amended motion seeking expert fees and costs from "the State or the Office of the Public Defender" (motion for expert fees). On October 19, 2017, I issued a decision and order granting

defendant's motion to compel the State to pay the costs of defense experts.

On October 17, 2017, the State moved for a stay of proceedings in other courts that raise issues potentially affected by the Supreme Court's ultimate determination in this case (Dennis cases). On November 2, 2017, I entered an order generally staying Dennis cases. On November 28, 2017, I entered a supplemental order providing that the prosecutor has the affirmative obligation to determine whether a pending proceeding is a Dennis case.

Discovery disputes included obtaining and reviewing in camera both Marc Dennis's personnel file and the discovery in his pending criminal matter, and determining which materials could be disseminated to counsel, subject to a protective order.

At the final case management conference of November 2, 2017, I scheduled the hearing to begin on Monday, December 4, 2017. However, over the Thanksgiving holiday, the State delivered a late discovery submission, containing new and voluminous materials. All defense counsel strenuously objected to the use of these materials at the hearing. They asked that either the material be barred or, alternatively, a thirty-day adjournment be granted to allow them and their experts time to analyze and be prepared to effectively deal with the materials

at the hearing. The State did not object to a thirty-day adjournment, and I chose that as the appropriate relief.

I therefore adjourned commencement of testimony by experts until January 3, 2018, and I scheduled an in-court demonstration by a coordinator of an Alcotest calibration check procedure to be held on December 14, 2017. On that date, the State presented Trooper David Klimik, who demonstrated a calibration check procedure and testified in detail regarding the process.

Beginning on January 3, 2018 and ending on January 22, 2018, the State presented four expert witnesses: Brettell; Shaffer; Baum, Director of the OFS from March 2008 until June 2017; and Alaouie, a research scientist at the OFS.

The State had also provided a report from Dr. Fiona Couper of Washington State. However, despite numerous efforts by the court and the parties to accommodate Couper's schedule, the State was unable to produce her for live testimony. The State requested that she be permitted to testify by electronic means through a video teleconference. Defendant opposed this procedure on the grounds that it would violate her confrontation rights under the United States and New Jersey Constitutions. I agreed with defendant's position and, by decision and order dated December 28, 2017, held that the State would need to

produce Couper live in court if it wanted to rely on her testimony. Couper did not appear.

Defendant produced one expert, Andreas Stolz, from Michigan State University, who testified on January 24, 2018. Defendant had also provided expert reports from two additional experts, but chose not to call them.

I dealt with evidence issues on January 30, 2018, and the parties and participating counsel submitted proposed findings of fact and conclusions of law on March 5, 2018. At my request, counsel appeared for limited oral argument on March 22, 2018.

C. The calibration check process

The calibration check performed on the Alcotest by a coordinator from the ADTU of the NJSP is essential to establishing that an instrument is in good working order. See N.J.A.C. 13:51-4.3(b) (requiring that each Alcotest instrument in use in New Jersey undergo a calibration check performed by a coordinator when placed into service initially or following repair, within 182 days of the last calibration check, or at any time that a coordinator considers it "necessary or otherwise appropriate"). N.J.A.C. 13:51-2.1 and -2.2 specify the requirements and qualifications for a member of the NJSP to become a coordinator, including "the knowledge to properly perform . . . calibration of approved instruments," but the

regulations do not describe the specific procedures a coordinator should use for a calibration check.

No prior case in New Jersey has explored details of the periodic calibration process and its relationship to the essential element of proof that the particular instrument in question was in good working order. In Chun, the Court noted the importance of the process and the documents generated by it, but the specifics of the procedure were not in dispute. The Holland court addressed the process in somewhat more detail but, again, the details of the procedure and the importance of each component of it were not in dispute. Here, the importance and necessity of the NIST-traceable thermometer step is directly in issue. Because an understanding of the full calibration check process is essential to understanding the necessity of the NIST-traceable thermometer step, I address that process in detail.

Brettell developed the calibration check procedures for the instrument, and the written "Calibration Check Procedure for Alcotest 7110 MK III-C," admitted into evidence as S-32, was drafted by Brettell (Calibration Check Procedure) (7T15;7T63-7T65). The document was last revised on December 13, 2004, and the procedures it delineates are still applicable to calibration checks performed by ADTU coordinators today. Brettell could not recall how many versions preceded the final version in 2004 or

when the first version was drafted, but he thought there had been fewer than five revisions (7T100-7T103). The first version must have been drafted by December 2000, which is when the Alcotest pilot program began in Pennsauken. The requirement for a NIST-traceable thermometer was in every revision (7T104).

After performing a calibration check on a specific instrument, the coordinator signs a certification, attesting, in pertinent part:

> Pursuant to, and consistent with, the current "Calibration Check Procedure for Alcotest 7110," as established by the Chief Forensic Scientist of the Division of State Police, I performed a calibration Check on the approved instrument identified on this certificate. The results of my Calibration Check are recorded on this certificate, which consists of two parts on two pages: Part I – Control Tests; and Part II – Linearity Tests. I certify that the foregoing statements made by me are true. I am aware that if any of the foregoing statements made by me are willfully false, I am subject to punishment.
>
> [S-1M.]

The Calibration Check Procedure contains six numbered paragraphs (S-32). The NIST-traceable thermometer requirement at issue in this case is referenced in paragraphs one and two, which provide:

> 1) For purposes of these procedures, the CU34 Simulator will be referenced as a "Calibrating Unit." All references to "Alcotest 7110" are intended to

indicate the Alcotest 7110 MK III or MK III-C. The Agency's Calibrating Unit will be prepared with a new bottle of 0.10% solution from a lot certified by the Chief Forensic Scientist, or qualified designee, which will be run as a control. At the same time, a second Calibrating Unit will be prepared with a new bottle of 0.04% solution certified by the Chief Forensic Scientist, or qualified designee, a third Calibrating Unit will be prepared with a new bottle of 0.08% solution certified by the Chief Forensic Scientist, or qualified designee, and a fourth Calibrating Unit will be prepared with a new bottle of 0.16% solution certified by the Chief Forensic Scientist, or qualified designee. These will be run as a quality assurance and linearity check. Ensure that each Calibrating Unit is appropriately marked with the concentration contained therein and sealed with a plug or temperature probe and tygon loop to seal inlet and outlet. Allow all three Calibrating Units to heat for 1 hour and then check the simulator temperatures with a NIST traceable thermometer. Temperatures must be 34 degrees Celsius plus or minus 0.2 degrees. Connect the keyed "coordinator's probe" to the Alcotest 7110 and use the "PROBE" function to "ADJUST" to the correct "probe value".

2) Attach the 0.10% Calibrating Unit to introduce a vapor sample directly to the cuvette. The "coordinator's keyed" temperature probe should be inserted in the rubber grommet of the Calibrating Unit. Verify that the temperature of the Calibrating Unit is 34.0 degrees Celsius plus or minus 0.2 degrees, by checking with the NIST thermometer. Use the "CALIBRATE" function to perform

> a calibration of the unit. Follow the Alcotest 7110's prompts to enter data for the Operator, Calibrating Unit, and Solution. Upon completion of data entry, the Alcotest 7110 will obtain a vapor sample from the Calibrating Unit and will adjust its calibration based on this "Known Standard." This process will output the "Alcotest 7110 Calibration report."

[S-32 (emphasis added).]

When questioned about developing the Calibration Check Procedure, Brettell said, "I put the steps in there to lay out the best possible calibration of the Alcotest instrument in my mind" (7T105). On cross-examination, Brettell was pressed on whether each and every step was scientifically necessary. I then interjected with the following:

> THE COURT: Can you answer that directly? Do you have a direct answer for that question?
>
> THE WITNESS: He's using the word "necessary" and I don't really want to use that word, because I don't think it's a scientific word.
>
> Q. Reliable, do you like that word? How about reliable?
>
> THE COURT: Were they collectively scientifically necessary, as opposed to parsing one against the other?
>
> THE WITNESS: Collectively, they are requirements that would be necessary for calibrating the instrument, yes.
>
> THE COURT: Scientifically?

THE WITNESS: Scientifically.

THE COURT: To ensure scientific reliability?

THE WITNESS: Yes.

[7T106-1 to 18].

On December 14, 2017, ADTU coordinator Klimik appeared as a witness for the State and gave a demonstration of a calibration check from beginning to end (6T). Coordinators such as Klimik are tasked with calibrating designated Alcotest instruments in municipalities in a particular region. Typically, each coordinator performs two calibration checks per day, four days per week (6T160).

Klimik demonstrated and explained each step of the calibration check process in detail, also answering questions from counsel and from me (6T).

He explained that, as a coordinator, he is assigned certain equipment that he brings with him and uses at each calibration check he performs. This equipment consists of (1) three CU34 simulators, (2) a black key temperature probe, and (3) a CC thermometer[11] (6T18;S-1B;S-1C;S-1E;S-1G;S-1I;S-1J;S-1K). He also

[11] As noted above, when Chun was decided, the NIST-traceable digital thermometer used by coordinators was manufactured by Erto-Hart. (Chun, 194 N.J. at 152;King SMR 139). In Holland, 423 N.J. Super. at 312, the Appellate Division held that the CC

brings with him (1) bottles of simulator solution with concentrations of 0.04, 0.08, 0.10, and 0.16, and (2) a power strip to use for his CU34 simulators (6T20;6T31;S-1D;S-1A;S-1F;S-1H;S-1L).

The police station or agency that operates the particular Alcotest to be tested supplies, for the calibration check, (1) the instrument itself, (2) one CU34, and (3) an agency temperature probe. The agency also maintains a supply of bottles of simulator solution with a concentration of 0.10, one of which the coordinator uses at the end of the calibration check process for a solution change.

A CU34, also known as a calibrating unit or a simulator, is a device manufactured by Draeger that accompanies, but is separate from, the Alcotest itself. The CU34 holds about a half liter of liquid, and it resembles a mason jar with a black top that contains a motor, microprocessor, and other components (9T120;S-1B;S-1E;S-1G;S-1I). The CU34 top plugs into a power source and, on the underside extending into the simulator solution, it contains a propeller, heat source, and attached probe to measure and maintain the temperature of the solution within the CU34 (9T120-9T121). The top also has a hole through

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thermometer "is comparable in all material respects to the Ertco-Hart digital thermometer."

which the black key probe, agency probe, or NIST thermometer will fit when being used by the coordinator. A CU34 does not have a gauge, screen, or other device that displays the temperature of the solution inside. Each CU34 is returned annually to Draeger for recertification.

As Brettell testified:

> The simulator, which is the calibrating unit for the Alcotest instruments, is an independent component. It sits outside the instrument. And all of the readings that the Alcotest takes are based upon that calibrating unit working properly.
>
> It has to heat up the standard solution to 34 degrees, plus or minus .2. And if it doesn't, the instrument will not be in calibration. So it's very, very important for the calibrating unit to operate properly, to be working properly.
>
> [7T89-15 to 24.]

The CU34 is a "wet bath" simulator, meaning that it uses liquid, known as simulator solution, rather than dry gas. Simulator solution is water-based and has a "known concentration of ethanol" (15T192).

New Jersey purchases the simulator solution through Draeger from a non-Draeger vendor that provides the solution in lots of 1400 bottles (15T75;15T194). The vendor sends "the first two bottles, the last two bottles, and four bottles from the middle"

of each lot to the OFS for analysis (15T75-15T76).[12] If the solutions pass the test criteria, the OFS issues a certificate and approves the lot for purchase by the State Police or other agencies (15T76;15T192-15T195;15T229-15T230).

The CU34 and simulator solution utilize the principle of "Henry's law," which the Supreme Court has explained as follows:

> Henry's law, in physical chemistry, states that when a liquid that contains a volatile substance, such as alcohol, makes contact with air in a closed container and at a known temperature, a certain amount of alcohol will escape into the air space above in the form of vapor. The rate at which the alcohol vaporizes will depend on the concentration of the alcohol in the liquid and on the temperature. The higher the temperature, the more alcohol will escape to the vapor. When there is a fixed temperature and concentration of alcohol, a state of equilibrium will result in which the amounts of alcohol in air and liquid are static.
>
> [State v. Downie, 117 N.J. 450, 459 (1990).]

See also King SMR at 163 ("Henry's law states that in a closed system and at a given temperature, there is a fixed ratio between a volatile substance, such as alcohol, in a liquid and the same volatile substance in a gas.").

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[12] At the time of the Chun hearings, the solution was purchased in lots of 1000 bottles, of which six were tested by the OFS (King SMR at 46, 108-09).

The concentration of each simulator solution used by the coordinator during the calibration check, 0.04, 0.08, 0.10, and 0.16, is such that, when the solution is heated to 34°C, plus or minus a tolerance of .2°C, and allowed to reach equilibrium, the air between the top of the liquid and the bottom of the CU34 lid, known as the headspace, will contain ethanol molecules of the stated concentration, within a specified tolerance.

During each calibration check, the coordinator uses two temperature probes that plug into the back of the Alcotest instrument, the black key probe assigned to the coordinator and the agency probe used by the agency for breath tests and solution changes between calibration checks. These probes have "a special kind of resister" that has "physical properties that change depending on temperature" (9T118). When the "key" end of a temperature probe is plugged into the instrument and the metal probe end is immersed in the simulator solution, the instrument "goes into a calculation that resolves and reports degree Celsius temperature" (9T118).

"For the purposes of measuring temperature there's no difference" between the black key probe and the agency probe (9T128). The difference is that the black key probe has a "few additional components which establish access rights for the person with this key to get at more menu functions" (9T128).

The only function that can be accessed with an agency probe is "Time" (6T70). Both types of probes are tested and recertified annually by Draeger (6T45-6T46;9T128).

When tested by Draeger at each annual recertification, the specific resistance of each temperature probe is determined at 34°C and, based on that resistance, the probe is assigned a probe value between 92 and 108 (6T43). Sometimes the probe value changes for a specific temperature probe, meaning that a probe could be returned by Draeger after recertification with a different probe value than that same probe had previously (6T44). This change is sometimes referred to as probe value drift.

Shaffer explained that a Draeger temperature probe "can't record temperature," but that:

> It's using a—as a sensor for the temperature it's using what they call a—it's a special kind of resister called an NTC, Nancy, Tom, Charlie, which has physical properties that change depending on temperature.
> And so using that resistance of the probe along with the probe value that's assigned during our certification process, inserting that probe into the instrument itself, together it goes into a calculation that resolves and reports degree Celsius temperature.
>
> [9T117-25 to 9T118-10.]

Stolz explained that probe value is "just a parameter" assigned to a probe by Draeger in its annual certification

process "to compensate for the differences of the different temperature probes" (17T114). It is not the actual resistance, nor does it reveal the resistance measured by the probe. The probe value goes into the algorithm and is factored into the temperature calculation of the instrument (17T114-17T115). If the probe value is incorrectly inputted into the instrument, the temperature calculation will be incorrect (6T81;7T83;8T127; 10T146;17T115).

The CC thermometer is a separate, hand-held device consisting of a probe to immerse in the simulator solution and a unit that displays a temperature reading (S-1K). The CC thermometer comes in a padded box "to make sure it doesn't get damaged during transport" (6T53). Each CC thermometer is certified for two years (6T61). Because the cost of recertifying a used CC thermometer is about the same as purchasing a new one, the used thermometers are discarded at the end of two years and replaced with new thermometers.

Klimik testified that agencies typically have their Alcotest instruments set up and running, with the agency CU34 attached, twenty-four hours a day (6T151). Thus, when he goes to an agency to perform a calibration check on an instrument in service, as opposed to a new instrument or one returning to service after repair, the first thing he does is detach and

empty the solution in the agency CU34. Once that solution is emptied, the coordinator must either conduct a solution change or complete a calibration check of the instrument before returning the instrument to service (6T114;6T156).

Each agency usually has one CU34 in service and one in reserve. Typically, the coordinator will not perform the calibration check with the same agency simulator that was already in use, but will put into service the agency simulator that is "in a sealed box with the corresponding certificates" following its annual recertification and return from Draeger (6T31-6T32). This is not mandatory, but the goal is to use in the calibration check, and to leave in service at the agency, a simulator with a certification date that extends beyond the next required calibration check (6T33).

The coordinator then prepares the agency CU34, using the bottle of 0.10 simulator solution he brought with him. He checks the seal "two or three times" by blowing into a tube and confirming that bubbles are not escaping from the side of the simulator (6T15-6T16). He then plugs the agency CU34 into the power strip, turns it on, and confirms that "the propeller is spinning and there's an orange light indicator on top of the heater which indicates that the unit is being heated" (6T16).

The coordinator then goes through the same steps to prepare the three CU34 simulators he brought with him, using the 0.04, 0.08, and 0.16 solutions (6T16-6T18;6T20-6T24).

The coordinator writes the serial number of the simulator on the corresponding bottle of solution and records the time on the final solution prepared (6T16;6T24). When the CU34 reaches the proper temperature range according to its internal temperature probe, the orange light begins "turning on and off" to indicate that it has reached and is maintaining the correct temperature (6T25).[13] This usually takes about thirty minutes, but the Calibration Check Procedure requires that coordinators allow each CU34 to heat for a full hour (S-32;6T25;8T123).

While the CU34s are heating, the coordinator will typically do various administrative tasks, such as downloading any data on the instrument since the last automatic weekly download, preparing pages for the discovery that will be produced as part of the calibration check, and confirming several settings that are checked "every time before performing a calibration to ensure that they are at their correct settings," including

[13] The CU34s are designed to reach and maintain a temperature of 34°C, plus or minus a tight tolerance of .02°C; however, the actual temperature of the solution cannot be determined until measured with a separate measuring device.

tolerances and linearity configurations (6T36-6T38;6T45;6T68-6T69).

The coordinator then adjusts the probe value setting in the instrument to the probe value of the black key temperature probe (6T69). The probe value function in the instrument would be set to the probe value of the agency probe when the coordinator arrives, so unless the values of both the agency and black key probes happen to be the same, the coordinator must adjust the probe value function to the probe value of the black key temperature probe before beginning the tests, and then must adjust it back to the probe value of the agency probe before performing a solution change at the end of the process (6T78-6T79;6T142). The probe value that the coordinator enters into the instrument does not print out on any of the reports generated by the calibration, nor is it handwritten by the coordinator (6T71-6T72;6T142).

Once the CU34s have been heating for an hour, the coordinator checks all four simulators with the CC thermometer, which is equipped with a digital read-out screen that reports temperature to three decimal places (6T86-6T87;6T115). Each time, the coordinator inserts the probe portion of the thermometer into the solution, waits about thirty seconds for the temperature reading to "stabilize," and then visually

confirms that the temperature is within the required range of 33.8°C to 34.2°C (6T87-6T88). Klimik noted that the temperature reading on the CC thermometer will continue to fluctuate within a few thousandths of a degree after it has stabilized (6T88). He testified that he will "wipe the temperature probe to ensure that there's no cross-contamination" before moving the CC thermometer from one CU34 to the next (6T88-6T89).

Once the temperatures of all four CU34s have been checked and determined to be within range, the coordinator is then finished with the NIST thermometer for the rest of the process and can return it to its carrying case (6T116;6T119). The temperature readings from the NIST thermometer are not written down or captured anywhere (6T89).

The coordinator will then attach the agency CU34 with the .10 solution to the rear of the instrument and place the black key probe in the solution (6T118-6T120). The coordinator then types in "CALIBRATE" and responds to prompts asking for various information regarding the coordinator and the solution and CU34 being used (6T120). Klimik noted that he and the other coordinators "always review the data, sometimes multiple times" (6T120).

Klimik explained that, during the CALIBRATE function, "[i]t's telling the Alcotest what a .10 solution is supposed to

look like" (6T121;6T125;11T113). The CALIBRATE function is critically important because the standard by which the instrument measures all headspace and breath samples after that point is based on its performance of that function. As Shaffer explained:

> [F]undamentally what's happening inside the instrument during a calibrate function is actually an adjustment. That's where we're telling the sensors inside the instrument, hey, you know what? Whatever you believed before, we're going to introduce a certain concentration to your sensors and I want you to adjust yourself internally so that you read exactly the target concentration that we tell you during this calibrate process.
>
> And so because of that, it's actually in a very sensitive mode at that point. It's being told trust whatever we give you in this particular step. That's a fundamental part of the adjustment process. And so, therefore, if this was wrong, we would just be teaching it wrong. And the instrument would not detect a problem because of the solution alone.
>
> [10T51-20 to 10T52-10 (emphasis added).]

The next step is the Control Test, which is performed with the same CU34 and simulator solution that was used in the CALIBRATE function (6T126-6T127). The purpose of this test, which is repeated three times, is to assure that the instrument had adjusted properly and reports the 0.10 concentration within the allowable tolerance. The control test certification prints

out and the coordinator can proceed to perform the linearity test.

But first, the coordinator will empty the agency CU34 and put a different bottle of .10 solution in to heat for the solution change at the end of the calibration check process (6T133). The .10 solution used by the coordinator to do the CALIBRATE function and control test must be a different lot number from the .10 solution used for the solution change (6T134). Usually, the coordinator brings a bottle of .10 solution to use for the CALIBRATE function and uses a bottle from the agency stores for the solution change.

The next step is the linearity test, which tests each solution in the coordinator's CU34s twice to ensure that the instrument reads the ethanol as within tolerance over a range of concentrations (6T133). The .04 CU34 is used first, then the .08, then the .16 (6T133;6T137-06T138). The black key probe is used throughout the linearity test (6T133;6T137). Klimik stated that he will "triple-check" the results for accuracy, acknowledging that more than one check for accuracy is important (6T139).

Once the linearity test is complete, the coordinator types in the data for a solution change, after which there is a "60-minute lockout" before that solution change can actually be

performed (6T140-6T141). During the data entry for the solution change, the coordinator must adjust the probe value function in the instrument to match the value of the agency probe rather than the black key probe (6T142).

The agency probe is used during the solution change, and during this part of the process, the instrument runs three tests to assure that the instrument measures the new solution within the allowable tolerances, in accordance with the adjustment made during the CALIBRATE function. The results of these tests print on the new standard solution report.

At the end of the calibration check, the coordinator produces "discovery" consisting of (1) "Alcotest 7110 Calibration Record," (2) "Alcotest 7110 Calibration Certificate Part I — Control Tests," (3) "Alcotest 7110 Calibration Certificate Part II — Linearity Tests," (4) "Calibrating Unit New Standard Solution Report," (5) Draeger certificates of accuracy for the four CU34s and two probes used, (6) a certificate of calibration for the CC thermometer, (7) OFS certifications of analysis for the five simulator solutions used, and (8) the coordinator's credentials (S-1M).

III. WITNESSES: QUALIFICATIONS AND ASSESSMENT OF CREDIBILITY

A. State's witnesses

1. Trooper David Klimik

Trooper David Klimik is a NJSP coordinator in the ADTU. As of the time of his testimony, he had been performing this role for nearly three years. He performed a demonstration of the calibration procedure in open court on the first hearing date. He was sworn and answered questions posed to him throughout the demonstration by all counsel and by me. All questions, answers, and colloquy were transcribed (6T), and video recorded. (Exhibit S-42). The demonstration lasted the better part of a full day.

Klimik has received all required training to qualify as a coordinator. See N.J.A.C. 13:51-4.2(a)(1)(ii). Klimik had performed approximately 500 Alcotest calibrations. It was clear from his testimony that Klimik was very well versed in the manner in which the device and all of its component parts operate and with the calibration procedure and the sequence and manner in which all required steps are conducted. He was able to explain what he was doing throughout the procedure and to answer questions about each step. He answered all questions forthrightly and without hesitation. When asked questions that required knowledge of science, computer programming, or the

like, he declined to answer, because such questions were beyond the scope of his knowledge.

Klimik was a very credible witness in all respects.

2. Dr. Thomas A. Brettell

Dr. Thomas A. Brettell received an undergraduate degree in chemistry in 1973 from Drew University, followed by a Master's Degree in chemistry in 1975 from Lehigh University. In 1987, he received a Ph.D. degree in analytical chemistry from Villanova University. He subsequently took additional graduate courses in forensic toxicology and general toxicology.

In 1976, Brettell began what would become a thirty-one year career in the OFS. He began as a forensic chemist and was promoted in January 1980 to the position of Supervising Forensic Scientist. In 1990 he became assistant to the Chief Forensic Scientist. Then, from 1998 to 2001, he was the Chief Forensic Scientist, the highest position in the OFS at that time. From 2001 until his retirement in March of 2007, Brettell served as the first Director of the OFS.

He has subsequently worked as an associate professor of chemistry at Cedar Crest College in Pennsylvania. He has taught both undergraduate and graduate courses in chemistry and forensic science. These courses have included forensic administration, which deals with administering and managing a

crime laboratory. Since his retirement, Brettell has also provided consulting services to the Inspector General's Office of New York State and to the District Attorney's Office in Bucks County, Pennsylvania, regarding the toxicology unit of the crime laboratory in that office.

Brettell holds a number of professional certifications and memberships including the following: Diplomat of the American Board of Criminalistics, Certified Forensic Laboratory Director, Laboratory Accreditation Board (ASCLAD) and Laboratory Inspector, the American Chemical Society, the American Society of Crime Laboratory Directors, the ASCLAD Laboratory Board of Directors, the American Academy for Forensic Scientists, and the Society of Forensic Toxicologists. He has testified more than ninety times as an expert in the courts of New Jersey and Pennsylvania. He provided extensive testimony in Chun.

During his long career in the OFS, Brettell performed a substantial role in the breath testing program and acquired substantial knowledge and expertise in breath testing and breath testing instruments.

Brettell's role with the Alcotest 7110 began when he was assistant to Chief Forensic Scientist Dr. Charles Tindall. They evaluated breath test instruments for purchase for the State of New Jersey to replace the breathalyzer instrument which was then

in use. After evaluating several different products, they recommended the Alcotest 7110. Brettell then took on the responsibility for developing the technical procedures for operating this device and for developing the calibration check procedure for it.

He is the author of the Calibration Check Procedure which is at the heart of this proceeding (S-32). The final revision of that document was effective December 13, 2004, and it remains in effect at this time without alteration. Brettell could not recollect how many previous versions preceded that final revision. He estimated no more than five. The first version must have been in effect by December 2000, when the pilot program for the Alcotest 7110 began in Pennsauken. Brettell testified that every version contained the requirement to test the simulator solutions with a NIST-traceable thermometer before activating the CALIBRATE function during the calibration process.

Brettell was qualified in this proceeding to render expert opinions in the fields of forensic chemistry, forensic toxicology, scientific measuring, and breath testing.

Brettell demonstrated a very high level of knowledge and expertise in the fields for which he was qualified. In particular, he possessed a very high level of knowledge

regarding the Alcotest 7110 instrument and its component parts. He performed the testing and validation of the instrument before finalizing the decision to purchase it. He developed all of the protocols to effectuate necessary scientific safeguards to assure scientific reliability in the breath tests it would produce. The safeguards were incorporated into the Calibration Check Procedure or other protocols in the OFS. Brettell's knowledge of these safeguards, the reasons for them and their importance was clearly superior to that of any other witness who testified in this proceeding.

Brettell answered all questions candidly and forthrightly, regardless of who was asking them. He was very sincere and careful in giving his answers. He displayed a very high level of appreciation for the solemn responsibility he had in selecting a breath testing device and developing scientifically reliable protocols to achieve in the best way possible the highest level of scientific reliability in breath test results. This demonstrated his appreciation, spoken as a scientist, of what lawyers and judges would refer to as the constitutional dimension of the need for breath test results that are sufficiently scientifically reliable to be used for evidential purposes and which, standing alone, constitute proof of guilt beyond a reasonable doubt.

Brettell's testimony was very credible. The facts to which he testified and the opinions he rendered are entitled to very substantial weight.

3. Brian Shaffer

Brian Shaffer is an employee of Draeger. He received a Bachelor of Science degree in engineering in 1992 from the University of Pittsburgh. He holds no post-graduate degrees. He worked in several jobs before being employed by Draeger in 2003.

While employed by Draeger, Shaffer received in-house training regarding breath testing instruments manufactured by Draeger. He also attended the Robert Borkenstein School, taking a one-week seminar for alcohol, and another program for drugs. He also took a Windows CE course dealing with operating systems and designing imbedded systems.

Although Shaffer does not have formal education in computer science or computer programming, and he acknowledges not being trained in computer science, he began his career at Draeger as a software engineer, a position which he held for about nine years. In this role, he collected and managed specifications and requirements from customers and formed those into source codes and algorithms that are placed into firmware. Shaffer explained that breath testing instruments have a basic

firmware that is developed at the factory, in Draeger's case in Germany. Then, customized codes are written to be imbedded in the firmware for each customer, and they are different depending upon the needs of each customer. Shaffer wrote the source codes that customized the Alcotest 7110 for New Jersey's specifications.

In Chun, Shaffer was called by Judge King to testify as both a fact witness and an expert in source code writing regarding the source code customized for New Jersey (King SMR II at 8;14;62). The subjects on which he testified are unrelated to the present case (King SMR II at 62-79).[14]

From 2013 to 2017, Shaffer worked as a "bid and tender manager." In that role, he carried many of the same responsibilities as he had when he was a software engineer, serving as a liaison between the customer and the various internal departments of the company, including the research and development, logistics, service, and legal departments.

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[14] Defendant contends that Shaffer "held the opinion in the Chun litigation that the use of a NIST-traceable thermometer was not necessary" and that "Judge King did not find Mr. Shaffer's opinion persuasive in Chun, as Judge King recommended the use of a NIST-traceable thermometer to the New Jersey Supreme Court, contrary to Mr. Shaffer's opinion" (Db33-Db34). This is incorrect. Shaffer's testimony in Chun related solely to software development, he discussed nothing regarding New Jersey's Calibration Check Procedures or the use of a NIST thermometer, and Judge King found his testimony to be "completely reliable and forthright" (King SMR II at 79).

Since 2017, Shaffer's title has been "Technical Specialist." He is the sole responsible party in the United States to support the Alcotest 7110. That instrument is currently used in New Jersey and Alabama, as well as in a few counties in California.

Shaffer is a "remote" employee, working primarily from his home in Colorado. He occasionally travels to each of the two Draeger locations in Texas, mostly to the service workshop, on average a few times a year. He also travels around the country to trade shows, where he engages in sales activities on Draeger's behalf. He also travels to customer locations to engage in customer relations and provide service support to existing customers, including New Jersey.

Shaffer described the allocation of his work as "about two-thirds sales, one-third would be project management related to the technical aspects of my role" (10T68). Thus, he acknowledged that "two-thirds of [his] time is spent dedicated to making money for Draeger" (10T69). Essentially, Shaffer is the national sales manager for Draeger's breath testing instruments. Most of his time with Draeger is devoted to promoting sales of Draeger products.

Shaffer was primarily a fact witness in this case. It was clear from his voir dire examination that he did not profess to

have expertise in certain relevant areas, and the State made clear that it was not offering him as an expert in those areas. Thus, he was not being offered to give expert testimony in source code writing nor as an expert in the New Jersey calibration check procedure (9T50). Likewise, he was not offered as an expert in traceability (9T79). Although Shaffer stated that he had an understanding of what NIST is and that it provides a nationally recognized standard of measurements, he acknowledged that he had never read the NIST guidelines for traceability (9T77-9T78).

Although the State proffered Shaffer as an expert on the workings of Alcotest 7110, it was limited to "the internal Draeger procedures for testing and certifying the CU34, the black key temperature probe and the agency temperature probes." [9T 88:13-21]. Further, counsel for the State made clear that he was "not offering [Shaffer] as a scientific expert" (9T93). His expertise with regard to the Alcotest 7110 would be limited to his working knowledge from a technical aspect of "the internal Draeger procedures for testing and certifying the CU34, the black key temperature probe, and the agency temperature probes" (9T93). Stated more simply, the State offered Shaffer as an expert with respect to "what does the instrument do" (9T94).

Subject to those limitations, I qualified Shaffer as follows:

> THE COURT: All right. Here's — I'm going to allow this witness to continue to testify with regard to his expertise about the device, instrument itself, the 7110, which he was a participant in the development of the firmware and the refinement of it to its current form.
>
> He can testify about the internal Draeger procedures with which he is familiar as a long-time employee of Draeger, and in his role there for testing and certifying the CU34 units, and the black key temperature probes, and agency probes and what the results of the calibration process, in his opinion, would be with or without the NIST-traceable thermometer being used as an early step in the process. He is qualified, in my view, to give testimony in those regards. Everything else will go to weight.
>
> [9T107-7 to 22.]

Shaffer's level of expertise is clearly limited. His education in electrical engineering does not qualify him to testify as an expert in the fields of chemistry or physics, which drive the issue in this case. There is no dispute that Shaffer is not a scientist and he was not proffered as a scientific expert. His knowledge of breath testing programs and instruments is limited to their technical aspects.

Shaffer's testimony was candid, he was knowledgeable regarding Draeger procedures, and he provided answers without undue evasion or equivocation. However, I further find from his

background, experience and the testimony he gave and the manner in which he gave it, that Shaffer has a built-in bias which serves to favor the State's position. He is a long-time Draeger employee. Having written the source codes for the New Jersey version of the Alcotest 7110, he is invested with defending the firmware and the device itself, when operated in accordance with Draeger's recommendations, without the need for additional safeguards imposed by an end-user, including New Jersey. Based on his employment, he has an interest in defending and promoting these devices as highly desirable for use by governmental entities, which are the present and prospective customers with whom he deals on Draeger's behalf. It is only natural that he would view any additional safeguards, beyond those recommended by Draeger, as not necessary or even important to assure reliability.

When testifying about various additional safeguards Brettell put into the calibration procedure, including but not limited to the use of the NIST-traceable thermometer, Shaffer repeatedly refused to acknowledge their worth or importance, stating instead that they did no harm but they were not necessary. These assertions were at odds with other credible testimony in the case, including from the State's other experts.

Based upon Shaffer's limited educational background, lack of scientific expertise, and his bias in favor of Draeger and its products, including the New Jersey Alcotest 7110 and its firmware, I find Shaffer's credibility to be limited, and I do not attribute high weight to it.

4. Dr. Howard J. Baum

Dr. Howard J. Baum served as the Director of the OFS from March 17, 2008 to his retirement on June 1, 2017. Prior to that, Baum had never been employed by the State of New Jersey in any capacity. His prior professional experience was in the State of New York.

His educational background is as follows: He received a Bachelor of Science degree in biology with a concentration in biochemistry from Cornell University in 1979. In 1986, he received from Brandeis University a Ph.D. degree in biochemistry with a concentration in molecular biology, which is DNA.

Prior to being employed in New Jersey, Baum served as Assistant Director, and eventually Deputy Director, of the Forensic Biology Department of the Office of the Chief Medical Examiner in New York City. He also served as the DNA Technical Leader in that office. He was responsible for the day-to-day operation of the Forensic Biology Department, which concentrated on DNA testing and some serology. Notably, Baum was responsible

for the World Trade Center DNA identification of the missing persons and crime scene reconstruction.

It is clear that Baum's primary area of scientific expertise is in the field of DNA studies and analysis. Indeed, since his retirement in 2017 from his position in New Jersey, he is an owner of Baum Scientific Consulting, LLC, through which he is now handling only DNA cases. He holds six patents, all dealing with DNA. Of his thirty-seven publications, about thirty involve DNA. None involve breath testing. He acknowledged that it is well known in the scientific community that he is a nationwide expert on DNA testing.

Prior to becoming employed in New Jersey in 2008, Baum had no experience whatsoever in breath testing programs or with breath testing devices. After being employed in New Jersey as Director of the OFS, he took some training from the State Police and Draeger to learn the basics of New Jersey's breath testing program and the device used, which, at the time of his hire was the Alcotest 7110 (12T22). He acknowledged that he had never used or touched an Alcotest device in his prior position (12T36). His training encompassed an aggregate time of about three to four weeks over a period of about a year (13T17).

While employed as Director of the OFS, Baum generally devoted about ten to fifteen percent of his time to the breath

testing program (12T37). When he first arrived, an individual on the existing staff was the manager of the breath testing program. At some point, Baum hired Alaouie (also a witness in this case), whom he designated as the manager of the program. As such, those individuals were responsible for the day-to-day operations of the breath testing program, for testing and certifying the accuracy of simulator solutions, and for setting up and monitoring the central database, also known as the Alcotest Inquiry System.

Baum is a certified ISO 17025 laboratory assessor (12T20-12T21). He acknowledged that through A2LA he performs ISO 17025 accreditation evaluations, and he acknowledged that ISO 17025 accreditation is the highest level of accreditation and can be characterized as the "gold standard" (12T47). He also acknowledged that NIST is the gold standard for traceability (12T53-12T54). He acknowledged his familiarity with the NIST policy review materials in evidence (A-1) (12T111-12T113).

It is clear from a review of Baum's overall testimony over a period of three days that he never took a particularly active role in the breath testing program, never familiarized himself thoroughly with it, and possesses limited knowledge about it. For example, he did not know that the simulator solutions come into the OFS with a certification of accuracy from the

laboratory that produced them. Therefore, he did not know that the testing of sample bottles in the OFS constituted a retesting as an added safeguard to assure scientific reliability. The same was true regarding Alcotest instruments received from Draeger after repair. He said that "[u]sually the Alcotest instruments are not certified" when repaired by Draeger, adding, "They're not certified, per se" (13T54). But when pressed and shown a Draeger certificate of accuracy for an Alcotest 7110, he agreed that "[t]here is paperwork with certification" from Draeger with the instruments returned after repair (13T54-13T55;S-9G).

Another significant example can be found in his testimony regarding CU34 read-out models. The CU34s utilized in New Jersey with the 7110 do not have a screen to read out temperature. Baum described in great detail that he considered obtaining CU34s for use with the 7110s which did contain such a read-out screen. He said he obtained them, and had them tested in the lab. He said he was considering using them as a replacement for the NIST-traceable thermometer step in the protocol. When asked why he didn't do so, he said his time ran out before his retirement, and also that there were funding problems. I directed the State to produce documentation to verify this information because Baum had never referred to it in

his reports and it constituted a surprise. The following day, counsel for the State reported that upon checking, it was learned that the simulator devices Baum was referring to did not apply to the 7110 at all. They applied to the consideration the State was then giving to obtaining a new instrument, and one of the models it was considering was Draeger's new generation 9510, which evidently comes with a simulator that contains a read-out.

Much of Baum's testimony was self-contradictory. In some instances, the contradictions were within testimony he gave in this very hearing. On other occasions, he gave testimony in this hearing that conflicted with a statement he gave to criminal investigators in the Dennis case in December 2015. And he also rendered testimony in this case that was contradictory to testimony he gave in the Holland hearing. I will discuss some of those with more particularity in the remainder of this section.

In addition to noting Baum's limited knowledge of the breath testing program and inconsistency in his testimony, I also note shortcomings in his recollection of events. Further, as I observed his demeanor and manner of answering questions, I note that his answers were often vague or qualified, resulting in a lack of clarity and allowing for him to change his answers

if challenged. He also became argumentative and evasive on many occasions in an effort to avoid having to answer questions.

For all of these reasons, which I will continue to discuss in further detail, I did not attach to Baum's testimony a high level of credibility, nor do I attribute significant weight to it.

Baum was qualified as an expert in the three fields for which he was offered, namely the Alcotest 7110, the breath testing program, and scientific measurement. He proceeded in his substantive testimony to discuss those areas and render opinions in them. As I have previously described, some of his opinions were at odds with opinions he previously gave in other proceedings, and some were internally inconsistent within his testimony in this proceeding.

It is apparent to me that Baum went out of his way to conform his testimony to fit a significant argument the State originally made in seeking this Special Master proceeding, namely that use of the NIST-traceable thermometer is merely a pre-step[15] for administrative convenience to prevent the waste of time by a coordinator if he were to begin the CALIBRATE function and one of the simulator solutions was out of range. However,

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[15] Baum and the State used the terms "pre-step" and "pre-test" interchangeably.

Baum then acknowledged that the same purpose can be achieved with the black key temperature probe (if that probe could be relied upon for the required accuracy). He explained that a coordinator could plug the black key probe into the Alcotest device, pull up the correct screen, and get a read-out, a procedure which could be performed on each of the four CU34s before activating the CALIBRATE function (12T58;13T23).

At another point in his testimony, Baum said this about the NIST-traceable thermometer:

> And the temperature probe from the thermometer is, in a pre-test, is put into the simulator solution to make sure that it's close to the 34 degrees that is necessary. When I say close, between 33.8 and 34.2 degrees Celsius and it's used to take temperature of the simulator solution in this process.
>
> [12T224-9 to 15.]

When asked why he called it a "pre-step," Baum said:

> [I]t's in the protocol for the calibration of the instrument, but it's a test to make sure that they are at approximately the proper temperature before plugging it in — with a black key temperature probe and plugging it into the instrument, the Alcotest instrument.
>
> [12T224-22 to 22T225-2.]

This testimony is an example of a witness trying to fit a proverbial round peg into a square hole. Baum attempted to minimize the importance of the NIST-traceable thermometer step

by calling it a "pre-test" and stating that it only has to show that the solutions "are at approximately the proper temperature." Yet, those concepts are internally inconsistent because he also identified the range which he characterized as being sufficient if they are "approximately" correct. The range he described is the precise range that is required in the calibration procedure. Further, he twice said that the NIST-traceable thermometer is used to "make sure" the temperatures are within the precise required range. Of course, "make sure" means to be certain that the required range is achieved.

Although characterizing this step as a mere "pre-test," Baum did not dispute that if the NIST-traceable thermometer does not give readings within range for all four CU34s, the coordinator is prohibited from proceeding with the calibration (14T8). Thus, Baum's attempted minimization of the importance of this step is contradicted by his own testimony and that of every other witness in the case.

At another point, Baum was again asked whether the procedure, prepared by Brettell, recommended by Judge King, and approved by the Supreme Court, was required to be followed to ensure scientific reliability. Baum tried to avoid the key part of the question by saying the Court "said the procedure had to be followed." When pressed as to whether the Court required it

to "ensure and guarantee the scientific reliability of the Alcotest," he finally said "Correct" (13T105-13T106).

There were significant discrepancies between Baum's answers to investigators in his December 21, 2015 interview and his testimony before me. In that interview, he said that if the NIST-traceable thermometer was not used, if the "internal thermometer," by which he meant the Draeger black key or agency probe, was not operating correctly, but read between 33.8 and 34.2, "the thing would pass even though it shouldn't" (14T173) (emphasis added). He then tried to negate that answer in his testimony in this case in two ways. First, he said it was a poor question so his answer didn't come out right. Second, he said that he only meant one calibration test would pass, not the entire calibration procedure (14T178).

Similarly, in his December 21, 2015 statement, he answered the following questions in the following manner:

> Q. So it says, HB. I'm going to start with the question. Question. This is from D-18 as well.
>
> That NIST thermometer then comes into play to ensure that the temperature of those solutions are 34 degrees?
>
> A. Correct.
>
> Q. If they weren't 34 degrees, uh, and the coordinator proceeded with the recalibration process, would he be successful, he or she be successful?

A. Yes, he would.

Q. Question: How so?

A. It would generate a linear line. However, when you went to read, uh, an individual was arrested for drunk driving, uh, it wouldn't be an accurate reading of their blood alcohol concentration.

[14T183-2 to 16 (emphasis added).]

Then, continuing with "live" questioning in this hearing:

Q. And you read that — I'm reading this correctly. It wouldn't be an accurate reading of their blood alcohol concentration. That's what you stated, correct?

A. That's what I stated, correct.

Q. Okay. And there's no qualifying language by you there, correct?

A. Correct.

[14T183-17 to 24.]

Yet, Baum then tried to negate the testimony he gave in that statement by saying that skipping the NIST-traceable temperature measurement in the calibration process would not be a problem because if the CU34 temperatures were out of range, it would be picked up by the black key probe or the agency probe or the CU34s themselves (14T187). This clearly contradicts what he said in his previous statement given in the Dennis criminal

investigation. This is yet another example of why I cannot rely on Baum's opinions, which are often in conflict with each other.

This witness exhibited a low level of knowledge, recollection, candor and consistency. His "reliable enough" approach to the requirement of NIST traceability to assure scientific reliability is not well supported by his own testimony. Nor is it persuasive in establishing that without the NIST-traceable step the Alcotest device does not drop below the level required to render results that are sufficiently scientifically reliable for their intended purpose, namely for evidential use, in which they establish per se guilt beyond a reasonable doubt.

5. Dr. Ali M. Alaouie

Dr. Ali M. Alaouie received an undergraduate degree in chemistry from the College of Staten Island in New York in 1999. He received a Master's Degree in environmental science from Long Island University in New York. In 2006, he received a Ph.D. degree from North Carolina State University in Raleigh, North Carolina in chemistry. He subsequently participated in two one-year appointments for post-doctoral work. The first was in biochemistry at the University of Edmonton in Canada; the second involved cancer research at New York University at the Polytechnic Institute in Brooklyn. Alaouie also received a

professional certificate from New York University in U.S. Law and Methodologies.

Alaouie has been employed in the OFS since January 30, 2012. His official title is Research Scientist, and his functional title is Program Manager of the Breath Testing Unit. As such, his primary functions are to conduct validation studies, scientific measurements, and any kind of data-driven analysis or research.

As Program Manager of the Breath Testing Unit, Alaouie oversees the Alcotest Online Public Database (also known as the Alcotest Inquiry System). This database captures and preserves the data from breath tests administered to subjects and solution changes. Because of a "bug" in the Alcotest firmware, the system does not capture calibration records. The system also does not capture the probe value of the Draeger probes it reports upon. Alaouie limits his role in this regard to checking on a weekly basis to be sure that all police agencies are uploading their data into the system. If there is a technical problem, he makes arrangements to send appropriate technicians to that police department to address it. If more than two or three weeks go by during which a department has not uploaded its data, a reminder is sent. However, neither he nor anyone acting under his supervision reviews the data for

purposes of analysis, which might identify and address any trends that might be problematic.

Alaouie took the Robert Borkenstein course on alcohol and highway safety in 2010. In 2011, he took training courses administered by the New York City Police Department regarding the Intoxilyzer breath testing device. He also received training provided by NIST, consisting of a two-day workshop in 2013, which dealt with trends in synthetic drugs. In 2015, Alaouie completed a course which resulted in his certification to inspect accredited laboratories according to ISO 17025 standards. He has either observed or performed about 100 calibrations of the 7110 while employed by the OFS.

Another major part of Alaouie's role is to check simulator solutions for accuracy and certify them before they can be used by the State Police or local police departments in calibrating Alcotest instruments or administering breath tests. The solutions are generated by various suppliers, and they come with a certificate of accuracy issued by those suppliers. However, it is part of the protocol established by Brettell that these solutions must be checked by the OFS before they can be used. The testing procedure complies with ISO 17025 standards, across five data points using five separate concentrations. The measurements are made against NIST-traceable standards, and the

measurement results are NIST-traceable. Alaouie oversees and reviews the work done by scientists under his supervision and, upon his satisfaction that all procedures have been performed correctly and all calculations are correct, he signs the certificates of accuracy for the simulator solutions.

Alaouie does not possess any specialized computer knowledge, including the ability to write or understand source codes, programming, algorithms, and the like. He is not a computer scientist or programmer.

Alaouie has performed a significant role in validating the Alcotest 9510, which is expected to be the next breath testing instrument used in New Jersey when it replaces the Alcotest 7110. As part of the validation process of the 9510, Alaouie did not perform any SIM TEMP error statistical testing between the 7110 and the 9510. He has never interrogated the 7110 system regarding SIM TEMP errors for the purpose of conducting a statistical analysis of such errors.

Alaouie acknowledged that in every procedure in which accuracy of measurement of temperature is critical, the measurement must be made with a NIST-traceable instrument. He further acknowledged that the user is obligated to satisfy itself of NIST traceability. He has relied upon the Draeger certificates of accuracy for the black key and agency probes.

Those certificates do not contain the substantial documentation required to satisfy NIST standards. Alaouie has never contacted Draeger in an effort to determine whether NIST standards are satisfied and to obtain the required documentation to satisfy himself, on behalf of the State of New Jersey, the user, of NIST traceability.

I qualified Alaouie as an expert in the Alcotest 7110, the testing of simulator solutions, and scientific measurement. I found him to be a very credible witness. He was forthright in answering questions posed by all parties.

The bulk of Alaouie's substantive testimony dealt with the testing of simulator solutions. This was not a hotly contested issue. Alaouie's testimony demonstrated that appropriate scientific procedures were utilized before he signed certificates of accuracy for the simulator solutions. The testing was compliant with all NIST-traceability standards, as evidenced by the certificates he issued. I attribute substantial weight to his testimony in this regard.

As to other issues dealing directly with the question before me, namely whether the failure to use the NIST-traceable thermometer undermines or calls into question the scientific reliability of resulting breath tests, Alaouie's knowledge and experience is limited. For the reasons I will discuss, I did

not find persuasive the underlying reasons he gave for his ultimate opinion that failure to use the NIST-traceable thermometer would not undermine or call into question the scientific reliability of breath tests. Thus, in areas other than the testing of the simulator solutions, I did not attach significant weight to Alaouie's opinions.

B. Defense witness

1. Dr. Andreas Stolz

Dr. Andreas Stolz holds a Ph.D. degree in physics, which he obtained from the Technical University in Munich, Germany. Metrology, the study of how to measure and the analysis of measurements, is part of his education in physics. He has been in the United States since 2001. He has been employed at Michigan State University since that time, first as an assistant professor, then an associate professor, and is now the head of operations for the National Superconducting Cyclotron Laboratory at Michigan State.

Dr. Stolz has presented many seminars and programs to attorneys, prosecutors, and judges in several states regarding the science of breath testing. Of the fourteen presentations listed in his CV, seven include in the title the word metrology, five others in their titles refer to measurements, and the

remaining two deal with forensic analysis in drunk driving cases (17T17).

Stolz has testified as an expert in drunk driving cases about twenty times, always for the defense. He has co-authored, together with a DWI defense attorney, many publications dealing with breath testing. Although these circumstances indicate a defense-oriented leaning, they also demonstrate extensive knowledge and experience in the field of breath testing.

I qualified Stolz as an expert in physics, metrology, and the science of breath testing (17T53). In broad general terms, Stolz's opinion is that without using the NIST-traceable thermometer there is no way of knowing what the temperature of the simulator solution is. He was emphatic that neither the Draeger black key nor agency probes are NIST-traceable, i.e. they are not capable of producing NIST-traceable measurements. And, because the measurement results from the probes do not include any expression of measurement uncertainty, there is no way of knowing the range of that uncertainty. It is that problem that causes, in his opinion, a loss of scientific reliability in the calibration process.

He acknowledged, as everyone does, that all measurements have uncertainty. This is not a problem in science. It is normal. It is accounted for by determining and expressing the

extent of the measurement uncertainty, which then provides a range within which an accurate measurement would fall. Without the NIST-traceable thermometer step, it is the absence of measurement uncertainty with the Draeger instruments that renders the calibration process scientifically unreliable.

I found his testimony to be credible. He was very forthright and precise in his responses. He "gave ground" when it was called for, and his testimony was very candid. His description of the science underlying breath testing was thorough and demonstrated a very good understanding of the scientific principles involved. I attribute significant weight to his testimony.

IV. DISCUSSION

A. Burden of proof and positions of the parties

The Chun Court held that the Alcotest 7110, "with the safeguards we have required, is sufficiently scientifically reliable that its reports may be admitted in evidence." 194 N.J. at 148. The Court further explained:

> Our analysis of the general scientific reliability of the Alcotest is grounded, in part, on our expectation that there will be proof that the particular device that has generated an AIR being offered into evidence was in good working order and that the operator of the device was appropriately qualified to administer the test. This requirement that the test results be supported by foundational proofs for

> admissibility has been part of our jurisprudence since we decided Romano. There we demanded that, as a precondition for admissibility of the results of a breathalyzer, the State was required to establish that: (1) the device was in working order and had been inspected according to procedure; (2) the operator was certified; and (3) the test was administered according to official procedure.
>
> [Id. at 134 (citing Romano, 96 N.J. at 81.]

These elements, including the good working order of the breath testing instrument at issue, must be proven by the State by clear and convincing evidence. Romano, 96 N.J. at 90 ("In drunk driving prosecutions a substantial burden of proof to establish the competence or admissibility of the results of the breathalyzer test is appropriate because of the serious consequences of the breathalyzer reading in such prosecutions."). As the Romano Court explained:

> Under Johnson, conditions of admissibility must be "clearly established." 42 N.J. at 171. To avoid any confusion over what is intended by this level of proof, it should be understood that it conforms to that standard conventionally referred to as "clear and convincing proof." The conditions of admissibility to which this burden of proof shall apply include those presently required to establish the admissibility of the results of a breathalyzer test, namely, the proper operating condition of the machine, the requisite qualifications of the operator, and the proper administration of the test.
>
> [Id. at 90-91.]

Clear and convincing evidence "is a higher standard of proof than proof by a preponderance of the evidence but a lower standard than proof beyond a reasonable doubt." Liberty Mut. Ins. Co. v. Land, 186 N.J. 163, 169-70 (2006). Evidence that is clear and convincing "should produce in the mind of the trier of fact a firm belief or conviction as to the truth of the allegations sought to be established." Ibid. (quoting In re Purrazzella, 134 N.J. 228, 240 (1993)). "To satisfy the intermediate clear-and-convincing standard, the fact finder 'must be persuaded that the truth of the contention is "highly probable."'" In re Perskie, 207 N.J. 275, 289-90 (2011) (quoting 2 McCormick on Evidence § 340, at 487 (Broun ed., 6th ed. 2006)). The evidence must be "so clear, direct and weighty and convincing" as to enable the factfinder to come to a "clear conviction, without hesitancy," of the facts in issue. Ibid. "Notably, evidence that is uncontroverted may nonetheless fail to meet the elevated clear and convincing evidence standard." Ibid. "This heightened standard is typically applied where the evidentiary matters are complex, prone to abuse, error or injustice, and also where an individual's interests in liberty or personal welfare are at stake." State v. C.W., 449 N.J. Super. 231, 257 (App. Div. 2017).

The State has conceded that it bears the burden of proving by clear and convincing evidence that the omission of the NIST-traceable thermometer step in the calibration process does not undermine or call into question the scientific reliability of the Alcotest 7110 (1T16;Pb2).[16]

The State's position is that "[u]sing the NIST-traceable digital thermometer improves confidence in the results but does not affect the scientific reliability of the instrument" (Pb52). This position is premised on the arguments that (1) Draeger uses NIST-traceable instruments to test and recertify the Draeger probes and CU34s, so those devices are sufficiently reliable without an independent check (Pb4;Pb38-Pb40;Pb44-Pb48;Pb58-Pb79), and (2) even without the NIST thermometer, the checks and balances built into the calibration procedure, combined with the scientific principles of breath testing, make it astronomically unlikely that a CU34 heating to an out-of-range temperature would go undetected through the whole calibration check process (Pb3;Pb19-Pb20;Pb54-Pb57).

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[16] In its brief, the State characterizes the issue as "general acceptance in the scientific community," but this misstates the standard (Pb2). Chun established the general acceptance of the Alcotest. The question here, as in Romano, goes to the good working order of a breath-testing instrument that has already achieved general acceptance.

Defendant and the participating attorneys stress the importance of having an independent, NIST-traceable measurement result for the CU34s during each calibration check procedure, and they contend that nothing short of that will suffice (Db77-Db79;Mb25-Mb26;Rb1). The NJSB argues that the many safeguards required by the Chun Court, including use of the NIST-traceable thermometer, form "a careful balance of many parts needed to make a 'sufficiently' scientifically reliable system" for breath testing and that removing the NIST thermometer part of this balanced system creates an unjustified level of scientific uncertainty for evidence used in criminal and quasi-criminal matters (Ab8-Ab12).

B. NIST-traceability

As detailed above, having the temperature of the simulator solution in the CU34s be 34°C, plus or minus .2°C, is of critical importance to the calibration and operation of the Alcotest. Being able to measure the solution temperature with reasonable scientific certainty is fundamental to ascertaining the good working order of the CU34s and, indirectly, the good working order of the Draeger probes and the instrument itself.

Measuring temperature is not as simple or straightforward as measuring, say, a length of wood. Dr. Stolz explained why temperature is more difficult to measure:

> Well, temperature is actually difficult to measure, because it's one of the few things that you can't measure directly. If you measure a length, you can compare two items of the same length easily. Just hold it back to back together and you can compare it.
>
> Temperature is different. And so in science we measure temperature by the effect it has on other things. It changes the properties of other things. It might be changing the volume of something. That is what you usually have in thermometers that have a little column inside. It might change the resistance of a small electronic element and that is what's built into those [Draeger] probes.
>
> [17T75-5 to 17.]

In the case of the black key and agency probes, by themselves they cannot provide a temperature reading (17T76). Stolz explained:

> [I]n order to achieve a temperature reading, the resistance [reported by the probe] needs to be measured by the Alcotest, the resistance needs to be transformed by some electronic component into a voltage, the voltage is being measured by an analog digital converter and the number is then being calculated with software into a temperature reading.
>
> [17T76-20 to 17T77-1.]

Brettell expressly required the use of "a NIST traceable thermometer" to verify the CU34 temperatures during the calibration check process (S-32). He agreed that when he selected the Ertco-Hart thermometer, it was important that it be

traceable to a NIST standard (7T117). He emphasized the critical importance of an accurate temperature reading of the simulator solutions:

> Well, like I said, the calibrating unit is what all the tests are based off of. The Alcotest gets calibrated against this calibrating unit and the solution that's in it. And so the temperature that that solution rises to and equilibrates to is extremely, extremely important. And I wanted to make sure that the calibrating unit was tested against the standards of NIST when — before we started anything.
>
> [7T120-19 to 7T121-1.]

"NIST refers to the National Institute of Standards and Technology, which is responsible for establishing, maintaining and publishing basic standards of measurement consistent with their international counterparts." Holland I, 422 N.J. Super. at 191 n.2 (citing King SMR at 45). NIST is part of the Department of Commerce and was formerly known as the National Bureau of Standards (Chun 3T73).

During the Chun hearings, Samuel E. Chappell, who had worked for NIST for thirty-eight years before becoming a consultant in legal metrology, explained:

> NIST is the national metrology lab for the United States, meaning the national measurement laboratory for the United States. They have the responsibility for establishing and maintaining and disseminating the basic standards of measurement that are consistent with

> international standards and also they have responsibility for carrying out research and development related to requests from other federal agencies, and they cooperate, of course, with our industry in supporting their efforts that may need standard references and so forth.
>
> [Chun 3T73-4 to 14.]

In this case, Brettell noted that NIST sets "the standards for the United States measurements, the SI units, volume, weight, temperature" (7T49;8T52-8T53). It is "the primary office for the United States as far as standards are concerned" (7T50). Baum acknowledged that NIST is the "gold standard" for traceability (12T53-12T54).

The concept of NIST traceability is key in this case. NIST states that "[t]he definition of traceability that has achieved global acceptance in the metrology community" is that traceability is the "property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty" (A-1 at 1). This definition was accepted by the experts in this case (7T188;9T62-9T63;10T142-10T143;11T35-11T36;14T-33;D-12 at 3).

Traceability of measurement results ensures that one measurement of a particular value is equivalent to another measurement of that same value (14T32-14T33). In the case of

temperature and the Alcotest, "[w]hen we say 34 degrees Celsius plus or minus .02 degrees, we want to be absolutely certain that everybody in the world would agree" with that reference (14T33).

Only measurement results are traceable, not devices, instruments, standards or organizations (A-1 at 1-2). "It is important to note that traceability is the property of the result of a measurement, not of an instrument or calibration report or laboratory" (A-1 at 1). Again, the experts did not dispute this basic principle (7T200;10T140-10T142;14T52;17T66-17T67).

NIST has further explained:

> It [traceability] is not achieved by following any one particular procedure or using special equipment. Merely having an instrument calibrated, even by NIST, is not enough to make the measurement result obtained from that instrument traceable to realizations of the appropriate SI unit or other specified references. The measurement system by which values and uncertainties are transferred must be clearly understood and under control.
>
> [A-1 at 1-2.]

The experts agreed that the NIST policy (A-1) is authoritative (7T200-7T201;14T31-14T32;15T120-15T121). Brettell specifically acknowledged that even having NIST calibrate an instrument does not, alone, create traceability.

Because measurements rather than instruments are NIST traceable, reference to a "NIST traceable thermometer" is inherently a bit of a misnomer. However, the phrase has been used throughout the case as a shorthand term to signify a thermometer providing temperature measurement results that are traceable, meaning results that can be related to a NIST reference standard through an "unbroken chain of calibrations, each contributing to the measurement uncertainty" (12T195).[17]

In its Supplementary Materials for NIST Policy Review, NIST addressed the question, "I want my measurement results to be traceable to NIST. What do I have to do?" (A-1 at 7). It explained:

> To achieve traceability of measurement results to standards maintained by NIST, you need to reference your measurement results through an unbroken chain of calibrations, including determining the uncertainties at each step, to NIST standards as the specified references . . . . The chain of calibrations may be short, if the user has instruments or artifacts calibrated by NIST or acquires standards from NIST and references measurement results to those. It may be longer, if the user references other calibrations in a chain of calibrations back to stated references developed and maintained by NIST.
>
> [A-1 at 7.]

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[17] As detailed below, the State's effort to "water down" the definition of NIST traceability is inconsistent with the globally-accepted definition of the term.

NIST has also explained the necessary elements to supporting a valid claim of traceability:

> To support a claim [of traceability], the provider of a measurement result must document the measurement process or system used to establish the claim and provide a description of the chain of calibrations that were used to establish a connection to a particular specified reference. There are several common elements to all valid statements or claims of traceability:
>
> - a clearly defined particular quantity that has been measured
>
> - a complete description of the measurement system or working standard used to perform the measurement
>
> - a stated measurement result, which includes a documented uncertainty
>
> - a complete specification of the reference at the time the measurement system or working standard was compared to it
>
> - an 'internal measurement assurance' program for establishing the status of the measurement system or working standard at all times pertinent to the claim of traceability
>
> - an 'internal measurement assurance' program for establishing the status of the specified reference at the time that the measurement system or working standard was compared to it
>
> An internal measurement assurance program may be quite simple or very complex, the level or rigor to be determined depending on

> the level of uncertainty at issue and what is needed to demonstrate its credibility. Users of a measurement result are responsible for determining what is adequate to meet their needs.
>
> [A-1 at 2-3.]

Consistent with these requirements, the American Association for Laboratory Accreditation (A2LA)[18] has noted that "[t]raceability is characterized by six essential elements," as follows:

> 1. an unbroken chain of comparisons: going back to a stated reference acceptable to the parties, usually a national or international standard;
>
> 2. measurement uncertainty: the uncertainty of measurement for each step in the traceability chain must be calculated or estimated according to agreed methods and must be stated so that an overall uncertainty for the whole chain can be calculated or estimated;
>
> 3. documentation: each step in the chain must be performed according to documented and generally acknowledged procedures; and the results must be recorded;
>
> 4. competence: the laboratories or bodies performing one or more steps in the chain must supply evidence for their technical competence (e.g. by

[18] A2LA is an accreditation body that accredits laboratories providing calibration services, among others (17T80-17T81). Stolz testified that the A2LA Policy on Measurement Traceability is recognized as authoritative by the scientific community (17T79-17T80).

demonstrating that they are accredited);

5. reference to SI units: the chain of comparisons must, where possible, end at primary standards for realization of the SI units;

6. calibration intervals: calibrations must be repeated at appropriate intervals; the length in of these intervals will depend on a number of variables (e.g. uncertainty required, frequency of use, way of use, stability of equipment).

[D-12 at 4.]

The CC thermometer used in the calibration process provides NIST-traceable measurement results, and the "Traceable Certificate of Calibration for Digital Thermometer" provided by Control Company satisfies the elements needed to establish NIST traceability [7T204-7T206;12T113;13T62-13T66;17T82-17T83;17T143-17T144;17T211-17T212;D-10;D-10A].

The State has taken somewhat confusing and contrary positions regarding the asserted NIST traceability of the Draeger temperature probes, at times suggesting that the probes are NIST traceable and at others relying on the NIST traceability of the instrumentation used to calibrate the probes. For example, the State argues that "Draeger relies on fundamentally following a traceability of measurements reflected in their operations, training, and procedures," that "NIST-

traceable standards were used to certify the CU-34s, the temperature probes and the simulator solutions," and that it has "proven NIST-traceability of" the "safeguards" in place that ensure scientific reliability even if the NIST thermometer step is skipped (Pb4;Pb57-Pb58). But it also states that "[i]n testing the component parts of the Alcotest, Draeger uses instruments that are third-party certified as traceable to NIST" and that the probes "are certified for accuracy using instrumentation with measurements traceable to NIST" (Pb19;Pb30).

For the reasons detailed below, I find that neither the black key probes nor the agency probes provide NIST-traceable measurement results.

Shaffer explained the process by which Draeger checks and certifies the accuracy of its probes. He noted that Draeger uses a "service workshop" rather than a "laboratory," and the service technicians perform the procedures (9T44;9T60). He stated that "our organization is covered by an ISO 9001 accreditation, and equipment that we use in our process is from laboratories that maintain NIST traceability for their

equipment" (9T65). The service workshop does not have accreditation beyond ISO 9001 (9T65-9T66;10T139).[19]

When doing an annual certification on a black key or agency temperature probe, Draeger prepares "a 34 degree C water bath" (9T132). This is "a large tank, maybe about the size of a large fish tank" (9T159). It "has a pretty sophisticated piece of equipment at its core" called an "immersion circulator" (9T159). The technician sets the temperature, and it heats and circulates the liquid (9T159). Typically, the water bath is "prepared the day before and there's plenty of equilibration that goes on" (9T156).

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[19] Accreditation is a process by which an internationally recognized accrediting organization determines that a laboratory or company adheres to a set of recognized standards (12T206). ISO 9001 can apply to any company and "sets out the criteria for a quality management system." (https://www.iso.org/iso-9001-quality-management.html). ISO 17025 is "the standard for calibration of testing laboratories" in particular (7T48;8T101-8T102). ISO 17025 accreditation indicates "a finding of a laboratory's competence and capability to provide technically sound and appropriate measurement services within the scope of [the] accreditation" (7T48). ISO 17025 is "the highest level of accreditation" for a testing laboratory (12T47). ISO 17025 accreditation is not necessary to establish NIST-traceability, but such accreditation is evidence of the competence of the laboratory performing calibrations (7T118;7T121;13T45-13T46; 17T222). As NIST explains: "Laboratory accreditation does not speak to the specifics of any individual measurement result but to overall capability of a lab to provide the service" (A-1 at 9).

The technician measures the temperature in the water bath "with equipment that has certificates with NIST-traceable measurements at its core," specifically an Omega HH41 model digital thermometer (Omega thermometer) (9T159-9T160). Shaffer noted, "So everything else that happens in the rest of our procedure comes from the integrity of that measurement right there" (9T159). Shaffer acknowledged that, if Draeger failed to use a NIST-traceable thermometer such as the Omega thermometer during this water bath process, "that would be a problem" because it would undermine the "fundamental measurement" (11T58-11T59). Baum agreed that the scientific reliability of Draeger's process for testing its probes would be undermined if the Omega thermometer was not used to ensure the correct temperature of the water bath (13T249).

The "current process" at Draeger is to use three Omega thermometers to test the water tank at the same time (9T163). Previously, only one Omega thermometer was used, but that changed at some point prior to 2015 (9Tl67;10T6-10T7). Draeger began using three Omega thermometers because "we thought it would be good to have additional validation of this temperature since so much of subsequent calibration activity comes from that water tank" (10T7). The three Omega thermometers are "not

always giving an identical result," and in that circumstance the technician relies on "the middle reading" (9T165;10T6).

The water bath is set to exactly 34°C using the thermometer that gave the middle reading (S-12). The "correction factor" of the water tank is adjusted until the temperature reads exactly 34°C, even if it is only slightly higher or lower (S-12;S-12A).

While the probes are placed and remain in the water bath, the technician measures and records the resistance of the probe to the third decimal point, using a Fluke mulitmeter (9T168-9T171;S-12B). This resistance number will determine the preliminary probe value assigned to the probe (S-12B;S-12C;S-12D).

Then, while still in the water bath, the probe is attached to a 7110 instrument and the assigned probe value is entered (9T171;S-12B). "And if it's accurate, it will pass with that preliminary probe value. And if an adjustment is needed, the technician will change the probe value to read the correct temperature, thereby making that measurement match what is in the water temp" (9T171-9T172).

Once the service technician determines that the probe "passes," Draeger issues a certificate of accuracy for that probe (9T132). This document contains the serial number, probe value, and certification dates for the probe and states:

> This is to certify that the Alcotest 7110 Temperature Probe has been tested for accuracy with instrumentation that is traceable to the National Institute of Standards and Technology (NIST). The manufacturer recommends accuracy verification of the Temperature Probe within 12 months of the certification date below, or sooner, according to your State Specification. For accurate temperature readings, the probe value on this certificate, noted below, must be programmed into the Alcotest 7110.
>
> [S-33C;S-33J;S-36;S-36B;D-4.]

The measurement results from the Draeger probes do not satisfy the basic elements of either an unbroken chain of calibrations back to a NIST standard or an ascertainable measurement uncertainty, so those measurements cannot be NIST traceable.

Stolz opined that the documents detailing Draeger's procedures for checking the accuracy of its temperature probes [S-12 through S-12D] are "procedures and how certain operations are being done," but they "have no meaning regarding traceability . . . [b]ecause they cannot connect a measurement result obtained with any of the black key temperature probes with a reference standard at NIST" (17T215). Stolz testified that an unbroken chain of comparisons is "absolutely essential" to traceability (17T87-17T88). He opined that the black key temperature probe cannot satisfy the NIST-traceable thermometer

requirement in the Calibration Check Procedures "[b]ecause the black key temperature probe cannot provide a NIST-traceable measurement result" (17T108;17T111;D-38).

Moreover, the Draeger probe measurement results are not made with a stated uncertainty, which is fatal to any claim of NIST traceability.

Stolz explained that "measurement consists of a measurand, an expression of the unit of measure we're concerned with . . . [c]oupled with a statement of the quantified uncertainty," and that "it's a combination of the measurand with the stated uncertainty that makes it a valid measurement provided we can trace it to NIST" (17T222). Brettell agreed that "measurement is a combination of measurand plus uncertainty" (7T200-7T201). Baum also testified that the result obtained from a measurement is called a measurand, and he agreed that "in order for the expression of a measurement to be scientifically reliable" the measurand must be "expressed with an uncertainty" (14T52-14T53).

NIST policy explains that achieving traceability includes "determining the uncertainties at each step" (A-1 at 7). The A2LA policy states that "[a] crucial element of the concept of measurement traceability is measurement uncertainty" (D-12 at 6). That policy explains:

> Not only should there be an unbroken chain of comparisons, each measurement should be accompanied by a statement of uncertainty associated with the farthest link in the chain from NIST, that is, the last facility that provided the measurement value. NIST does not have that information; only the facilities that provided the measurement values to the customer can provide the associated uncertainties and describe the traceability chain.
>
> [D-12 at 10.]

Brettell acknowledged that "[t]here's uncertainty in every measurement" (7T206). He noted that measurement uncertainty is greater the further it goes down the chain from the NIST standard (7T224).

Stolz noted that the existence of uncertainty in measurement is not a problem, but not knowing the extent of the uncertainty makes a measurement unreliable (17T217). He explained:

> Well, every measurement has a measurement uncertainty. As a matter of fact, a measurement result is never, ever just a single number. It's always a range of values where the true value of the quantity that I want to measure lies within. And this interval where the true value lies within is usually stated as a measurement uncertainty, a range of value where the actual true value—it's impossible to know the true value. Even with the best possible measurement instruments, even with many, many repeated measurements you would not know the true value. But you only know it within that measurement uncertainty

> interval. That's not a problem in science. That is a well-accepted fact in science and scientists have lived with that since ages.
>
> [17T88-16 to 17T89-5.]

Stolz noted that knowing the uncertainty of a measurement result "is essential because without the uncertainty, again, I would not know what kind of conclusions can I draw from a measurement result. And so the knowledge of measurement uncertainty is essential" (17T89). "The test temperature needs to be actually stated with their own uncertainty and the result needs to be stated with the uncertainty" (17T146).

The uncertainty of the measurement results obtained by the Draeger probes is unknown, so those results cannot be NIST traceable.

The State seeks to discount Stoltz's testimony regarding the need for a stated uncertainty by noting (1) the experts disputed whether the calibration certificates for the Omega thermometers and Fluke multimeter sufficiently stated the uncertainties as to the measurement results from those instruments, and (2) Brettell testified that the NIST thermometer "is not going to have an effect on the measurement uncertainty" of the instrument itself (Pb17-Pb18). However, these issues are unrelated to the uncertainty that is critical to NIST-traceability, specifically the uncertainty associated with measurement results from the Draeger probes.

As to the documentation relating to the Omega thermometers and Fluke multimeter, regardless of whether the uncertainties are properly stated for measurement results obtained from those instruments, knowing those uncertainties does not resolve the uncertainty issue for the Draeger probes. There is no dispute that the uncertainties of measurement results from the Draeger probes are unknown.

The Brettell testimony cited by the State had nothing to do with the measurement uncertainty of the Draeger probes at all. I questioned Brettell as to why the protocol he developed would "bother with this NIST thermometer" if the Alcotest instrument was "a failsafe machine" without it. He responded that "it's a standard laboratory practice to do two independent tests for anything," and he reiterated that the NIST-thermometer step was "not meaningless at all" and that using it "would tell you that the calibrating unit is either working or not working before you got into the probe or anything" (8T135-8T139). Brettell agreed that, without the NIST tmermometer step, "there is some reduced level of certainty" as to the good working order of the Alcotest, although "you can't quantify it" (8T139).

I asked if this reduced level of certainty was related to the concept that "there's always some amount of uncertainty with every measurement," and Brettell said that "maybe we're using

the wrong term of the uncertainty" in that context (8T140-8T141). He explained that "there's an uncertainty even with" the BAC reported by the Alcotest and "this traceable thermometer is not going to have an effect on that uncertainty, okay, because it's only checking the calibrating unit" (8T141). He noted that the problem with reduced certainty in the good working order of the instrument had to do with "the error rate" rather than measurement uncertainty (8T141-8T142). None of this testimony concerned the problem that uncertainty of the measurement results from the Draeger probes is unknown.

Notwithstanding the "global acceptance in the metrology community" and by the experts in this case that traceability is the "property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty," the State tries to water down the definition of NIST traceability to mean something other than this for the Draeger probes.

During the hearings, counsel for the State acknowledged that "[w]ithout NIST traceability . . . to the CU34 and the [Draeger] temperature probes," the State's case has "a problem" (12T174). However, counsel appeared to conflate "tested with

instruments traceable to NIST" with the concept of actual NIST traceability (12T175).

Baum's testimony also attempted to conflate these separate concepts. Baum agreed with the six essential elements of traceability set forth in the A2LA policy (13T39-13T42). However, he referred to the Draeger probes as "NIST-traceable temperature probes" even though they plainly failed to satisfy the six elements (14T20-14T21). At one point, Baum said that the black key probe does not have to be traceable to NIST as long as it's calibrated with instrumentation traceable to NIST (13T91-13T92). Later, he also equated NIST traceable devices to those that are "calibrated using instrumentation that's traceable to NIST" (14T164-14T165). Baum even suggested that the references to "a NIST traceable thermometer" in the Calibration Check Procedure only means a "thermometer that's calibrated with NIST-traceable equipment" (13T92-13T93). At another point, he stated that "[t]here's no claim for traceability" of the independent thermometer used by the coordinators, and he only included the phrase "[t]raceability to a NIST . . . standard" as a requirement for a replacement for the Ertco-Hart thermometer in his December 2008 memo as "an example of quality" (14T71-14T72;D-1).

In a footnote in its brief, the State contends that "[i]t is understood" that the statement that "a 'thermometer is NIST-traceable' refers to the fact that it was calibrated using measurements that are traceable to NIST," citing to testimony by Shaffer and to a record statement by me (Pb45 n. 20). This misstates the record. Shaffer merely stated that "it's a misnomer in the scientific community" to refer to NIST-traceable instruments because measurements, not instruments, are NIST traceable (10T140). Shaffer's overall testimony was consistent with the NIST definition of traceability, and he never stated that terming an instrument NIST-traceable indicates merely that it was calibrated using NIST-traceable measurements (10T140-10T144).

My statement on the record was in direct contrast to the State's synopsis of it. I acknowledged that the parties, the witnesses, and the Court have all referred to "NIST traceable instruments," despite the fact that only measurements can be NIST traceable. What was actually understood by the phrase, and what I clearly said, was that referring to an instrument as NIST-traceable was "a shorthand way of saying the measurements derived from this instrument are traceable to NIST" (12T195).

In another footnote, the State appears to recognize this, stating:

> The State recognizes that "instruments" cannot be traceable to NIST, but only measurements and standards can be traceable to NIST. For purposes of this Brief, references to "NIST-traceable instruments" or "instruments traceable to NIST" are intended to refer to instruments "with measurements" or "with standards" traceable to NIST.
>
> [Pb28 n. 10.]

Even this explanation is confusing. Only measurement results are traceable, and those results are traceable to standards kept by NIST, so it is not clear what the State means by instruments "'with standards' traceable to NIST."

I reject Baum's testimony and the State's contention that the Draeger probes can be considered NIST traceable by virtue of being calibrated or checked for accuracy with "instrumentation that is traceable" to NIST. Even assuming that the State has firmly established that the measurement results of the three Omega thermometers and the Fluke multimeter that Draeger used to certify the accuracy of its probes were NIST-traceable,[20] simply using those instruments to check or adjust the accuracy of the probes does not make those probes NIST-traceable. As the NIST policy notes, "[m]erely having an instrument calibrated, even by

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[20] The parties dispute the adequacy of the underlying documentation relating to the Omega thermometers and Fluke multimeter for establishing the NIST-traceability of the measurement results of those instruments (See Pb44-Pb48;Pb59-Pb61).

NIST, is not enough to make the measurement result" from that instrument NIST traceable (A-1 at 2).

In two footnotes, the State contends that Judge King's report in Chun "recognized the NIST-traceability of the black key and agency temperature probes" (Pb31 n.11; Pb39 n. 18). This, however, mischaracterizes Judge King's statements. First, as noted above, there was no dispute in Chun regarding the nature or extent of the calibration check process or the meaning of NIST traceability. Second, Judge King's statements in his Chun report do not actually "recognize" the NIST traceability of the probes at all. Judge King stated:

> Calibration of the Alcotest 7110 involves a wet bath simulator, the Draeger CU34, and one bottle of 0.10 ethanol alcohol solution. The ethanol alcohol solution is poured into the simulator jar where it is heated to 34 plus or minus 0.2 degrees C. A NIST-traceable temperature probe monitors the temperature of the simulator solution. NIST refers to the National Institute of Standards and Technology, which is responsible for establishing, maintaining and publishing basic standards of measurement consistent with their international counterparts. Each temperature probe has a probe value, which can be changed only by a coordinator using the "black-key" function. When the instrument determines that the simulator has reached the correct temperature, the coordinator hooks up the simulator to the back of the instrument through the rear port of the cuvette. The coordinator then hits the escape key, the function appears on the display screen, the coordinator types in

> calibrate, and follows the instrument's prompts.
>
> [King SMR at 44-45.]

It is not clear from this description whether Judge King was referring to the Ertco-Hart thermometer as a "NIST-traceable temperature probe" or did not clearly understand that the thermometer was an independent component from the Draeger probes. His later reference to "the NIST-verified temperature probe" cites testimony from Flanagan that the temperature of the CU34s is verified "using ERTCO HART digital NIST" (King SMR at 141-42, citing 54T25). In short, despite some apparent confusion regarding the distinction between probes and thermometers, Judge King understood that the calibration check process required a NIST-traceable measurement result for the CU34s. This proceeding has clarified that the only way to obtain such a measurement result is to us an independent NIST-traceable thermometer in the process, not just the Draeger probes.

I also find persuasive two reasons given by Stolz in addition to lack of NIST traceability as to why the Draeger probes cannot serve as an effective substitute for the CC thermometer in the calibration check process. First, Stolz noted that the Alcotest will report an incorrect temperature if the probe value is not entered correctly (17T111-17T115;D-38).

As discussed in more detail in the following section, both this problem and the potential for probe value drift between annual recertifications is a cause for concern regarding the accuracy of the probe's temperature reading.

Second, Stolz explained that a probe failure could occur such that the resistance reported by the probe might not change in accordance with a temperature change in the solution being measured (17T123;17T158). This problem would not be detected by Draeger's recertification process, which checks the probes at a single point and does not test over a range of temperatures (17T123). Stolz explained that, because the probes are only tested at a single temperature, if the resistance of a given probe did not change as the temperature of the solution changed, it "would always report the resistance corresponding to 34 degrees Celsius" regardless of the actual temperature of the solution (17T158).[21]

The State concedes that using an independent NIST-traceable thermometer "improves confidence in the results," but it contends that it "does not affect the scientific reliability of

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[21] Stolz also opined that the Draeger probes cannot be an effective substitute because a hardware or software malfunction in the Alcotest could affect the temperature reading of the Draeger probes (17T122). I find this unpersuasive because there was no evidence of any such malfunction ever occurring or that such an unspecified malfunction would produce an incorrect temperature reading.

the instrument" (Pb52). This sets up a false dichotomy treating "confidence" and "reliability" as separate concepts. As Brettell's testimony showed, confidence and reliability are interrelated concepts, not separate ones.

Brettell explained that "when we talk about reliability, and you're asking a question about the degree of reliability, it's really the degree of confidence that you have in the measurement of that instrument" (7T242). Thus, Brettell essentially equated degrees of reliability with degrees of confidence. This cuts against the State's effort to distinguish the two concepts and argue that Brettell's only purpose in requiring the NIST thermometer was to increase confidence but not reliability. Brettell continued that thought as follows: "So when you talk about the degree of reliability, scientific reliability of an instrument, you're really talking about the uncertainty and level of confidence that you make in that measurement" (7T244).

On redirect examination, Brettell expanded upon the concept of confidence and reliability:

> And I thought I explained that the word necessity really wasn't a technical term. And I went on to explain about confidence levels and the difference — the different levels of reliability based upon the confidence levels.
>
> [8T6-2 to 6.]

C. Importance of NIST-traceable thermometer step

From the outset of this proceeding, the State has argued that the NIST thermometer step is not even part of the calibration check procedure. Instead, it argues, it is only a "pre-step," the purpose of which is to provide an "administrative convenience" and which has very little or nothing to do with scientific reliability. The convenience, according to the State, is to enable the coordinator to be assured that the simulators have heated to the correct temperature range before he attaches the black key probe to the Alcotest instrument and activates the CALIBRATE function. Once that function is activated, if any SIM TEMP or other error is generated, the calibration process will automatically abort.

The coordinator will then be confronted with two choices. Assuming the error indicates that one of the CU34s is out of tolerance, the coordinator could replace that CU34 with a different one (if one is available), put in a new solution of the same concentration that had previously been in that unit, heat it up for an hour, and start the process over again. The second choice would be to take that Alcotest instrument out of service. Both choices, of course, would cause inconvenience.

In its September 19, 2016 letter to Judge Grant requesting the appointment of a special master, the State included a footnote stating:

> As background, the Office of Forensic Science included the preliminary NIST-traceable thermometer step in New Jersey's calibration procedure not because of scientific necessity but rather for a practical purpose — to confirm that the liquid simulator solutions are within the accepted temperature range before the coordinator initiates the actual calibration. This preliminary step is distinct from the actual calibration, in which the temperature of the liquid simulator solutions is measured independently by a black key temperature probe connected to the instrument, separate and apart from the NIST-traceable digital thermometer. If the black key temperature probe confirms that the temperature of the liquid simulator solutions is within the required ranges, the Alcotest instrument records that temperature on the resulting printed reports. If the black key temperature probe records that the temperature of the liquid simulator solutions is not within the required ranges, the Alcotest instrument will end the calibration and will give an error message. In other words, the black key temperature probe ensures proper calibration of the Alcotest instrument, regardless of the use (or non-use) of the NIST-traceable digital thermometer.
>
> [D-6.]

This assertion by the State, which it has continued to advance throughout the proceedings before me and in its post-

hearing proposed Findings of Fact and Conclusions of Law is simply not supported by the evidence.

In his overall testimony, Brettell repeatedly stated that the purpose for which he put the NIST thermometer step in the procedure was to achieve scientific reliability. He emphasized the extreme importance of an accurate temperature in the CU34s, especially the agency CU34 that is used in the CALIBRATE function. All experts agreed with him on that. Brettell repeatedly explained that only by a direct temperature measurement with an independent and outside NIST-traceable thermometer could a scientifically reliable measurement of those temperatures be achieved. The CU34s themselves are not equipped with any kind of read-out screen, as a result of which the temperature of the solutions they contain are unknown until measured.

Brettell was unwilling to rely on the Draeger probes for that measurement, insisting that an outside NIST-traceable temperature measuring device, completely independent of Draeger, was necessary. If the NIST thermometer measured the temperatures of the solutions as within range, that would establish that the CU34s were in good working order. Thereafter, having accurately determined that the temperatures of the simulator solutions were within the required range, the

good working order of the Draeger probes could be "verified" if they also reported in-range temperatures.

I rely upon several aspects of the evidence in rejecting the State's "pre-test" argument. First, if this were merely an administrative convenience to avoid activating the CALIBRATE function without first checking the CU34 temperatures, the same result could be achieved by using the black key temperature probe. Klimik and Shaffer both testified that with the black key probe, the coordinator could, before activating the CALIBRATE function, simply press the escape key, pull up the appropriate screen, and, using the black key probe, get a temperature reading on each of the CU34s without activating the CALIBRATE function.

The obvious inference to be drawn from this is that Brettell did not have sufficient confidence in the scientific reliability of using the black key probe for that purpose, notwithstanding the many safeguards built into the Draeger equipment. Of course, this would be consistent with his unwavering testimony that the black key probe could only be verified for accuracy by indirect means after first measuring the solution temperatures with an independent NIST-traceable thermometer. And Brettell, as well as most other witnesses, would leave the step in the procedure if writing it anew today.

In the seventeen years that the Alcotest 7110 has been in use in New Jersey, neither Brettell nor his successors ever took steps to remove the NIST step from the check procedure and replace it with the black key probe as an administrative convenience before activating the CALIBRATE function.

My second point of reliance is based on Brettell's very credible and forceful testimony when confronted with the above quoted footnote from the State's September 19, 2016 letter. Brettell was shown the footnote and asked to read its contents out loud, after which this colloquy occurred:

> Q. Thank you. Do you agree with that statement?
>
> A. No, I don't.
>
> Q. What don't you agree with?
>
> A. Well, it's — it's not to confirm that the liquid simulator solutions are within the accepted temperature range, but it's to confirm — in a way, that's true, but it's more to confirm that the actual simulator, or calibrating unit's operating properly to get to that temperature.
>
> Q. And do you agree that that step was not scientifically necessary?
>
> A. Well, it was for me.
>
> [7T148-25 to 7T149-12.]

I remember very distinctly that Brettell expressed his initial answer, "No, I don't," in an emphatic tone. When he

went on to answer what he didn't agree with, about half-way through, just before saying "in a way, that's true," he paused in a reflective manner, and then allowed that it would have the effect of informing the coordinator that he could now actuate the calibration function, but that is not the purpose for the step. The purpose is to make sure that the CU34 is operating properly, which would be indicated by the fact that it achieved an in-tolerance temperature reading, as measured by a NIST-traceable thermometer.

Third, after learning that the Ertco-Hart thermometers could no longer be used, the State did not take steps to remove the NIST thermometer step from the Calibration Check Procedure. Instead, it doubled down through Baum's December 23, 2008 memorandum recommending the purchase of a new model digital thermometer which would comply with all of the strict requirements for NIST traceability and would be produced by an ISO 17025 accredited lab. His recommendation was accepted and the Control Company thermometer was put into use.

In the Holland litigation, defendants challenged the use of this substitution, claiming that, under Chun's literal terms, only the Ertco-Hart could be used. The Holland Court rejected that argument and, after a remand for an evidentiary hearing, concluded that the Control Company thermometer was comparable

and a sufficient substitute for the Ertco-Hart. The State never asserted in that litigation, either as its primary or alternative position, that a NIST-traceable thermometer is not required to assure scientific reliability. It did not seek authorization to remove the NIST thermometer step from the calibration check procedure or to designate it as an optional step. It certainly did not argue to the Holland court that it was a mere pre-step for administrative convenience that had nothing to do with scientific reliability.

Finally, the State intends to leave the NIST thermometer step in as a mandatory part of the calibration check process. It does not seek judicial authorization to remove it or designate it as optional.

The evidence supports the finding that the NIST thermometer step is an integral part of the calibration check procedure, not a "pre-test" or administrative convenience. Indeed, if that step reveals a simulator solution temperature even slightly outside the precise range allowed, the coordinator is required to stop everything and not proceed with the CALIBRATE function.

D. Undetected miscalibrations

The witnesses agreed that it is critical that the CU34s heat to 34°C, plus or minus .2°C. This precise temperature range is important because, at the correct temperature, the

headspace in the CU34 will generate an ethanol concentration within the correct tolerance to pass control and linearity tests.

Having the temperature in the correct range is particularly critical for the agency CU34 when used in connection with the CALIBRATE function. During control and linearity tests, the instrument measures the ethanol concentration but makes no internal changes. During the CALIBRATE function, however, the instrument is essentially being instructed that the headspace ethanol concentration it is measuring is 0.10, and it adjusts itself to that and bases all of its subsequent calculations on that instruction until the next CALIBRATE function (7T84;10T51; 11T113). If the headspace ethanol concentration is not 0.10, the adjustment and subsequent calculations will be wrong.

Both Brettell and Stolz testified that each 1°C change in the temperature of the simulator solution from the target 34°C would cause a change in the ethanol concentration of the headspace of approximately seven percent (7T92;11T168). As Stolz explained, if a coordinator performed the CALIBRATE function with an agency CU34 heated to 33°C rather than 34°C, then "everything that instrument sees" until its next CALIBRATE function "would actually be reported as seven percent higher" (17T168). Performing the CALIBRATE function based on an

incorrect headspace calibration (a miscalibration), if left undetected throughout the remainder of the calibration check process, would impact later breath tests performed on that instrument because the coordinator would have "taught the instrument that a .1 sample looks like a .093 sample" and then placed the instrument back in service (17T168). Thus, an undetected miscalibration based on a too-low temperature would have the effect of overstating the true BAC during later breath tests.

Conversely, if the agency CU34 was heated to 35°C during the CALIBRATE function, the instrument would report headspace readings as seven percent lower than the actual concentration being measured until the next CALIBRATE function was performed. An undetected miscalibration based on a too-high temperature would have the effect of understating a subject's BAC in later breath tests.

The State's witnesses did not dispute that, if the CALIBRATE function was completed using an agency CU34 heated to the wrong temperature, then a miscalibration would occur and the Alcotest would fail to read subsequent ethanol concentrations correctly. It also does not dispute that, if undetected, this miscalibration would have the effect of either overstating or understating the results of breath tests performed on that

instrument, depending on whether the agency CU34 temperature was too low or too high.

Using the NIST thermometer as required in the calibration check process would effectively prevent an undetected miscalibration from ever happening because the out-of-range CU34 would be identified and replaced before the coordinator ever began the CALIBRATE function (6T155;7T107). Both Klimik and Brettell testified that coordinators are trained not to proceed with the calibration check if the NIST thermometer shows any of the CU34s to be heating out of range (6T155;7T107). Thus, no miscalibration could ever occur unless the NIST thermometer step was skipped.

The State does not dispute this. Rather, the State's argument is that the NIST thermometer is not essential because the instrument itself and other components have so many checks and balances that it would be (1) unlikely for a miscalibration to occur during the CALIBRATE function, and (2) virtually impossible for a miscalibration to pass undetected during the remainder of the calibration check process. Shaffer was the primary proponent of this theory, although Brettell agreed with it in his testimony (7T89-7T96). Shaffer testified that a situation in which an unidentified miscalibration could occur was "pretty unimaginable" (10T58). Brettell, referring to

Shaffer's theory as expressed in Shaffer's report, said that it would be "like trying to line up the moon and all the planets at the same time for that to really happen" (8T133).

Shaffer noted that the NIST thermometer requirement in the calibration process is specific to New Jersey and neither required nor recommended by Draeger (10T34-10T35). In his opinion, a check with the NIST thermometer is not necessary for scientific reliability because of "three fundamental measurement mechanisms" in other components used in the calibration check (10T37-10T38). First, the Draeger temperature probes "are measuring the solution temperature as an integrated part of the calibration process built into the instrumentation" (10T38). Second, the CU34 is "an independent piece of equipment separately and independently certified and tested," its "sole purpose" is to heat simulator solution to the proper temperature range, and it "has an independent temperature measuring probe inside it which operates independently and generates its performance independently" (10T38-10T39). Third, the simulator solutions are independently certified for accuracy and, because of Henry's law, if the temperature of a CU34 were out of range, the headspace concentration of ethanol would be out of tolerance, "and this would be identified throughout the process" (10T40).

Shaffer drew an exhibit delineating each step in the calibration check process and listing the CU34, probe, and solution used at each point (10T42-10T58;S-46). He opined that, if the agency CU34 had an out-of-range temperature, that error would necessarily be detected unless both probes, all three other CU34s, and four of the five simulator solutions used were also wrong or malfunctioning (10T42-10T58). Moreover, according to Shaffer, each of the malfunctioning components would have to be wrong "in tandem" with the others to avoid detection of the errors (10T42-10T58).

Shaffer explained that, if the agency CU34 were heating out of range during the CALIBRATE function, the black key probe used to perform that function would report a SIM TEMP error rather than perform the function unless that probe, too, was malfunctioning (10T50-10T51). He further explained:

> Not only that, but they would have to be wrong in the same direction, meaning they would have to both be falsely, you know, creating and reporting a temperature too low or too high. And then even further, they would need to be reporting in the same direction, but also the same magnitude. It wouldn't be enough if they were just too low and one was, let's say, 2 degrees too low and the other 5 degrees too low. They would have to be wrong together.
>
> [10T51-3 to 11.]

Thus, before a miscalibration could occur, both the agency CU34 and the black key probe would have to be incorrect.

If a miscalibration occurred, Shaffer noted that the control test would not detect it, as the same agency CU34 and black key probe used in the CALIBRATE function are used in that test (10T53-10T54).

However, Shaffer testified that a miscalibration would be detected in the first step of the linearity test, when the coordinator uses his own 0.04 CU34 and a bottle of 0.04 solution (10T54). If the black key probe had incorrectly reported the agency CU34 temperature to be in range, thus allowing the miscalibration, then the 0.04 CU34 would have to "fail also in the same direction and the same magnitude" for the black key probe to consider its temperature to be in range (10T54). In addition, if the instrument had been calibrated to the wrong ethanol concentration during the CALIBRATE function, then the instrument's reading of the headspace of the 0.04 solution would be out of tolerance unless the coordinator's bottle of 0.04 solution was not the concentration it purported to be (10T54). He explained:

> To complicate matters, in this hypothetical, this solution, because of Henry's Law, a very well understood scientific principle, the foundation of what was used as wet bath simulators, this solution needs to fail, but it needs to fail in an opposite direction.

> Because if—if we're assuming in the hypothetical that A, B and C [the agency CU34, the black key probe, and the coordinator's 0.04 CU34] are low, then in order for us to pass this step, this solution would need to be correspondingly higher because Henry's Law, if it's truly cooking at a temperature lower than 34, then its concentration would need to be too high in order for it to come into the proper tolerance range for the instrument.
>
> [10T54-12 to 24.]

The same rationale applicable to the 0.04 portion of the linearity test would also be present for the 0.08 and 0.16 portions, meaning that the coordinator's 0.08 CU34, 0.16 CU34, bottle of 0.08 solution, and bottle of 0.16 solution would all also have to fail in tandem, "in a correspondingly incorrect offset," for the instrument to get through the linearity test without detecting the miscalibration and triggering an error (10T54-10T56).

Finally, even assuming that all of these coordinated errors occurred, in the final step of the calibration process the coordinator performs a solution change using the agency probe and a new bottle of 0.10 solution from a different lot than the solution used during the control test (10T57). Shaffer testified that the agency probe would have to be wrong in the same way and to the same degree that the black key probe was wrong, or it would detect a SIM TEMP error in the agency CU34,

which was used for the CALIBRATE function and is used again for the final solution change (10T57). Moreover, the 0.10 solution used in the solution change would have to be wrong in tandem with the wrong solutions used during the linearity test, or the ethanol concentration readings taken during the solution change would be out of tolerance (10T57).

Shaffer concluded, "[T]hat's 10 different independent unique things failing together in an orchestrated way in order for that scenario to hold true" (10T60). He stated, "I almost can't even imagine it" (10T60). Brettell also noted that for an undetected miscalibration to occur, the CU34s, probes, and simulator solutions would "all have to be off in the same direction" (8T133). I refer to this theory as the ten-tandem-failures theory.

Shaffer also noted that each of the four different simulator solutions that would have to be wrong in the ten-tandem-failures theory "has its own NIST traceability trail" (10T58). Because "those solutions would have to be wrong in order for such a scenario to play out without failure by the instrument," he was even more confident that "such a hypothetical could not be realized" (10T58).

This theory has a certain appeal. The NIST thermometer serves the purpose of ensuring that the CU34s are heating

properly. If multiple other safeguards serve the same purpose and actually make it "pretty unimaginable" that an undetected miscalibration could actually occur and lead to incorrect BAC results, then the NIST thermometer would serve little practical purpose.

Shaffer's insistence that four of the five simulator solutions would have to be wrong for an undetected miscalibration to occur, if true, would be particularly persuasive. Although lots of simulator solution are purchased through Draeger, (1) they are manufactured to the specified concentrations by an independent vendor, (2) Draeger provides a certification as to the accuracy of the concentration in each lot, and (3) the OFS tests and certifies the accuracy of samples of every lot before authorizing purchase of bottles within that lot (10T116-10T116;15T74-15T76;15T192-15T195;15T229-15T230;King SMR 67, 108). Alaouie testified in detail about the process used by the OFS to certify the accuracy of each lot of simulator solution, and he noted that he could not recall any circumstance in which the OFS tested a lot and determined that its stated ethanol concentration was inaccurate (15T192-15T227;15T231;S-15 through S-24). The OFS testing of the solutions does indeed meet NIST standards and the measurement of the solutions is NIST-traceable.

The parties did not dispute this evidence, and it compels the conclusion that the stated ethanol concentrations of the bottles of simulator solutions used by ADTU coordinators and police agencies are correct. There is no basis to suppose that any lot of mislabeled solution or wrong-concentration solution could somehow slip through both the original and OFS analyses, much less that unrelated lots of different concentrations would slip through and then all be used during the same calibration check procedure. Thus, if the State is correct in its position that an undetected miscalibration simply could not occur unless four of the five bottles of simulator solution were wrong, then terming the ten-tandem-failures theory "pretty unimaginable" would be accurate.

Defendant, amicus, and participating counsel have all essentially failed to address the ten-tandem-failures theory, either in expert reports, through Stolz's direct testimony, or in their proposed findings of fact and conclusions of law.

However, Stolz was asked about it on cross-examination. He posited "a scenario" in which an undetected miscalibration could occur "even if all your solutions are absolutely correct or have very small tolerances in concentration" (17T167-17T169). He noted that, if one were to "assume that the temperature that Draeger use[d]" to test and certify all of the probes and CU34s

used in a given calibration check was 33°C rather than 34°C, then a miscalibration would occur, but it would remain undetected because all of the other solution concentrations, while actually seven percent higher than reported, "would fall neatly on the calibration curve that we want to verify and it would not indicate a problem" (17T168-17T169). Thus, Stolz presents a scenario in which it would be possible for an undetected miscalibration to occur if the solution concentrations were correct and the only "problem" was that the two probes and four simulators provided by Draeger had been somehow "misset" to treat 33°C as if it were 34°C.

On the surface, Stolz's scenario appears to target the strongest aspect of the ten-tandem-failures theory, namely the astronomically-unlikely possibility that four of five simulator solutions could somehow be wrong in a coordinated manner during a calibration check. In the Stolz scenario, the solutions could be fine and only the six devices provided by Draeger would have to be wrong. The Stolz scenario also posits a hypothetical as to how it would be possible for all six devices to be wrong; specifically, Draeger could have mistakenly misset everything to the wrong temperature.

Brettell echoed this concern when explaining why he considered it necessary to include the NIST thermometer step in

the calibration check process in the first place. In designing the calibration check procedures, Brettell was aware of the importance and legal significance of "the results that come out of the evidential breath testers," so he wanted "to do everything in my power to make sure the instruments are working properly" (7T238). So, even though he thought "Draeger puts out a great instrument" with many checks and balances, he "wanted an independent test done on the calibrating unit to be done to make sure that that calibrating unit was working" (7T238). He testified, "I wanted to make sure it was working. It's as simple as that. And I wanted to make sure it was — I didn't want to rely on Draeger to tell me that this thing was working" (7T240-7T241).

Brettell later explained:

> I felt — it was my view of this is that the Alcotest 7110 MK III is manufactured by Draeger and calibrated by Draeger. The CU34 simulator calibrating units are manufactured by Draeger and certified by Draeger. The simulator solutions are purchased from [Guth] through Draeger. Draeger puts a solution [sic] on that, and we independently check that and test that.
>
> And so I wanted an independent temperature check to make sure that the calibrating unit was working. Because the calibrating unit is what the Alcotest is based on. And it's an independent component. And so if we independently tested the solution it was in, and we independently tested the temperature

> it was in, at least that part of the component and the instrument is independently tested from Draeger. And I felt that was very important, okay.
>
> * * *
>
> And it's simply because of one very small part of the calibration check, which I think is important. But if you put everything into Draeger's hands as far as certifying the solutions, the instrument, the calibrating unit and everything else, what if – what if there is a bias or an error in Draeger's laboratory? What impact would that have on the breath test program in New Jersey?
>
> And so as far as the risk assessment, I took every step I could to independently test as much as I could of this program independently of Draeger to make sure that if that happened, we have a good chance of stopping it before it proliferated out. And so that's my view of this situation.
>
> [8T29-1 to 8T30-13.]

Brettell confirmed this is "exactly why I added this step" (8T30). He later added:

> The NIST thermometer would tell you that the calibrating unit is either working or not working before you got into the probe or anything. Because is it – I don't even know, is it possible that something could go through Draeger that the calibrating unit and the probe are tied together and there's a bias and it goes right into the instrument and nothing catches it? Okay. And so it you can test that with an independent thermometer, then I'm sure that calibrating

> unit is working and then we can move on from there.
>
> [8T138-7 to 17.]

Brettell's concern was justified that, absent the inclusion of the NIST thermometer step, a potential systemic bias in Draeger's equipment or procedure might have gone undetected. The NIST thermometer step has been part of the process since its inception and, notwithstanding the fact that Dennis allegedly failed to use his NIST thermometer when performing three calibration checks, there is no reason to suppose that Klimik and the other coordinators have ever failed to use their NIST thermometers as they were trained to do.

The problem with Stolz's "Draeger could have set everything to 33°C by mistake" theory is that it does not present a realistic scenario of a problem that could actually have resulted from a single coordinator skipping the NIST thermometer step. A scenario in which both an agency's and coordinator's equipment could all be misset to accept a temperature outside the required range of 33.8°C to 34.2°C (1) could not occur absent systemic errors in Draeger's processes, and (2) would be detected unless no coordinators used their NIST thermometers.

As to the first point, Stolz supposes a type of systemic error within Draeger that would have to result in a very large number of misset probes and CU34s. Mere isolated issues within

Draeger's recertification process affecting only a few probes or simulators could not realistically lead to a scenario in which an agency's two devices (probe and CU34) and a coordinator's four devices (black key probe and three CU34s) had all been misset to accept the same wrong temperature yet all came together in one calibration check procedure. Moreover, even assuming this somehow happened at one agency, because coordinators typically visit two agencies per day, four days per week, the misset coordinator's devices would repeatedly run into a problem unless the probes and CU34s at subsequent agencies had also been misset. Thus, only a systemic error at Draeger resulting in a missetting of large numbers of devices could realistically result in a circumstance in which an undetected miscalibration could occur and remain undetected as the coordinator who performed it moved from agency to agency.

Second, even assuming a systemic problem occurred at Draeger causing a large number of devices to be misset, the problem would have been detected by coordinators using the NIST thermometer. Klimik's testimony that coordinators are trained to do the NIST thermometer step "every time" with "[n]o exceptions" and that he has, in fact, done so, was credible (6T105-6T106). Accordingly, the Stolz theory that everything

from Draeger could be misset is an extremely unlikely possibility.

This analysis, while negating Stolz's theory, does serve to illustrate the significant role of the NIST thermometer in the calibration process. Daily use of the NIST thermometer by the six coordinators in the field is what would reveal a systemic bias at Draeger. This illustrates the critical importance of using the NIST-traceable thermometer in this process. This analysis also shows that the ten-tandem-failures theory is not irrefutable, as argued by the State.

Continuing with the analysis, I am persuaded by other evidence and testimony that the ten-tandem-failures theory significantly overstates the case in contending that ten errors would have to happen in a coordinated manner for an undetected miscalibration to occur. Taken together, the evidence suggests that under the right circumstances three plausible and relatively minor failures, specifically in the agency CU34 and both probes, could result in an undetected miscalibration. Significantly, none of these failures would involve any of the simulator solutions or depend upon speculative software bugs or large-scale systemic error.

The State's position is that an agency CU34 temperature that was even slightly outside the precise temperature range of

34°C, plus or minus .2°C, would result in a SIM TEMP error because the agency and black key probes would either (1) if functioning correctly, recognize the out-of-range temperature in the agency CU34 during the CALIBRATE function, or (2) if functioning incorrectly, mistakenly read the temperature of the coordinator CU34s as out-of-range during the linearity test. Thus, the State contends that even malfunctioning probes would generate a SIM TEMP error at some point during the calibration process unless all of the CU34s were malfunctioning in tandem with the agency CU34.

However, the evidence regarding probe value suggests that, in some circumstances, a Draeger probe might interpret as acceptable a temperature range that overlaps but is not coextensive with the actual acceptable range of 34°C, plus or minus .2°C.

All of the witnesses agreed that if the probe value entered by the coordinator into the instrument was not the same as the actual probe value, then the reported temperature measurement from that probe (the misaligned probe) would not be correct (6T44;6T81-6T83;8T127-8T130;8T157-8T158;9T117-9T118;10T146; 12T131;14T6-14T7;17T111-17T115). Klimik noted that if the probe value entered into the instrument was lower than the actual

probe value, the instrument would "read" a lower temperature than the actual temperature of the simulator (6T82).

The evidence also established two plausible ways in which the entered probe value could be wrong: (1) a data entry error by the coordinator, or (2) probe value drift. As detailed above, coordinators must manually input the probe value of the black key probe before performing the CALIBRATE function and of the agency probe before performing the solution change, and no record is made of the number entered (6T69;6T71-6T72;6T78-6T79; 6T142). A simple typo by the coordinator, for example entering "5" rather than "6" for a probe value of 106, could easily occur and potentially go undetected. Also, during its year of use, a probe value could drift to the point at which, by the time it is sent to Draeger for recertification, the probe value assigned to that probe must be changed in order to match the manner in which the probe is actually measuring resistance.

Shaffer testified that entering the wrong probe value "would absolutely give an error message . . . [p]robably in the first step of the calibration process" (10T145-10T146). He was asked to consider a specific example in which the actual probe value was 108 and the coordinator incorrectly entered 98 (10T146). Shaffer testified that, in that circumstance, the Alcotest would report that a 34°C solution was "something like

33.5, maybe 33.0, somewhere in that range, degrees C reading" (10T146). Shaffer, however, only addressed the hypothetical in which the entered probe value and the actual probe value diverged by ten points, and he was not asked to quantify the temperature that would be reported if the actual probe value was only slightly different from the probe value entered into the instrument.

Both Brettell and Klimik testified that a misaligned probe might or might not abort the calibration check process, depending on the degree of misalignment. Brettell testified that, under some circumstances, a misaligned probe might report as appropriate a simulator-solution-temperature range that overlaps but is not coextensive with the actual acceptable range of 34°C, plus or minus .2°C. A probe misaligned in this way could report as within range both (1) an agency CU34 that was heating slightly below the correct temperature range, and (2) three coordinator CU34s that were heating properly. Brettell explained it thusly:

> Because if it happens that that probe value overlaps the real probe value, because when you put that probe value in there, there is a range of resistance that that probe is matching, okay.
>
> So let's say we put a probe value of 103 and we have a certain range, it's possible that those two probe values in a certain part of

> that range will overlap, okay, for the resistance. Follow me?
>
> So that if you put in the wrong probe value and it measures the resistance, it might be out of range for that number and give you— abort the test, or it could read the resistance in that range that overlapped what the real resistance is and would say is temperature is okay. So it could.
>
> THE COURT: Would you be confident that the temperature is okay as a result?
>
> THE WITNESS: You wouldn't know. You wouldn't know unless you tested with a NIST-traceable thermometer.
>
> [8T127-16 to 8T128-10 (emphasis added).]

Brettell thought that "most likely if you put in the wrong number, it will not read the temperature [as] right" and will abort the test (8T129-8T130). He acknowledged, however, that because the probe value inputted by the coordinator is not recorded, there would be no way to know if an inadvertent mistake had been made (8T129). The same would be true if the probe value had drifted from the number assigned in its last Draeger recertification. Most significantly, "[y]ou wouldn't know unless you tested with a NIST-traceable thermometer."

Later, Brettell acknowledged that if a probe value was incorrectly inputted, "the instrument may or may not pick it up, . . . depending on how close to the actual probe value his mistake is" (8T156). He explained:

A. Well, if the proper probe value was inserted, the resistance range would be lining up with the temperature range equal like this. Okay. If the probe value is put in differently, such that the resistance range is shifted one way or the other, okay, now, the resistance range is here and the temperature range is here, there's an overlapping range where that — if that resistance reads in there, it's going to read the proper temperature, okay. If it reads the resistance down here, okay, it's not going to read the right temperature.

Q. But then he removes the black key temperature probe and inserts — and substitutes for that the department's temperature probe, which has its own probe value, which he is then required to input into that machine, and he does that step properly, okay?

A. Okay.

Q. Can you tell me whether that's — that wouldn't equal the difference between an 079, a .079 and a .080 on a breath test?

A. I couldn't tell you that.

Q. Nobody could.

A. No.

[8T157-25 to 8T158-22 (emphasis added).]

Klimik acknowledged that a misaligned probe could indicate that a temperature was within the appropriate range, even though it was not (6T81-6T83). He said that "[h]ypothetically speaking," it was possible that the black key temperature probe could show a CU34 temperature as within range even though the

NIST thermometer would show that it was slightly out of range (6T155). This was hypothetical in Klimik's view because he said he would never proceed to calibrate the instrument if the NIST thermometer was not in range, but if someone did, it could possibly happen that the process would "go[] through clear" (6T155). Of course, if the CU34 was not initially tested with the NIST thermometer, the coordinator would not know that the black key probe was incorrectly reporting a slight out-of-range temperature as being within range.

In addition to the problem of incorrectly entered probe value or probe value drift, Stolz noted that the Draeger probes could fail in such a way that changes in temperature would not result in corresponding changes in resistance (17T123;17T158). If this happened to a black key probe, it would fail to detect the problem if the agency CU34 was out of range, but it would still "read" the coordinator's CU34s as within range.

The State's position is that any or all of these issues with the Draeger probes would not result in an undetected miscalibration because, even if they occurred, if the simulator solutions were correct, then the ethanol headspace concentration would be out of tolerance and the calibration check procedure would fail at the linearity test stage. I find this

unpersuasive. Like Shaffer's ten-tandem-failures theory, the State's position substantially overstates the case.

As stated in the Calibration Check Procedure, the acceptable tolerance in the linearity test allows the ethanol headspace to be "within plus or minus 5% or 0.005, whichever is greater" (S-32). Logically, given the range of this tolerance, some out-of-range temperatures in the agency CU34 could lead to a miscalibration that would (1) change the linearity test results from what they would have been had the CU34 temperature been correct, but still (2) fall within the acceptable tolerance range and appear to "pass" the linearity test.

The State's position does not take into account the credible testimony of its own witnesses, which establishes that relatively minor inaccuracies in three components could allow miscalibrations to slip through undetected. And, very important in the analysis, the State's witnesses could not quantify the problem because without performing the NIST thermometer step, the process lacks NIST traceability, as a result of which no scientifically accurate temperature measurement of the CU34 was ever achieved and no measure of uncertainty in such a measurement is known. Major inaccuracies would be detected because of Henry's Law. But, even so, the evidence does not establish where a line might be drawn with reasonable scientific

reliability. The State bears the burden of proof by clear and convincing evidence. Its failure to prove this critical fact by that standard, if it is indeed capable of such proof, cannot be disregarded and results in a substantial diminution in the scientific reliability of resulting breath tests.

Significantly, although Brettell generally agreed with the ten-tandem-failures theory, he still believed that it was important to include the NIST-traceable thermometer step in the calibration check process. He testified:

> A. When I was the Director of the laboratory, I required the calibrat[ing] units to be checked by a NIST-traceable thermometer prior to being checked by the Draeger probes. And I — because I wanted an independent test that was traceable to NIST.
>
> Q. And you haven't changed that opinion?
>
> A. No. But I'm not the Director of the lab anymore.
>
> Q. I understand, but you're giving us your best opinion here today as an expert.
>
> A. Yes.
>
> Q. So the failure to use that — so the utilization of that is necessary, in your opinion?
>
> A. In my opinion, it's — you have to understand where I'm coming from, okay? As the Director of the laboratory —
>
> Q. Well, could you answer my question yes or no —

A. No, I would like to —

THE COURT: Let him answer it the way he wants to answer it.

MR. FISHMAN: Sure, Judge.

A. As the Laboratory Director, my responsibility is for the quality of this breath testing program. And as you can see from this hearing, the results that come out of the evidential breath testers is very important. It expands a large number of people and there's a lot of legal, you know, ramifications of it. So from where I'm sitting I have a very — you know, I have a lot of responsibility for this. And so I'm going to do everything in my power to make sure the instruments are working properly.

Draeger puts out a great instrument. The probes work fine. If you have the solutions calibrated and the probes are working and calibrated, the instruments are working, everything is fine. And so they have a design-arranged — they have a really exuberant checks and balances. And I think we — I went over this and somebody explained them, but I think 10 or more things have to go wrong in a row for a wrong breath alcohol value to come out of the instrument.

With all that said, all that data depends on Draeger. And from where I'm sitting, and my responsibilities, I wanted an independent test done on the calibrating unit to be done to make sure that that calibrating unit was working.

And so that was just my call. The instrument reliably put out a breath test sample? Sure it will.

> And so that's how I feel. This word "necessary" keeps coming up. It's only necessary from where you sit and stand on this. So that's my explanation of it.
>
> [7T237-2 to 7T239-3.]

The evidence supports the conclusion that a miscalibration resulting from an agency CU34 heating slightly outside the acceptable range might not (1) trigger out-of-tolerance results for ethanol concentration during the linearity test, or (2) be detected by the black key or agency probe if (a) the probe values entered into the instrument were incorrect, whether because of coordinator error or probe drift, or (b) probe failure occurred. Having these three errors occur in a single calibration check process is unlikely, but they are nevertheless possible errors based on the evidence.

Significantly, this evidence suggests a plausible circumstance in which only three of the devices used during the calibration check process (the agency CU34, the black key probe, and the agency probe) could be slightly wrong yet ultimately result in an undetected miscalibration. These potential errors are not "pretty unimaginable" or "like trying to line up the moon and all the planets at the same time."

I find that the State has failed to show that an undetected miscalibration could not plausibly occur during a calibration

check process if the NIST thermometer step was skipped. Such an undetected miscalibration would result in incorrect results in evidentiary breath tests done on such an instrument until the next calibration.

E. Discussion of Baum and Alaouie opinions

In the previous section, I discussed in detail the basis for Shaffer's opinion that the scientific reliability of breath tests produced by an Alcotest device which was calibrated without using the NIST thermometer step would not be undermined or called into question. Shaffer's theory required detailed analysis because it is somewhat complex and because it forms a fundamental underpinning of the State's position in this case. In this section, I will go on to discuss the "bottom line" opinions rendered by two of the State's other experts, Baum and Alaouie. Unlike Shaffer's theory, the opinions rendered by these experts were supported by several discrete reasons. In each case, I find the reasons unpersuasive and I find it unnecessary to provide an extensive discussion.

When Baum was asked for his ultimate opinion regarding the issue presented in this case, this was the colloquy:

Q. Is it a required legal step?

A. It's required by the Chun decision, yes.

Q. Doctor, is the use of the Control Company digital thermometer, based upon your expertise, required scientifically in order for the instrument to be scientifically reliable?

A. No, it is not.

Q. Can you please explain to the Court the basis of your opinion?

A. The basis of my opinion is, there's a number of systems in the instrument to indicate and stop if the temperature is not appropriate.

First of all, as I testified recently, during a solution change, it's not used or during evidential breath testing it's not used.

Second, there is the CU34, which is this calibrat[ing] unit, and the CU34 is calibrated annually by Draeger Scientific, and that is calibrated to show that it can hold the temperature 34 plus or minus 0.2 degrees Celsius. Also, there is the temperature probes, whether it's the black key or agency temperature probes that are calibrated annually. And those also have to be within range. And the instrument will not go forward with the test. There's complicated source code in the instrument that won't allow it to go forward if it is not reading. The overriding decision is the instrument, it's not the hand[-]held thermometer, of whether to go forward or not with the test.

* * *

Q. Doctor, the black key temperature probe and the calibration process, what effect does that have on your opinion, if any?

A. The calibration and the black key temperature probe is crucial to make sure that it properly can read the temperature of 34 degrees.

Q. The agency temperature probe and the calibration of the agency temperature probe, what effect does that have on your opinion?

A. Again, it is crucial that it's calibrated so that it can read the temperature of 34 degrees plus or minus the 0.2 degrees.

Q. The testing of the CU34 simulators, the calibration of the CU34 simulators, what effect does that have on your opinion?

A. Again, it shows that the simulators will heat up to and maintain the proper temperature, which is also very important.

Q. And the testing of the simulator solution and the lots that you referred to earlier, what effect does that have on your opinion?

A. That also affects the opinion because it's very important to have simulator solution with the right amount of alcohol, because it could not be properly calibrated with the wrong amount of alcohol.

[12T244-11 to 12T245-14; 12T245:23 to 12T246-22].

Baum's first reason contains two components. He relies on the fact that the protocol does not require use of the NIST

thermometer (1) during a solution change, or (2) during evidential breath testing.

At the very end of the calibration process, the coordinator performs a solution change, using the agency CU34. There is no need to test the agency's CU34 at that time because it was just tested an hour or two earlier with the NIST thermometer and proven to be producing a solution temperature within the required range. Then, after the calibration procedure is completed and the coordinator leaves, the local or State Police who are qualified as operators in that agency are required to perform periodic solution changes after not more than twenty-five breath tests are administered. These solution changes are conducted during the six-month cycle preceding the next calibration check. In Chun, a thorough analysis was conducted and it was determined that with all of the specified requirements and procedures, including a six-month calibration check interval (as opposed to Draeger's recommended one-year interval), the Alcotest device and its components would be deemed sufficiently scientifically reliable to be in good working order. Thus, there is no need during the six-month interval for further testing of the agency CU34, which was established in the previous calibration check to be in good working order by virtue of measuring its temperature with a

NIST-traceable thermometer. This same reasoning applies to breath tests administered during the six-month interval.

In his second reason, Baum relies on the fact that the agency CU34 is calibrated annually by Draeger. From that, he concludes that it has been established that the CU34 can be relied upon to produce in-range temperatures during that year. For reasons previously discussed in this report, whether Draeger uses NIST-traceable instrumentation or not in its annual calibration process, the device calibrated does not achieve NIST traceability. Stated differently, that device does not acquire the ability through that process to produce temperature measurements traceable to a NIST standard.

The same is true with respect to the first portion of Baum's third reason, namely that the black key and agency probes are calibrated annually by Draeger and, in the course of that calibration, were determined to have read temperatures within range. Again, that process does not confer on the Draeger probes the capability of rendering a NIST-traceable measurement result. Reliance upon the CU34s and the Draeger probes without the NIST thermometer results in a temperature determination that simply lacks NIST traceability. That is the scientifically required aspect of the temperature measurement that is essential to determining the good working order of the CU34s before the

CALIBRATE function can be activated and the calibration check procedure can be completed.

In the second part of Baum's third reason, he states that after the CALIBRATE function is activated, the instrument will not be able to go forward if there is a temperature error detected by the Alcotest firmware. He continues that "[t]he overriding decision is the instrument, it's not the hand[-]held thermometer, of whether to go forward or not with the test." That statement is incorrect. Everyone in this case agrees that if the "hand-held thermometer," which is the NIST thermometer, does not read within range, the coordinator is not permitted to "go forward" with the test.

After expressing those three reasons, several additional questions were posed to Baum by way of follow-up as set forth above. To the extent that those follow-up questions dealt with the black key temperature probe, the agency temperature probe, and the CU34s, Baum's answers added nothing to his three stated reasons.

Finally, he was asked whether the testing for accuracy of the simulator solutions affected his opinion. He answered affirmatively. However, for reasons expressed elsewhere in this report, the accuracy of the simulator solutions will not necessarily prevent miscalibrations if the agency CU34 and the

Draeger probes are slightly misaligned. This is why it is so extremely important to ascertain, with an independent NIST-traceable temperature measuring device, that the temperatures are precisely within range. If those temperatures, particularly in the agency CU34, which is used in the CALIBRATE function and which "teaches" the instrument what a 0.10% ethanol concentration is, are even slightly outside the allowable tolerance, that instrument could slip through the calibration check process and result in a miscalibration.

There is no dispute that the accuracy of the solution concentrations is essential. The evidence clearly supports a finding that the testing performed by the OFS achieves the required NIST-traceable accuracy. But that alone will not necessarily prevent miscalibrations if temperatures are slightly off under circumstances described elsewhere in this report.

Counsel for the State further questioned Baum about the Shaffer theory, with which Baum said he agreed (12T251-12T252). This does not require further discussion here, because, for the reasons set forth in the previous section of this report, I have rejected Shaffer's theory.

Accordingly, I do not find the reasons given by Baum in support of his opinion to be persuasive, either individually or collectively. This finding is further amplified by my

assessment of Baum's credibility. I therefore reject Baum's ultimate opinion.

Alaouie expressed his opinion in the following colloquy:

> Q. Although the use of the Control Company digital thermometer is a required step, if a coordinator does not use this step for whatever reason, would the fact that the coordinator skipped the step make the results of the calibration process scientifically unreliable?
>
> * * *
>
> A. No, it does not.
>
> Q. Why?
>
> A. Because the Control Company temperature — digital thermometer is used in a qualitative administrative manner where the observation is only visual. There's no documentation of the observation. The instrument does not perform any adjustments based on that observation. And the vendor Draeger does not require the use of that temperature probe.
>
> THE COURT: So it's because it's not recorded —
>
> THE WITNESS: Correct.
>
> THE COURT: — it's because there are no manual or automatic prompts that would cause an adjustment to be made?
>
> THE WITNESS: Correct.
>
> THE COURT: And because Draeger does not require it?

THE WITNESS: Correct. And there is also no documentation of that observation as well.

THE COURT: That was the first thing I asked.

THE WITNESS: Yes.

[16T10-18 to 16T11-24.]

Counsel for the State followed up with two additional questions, asking whether the annual testing by Draeger of the black key temperature probes and CU34s played a role in his opinion. Alaouie answered affirmatively. With respect to the black key temperature probes, he stated:

A. The black key temperature probe or the agency temperature probe are the ones that are actually monitoring the temperature of the solution. Both of these are NIST traceable. And the — whatever like status messages will be triggered due to the fact that the temperature is out of tolerance will be reported by those specific temperature probes, whether it's the black key or whether it's the agency's temperature probe.

[16T12-6 to 14.]

With respect to the CU34s, he stated:

THE WITNESS: Yes, it does. Because the same thing, the CU34 gets calibrated annually. It comes with a certificate of accuracy to NHTSA, which is N-H-T-S-A, which stands for the National Highway and Traffic Safety Administration.

[16T13-8 to 12].

I do not find any of these reasons, individually or collectively, persuasive as a basis for Alaouie's opinion. His first reason is that the coordinator only makes a visual observation of the NIST thermometer temperature reading, but does not record the result. While this is true as a statement of fact, it ignores that it is a mandatory part of the calibration process and, when a coordinator certifies that he has performed all required steps in that process, he is, in effect, documenting that he observed a temperature reading produced by the NIST-traceable thermometer in each CU34 between 33.8 and 34.2 degrees Celsius. The fact that the specific reading is not memorialized does not detract from the importance of this step. Indeed, if this step is not successfully completed, the protocol prohibits the coordinator from continuing with the calibration check procedure.

The lack of recording of the NIST thermometer temperature readings is no different than the lack of recording of the entry of the correct probe value. Nowhere does the coordinator write down nor does the instrument capture the actual probe value the coordinator entered. Therefore, by Alaouie's reasoning, it is not documented that the coordinator entered a probe value that matches the probe value assigned to his black key probe or that which is assigned to the agency probe. It is left to the

trustworthiness of the coordinator to do it in a diligent and reliable manner and, when signing his certification, indirectly documenting that he did so. No one would suggest that entering the correct probe value is not extremely important. Indeed, the certificates of accuracy issued by Draeger for the black key and agency probes states: "For accurate temperature readings, the probe value on this certificate, noted below, must be programmed into the Alcotest 7110" (S-33C).

Alaouie's second reason is that "[t]he instrument does not perform any adjustments based on that observation." Once the CALIBRATE function is activated, his statement is correct. However, he agreed with my clarification or amplification of that reason that "it's because there are no manual or automatic prompts that would cause an adjustment to be made." If the NIST thermometer reading is out of range, the coordinator never activates the CALIBRATE function. This constitutes a manual prompt that there is a SIM TEMP error, and it directs the coordinator to stop everything and refrain from activating the CALIBRATE function unless the malfunctioning CU34 is replaced and, after heating for an hour, produces a reading from the NIST thermometer that is within range.

Alaouie's statement that the digital thermometer step is merely used in an "administrative manner" is consistent with the

State's position in this case that it is nothing more than a "pre-step" that was put into the procedure for administrative convenience so coordinators would not encounter a waste of their time if they blindly activated the CALIBRATE function only to get a SIM TEMP error through the black key temperature probe, which would abort the test. If that happened, the coordinator would either start all over again or be required to take the Alcotest device out of service. As I have discussed elsewhere in this report, and particularly in Section IV(C), this characterization by the State is completely unsupported by the evidence and I reject it.

Alaouie's third reason, that Draeger does not require the NIST thermometer requires little discussion. Each State tailors its own system to its own needs and specifications, putting in additional safeguards as it deems appropriate beyond those minimally required by the manufacturer. New Jersey, under Brettell's very capable direction, installed a number of these, such as testing the simulator solutions separately in the OFS, calibrating devices following the New Jersey calibration check process when received from Draeger (either new or after being returned from a repair), and requiring a one-hour, rather than thirty-minute, heat-up time. These are all beyond Draeger's recommendations. Likewise, as a result of Chun, based on Judge

King's recommendation, the Court shortened the calibration time to six months, rather than the one year recommended by Draeger. Indeed, in addition to the importance of NIST traceability of temperature measurements, one of Brettell's primary reasons for inserting the NIST thermometer step was to assure that a scientifically reliable temperature measurement would be obtained by a NIST-traceable thermometer, separate and independent from Draeger and the Alcotest instrument.

Alaouie's answer to the follow-up questions cited above, are likewise unpersuasive as a source of support for his opinion. In the first, he states that the Draeger black key and agency temperature probes are NIST traceable. For the reasons I have previously stated at length, they are not. Alaouie's statement constitutes an acknowledgment that NIST traceability is essential to the temperature measurement. However, his statement that NIST traceability is achieved with the Draeger probes alone is unsupported by the evidence.

In his other follow-up answer, Alaouie said that his opinion was also influenced by the fact that the CU34s are calibrated annually by Draeger with a certificate of accuracy to NHTSA standards. Such a certification is far removed from the requirements for NIST traceability. Like the Draeger probes, the good working order of the CU34s cannot be determined in a

scientifically reliable manner without the initial use of an independent NIST-traceable thermometer.

Accordingly, I reject Alaouie's opinion that failure to perform the NIST-traceable step in the calibration process does not call into question or undermine the scientific reliability of the calibration process and subsequent breath test results produced by that instrument.

F. Discussion of Brettell opinions

Of the State's four expert witnesses, the opinions rendered by three of them (Shaffer, Baum and Alaouie) on the ultimate issue in this case were expressed in definitive terms in favor of the State's position. For the reasons already stated, I have rejected those opinions as unsupported by the evidence.

The opinions rendered on the ultimate issue by the State's other expert, Brettell, cannot be so simply described. Excerpts of his testimony can be picked out which might seem to support the State's position that failing to use the NIST thermometer will not undermine or call into question the reliability of the calibration procedure or resulting breath tests. Other excerpts are to the contrary. A full reading of Bretell's testimony is necessary for a fair assessment of what his opinion actually is.

I do not mention these potentially conflicting aspects of his testimony as indicating any measure of evasiveness,

deceitfulness, lack of knowledge, bias, or the like. In Section III(A)(2), discussing Brettell's qualifications and credibility, I stated that he answered all questions candidly and forthrightly, regardless of who was asking them, that he was very sincere and careful in answering, and that he displayed a very high level of appreciation for the solemn responsibility he had in selecting a breath testing device and developing scientifically reliable protocols to achieve, as best as could be done, the highest level of scientific reliability in breath test results. I concluded that his testimony was very credible and his opinions are entitled to very substantial weight. I adhere to those assessments. I also adhere to my credibility assessment comments that Brettell's knowledge of the Alcotest 7110, the calibration check procedure (which he developed and authored) and the safeguards in it, and New Jersey's breath testing program are clearly superior to that of any other witness in this case.

Based upon my observations of Brettell's testimony over two full days and his demeanor in rendering that testimony, and now having read through the transcripts of his testimony, this is my conclusion. Brettell believes that the Alcotest 7110 is a reliable breath testing instrument that produces reliable breath test results. After all, it was he who was largely responsible

for testing and validating the instrument and recommending its purchase for use in New Jersey to replace the Breathalyzer instrument. And, in Chun, after a very protracted hearing, Judge King rendered a comprehensive and thoughtful report in which he concluded that the device is generally scientifically reliable. The Supreme Court then conducted its own exhaustive analysis of the record and in a comprehensive opinion concluded that the device is sufficiently scientifically reliable to allow its reports to be admitted in evidence.

Everything stated in the preceding paragraph, however, is tempered by an indispensable qualification, namely that all of the necessary procedures and safeguards for testing the device and administering breath tests with it are followed.

Certainly, the Chun Court expressed this qualification in stating that it had "no doubt that the device, with the safeguards we have required, is sufficiently scientifically reliable that its reports might be admitted." Chun, 194 N.J. at 158.

My analysis of Brettell's testimony leads me to conclude that the overriding thrust of his testimony and ultimate opinion regarding the role of the NIST thermometer in the calibration procedure weighs in favor of the qualification that the 7110 is a good breath testing device that produces reliable breath test

results, if all requirements[22] are complied with, including use of the NIST thermometer.

In other words, Brettell holds two opinions relevant here, namely that the device is generally reliable and that use of the NIST thermometer in periodically calibrating it is a necessary component in assuring that reliability. These opinions are not at odds with each other and are certainly not mutually exclusive. Indeed, their harmonization should be readily understandable in light of the extreme measures taken by Brettell and his OFS colleagues to test and validate the device, to develop protocols and safeguards to achieve the highest level of scientific reliability possible, and to put the instruments into the field, knowing they would be in the years to come essentially the final arbiter of guilt or innocence of many thousands of individuals – that is if they are in good working order, and the breath test is administered correctly by a qualified operator.

My finding based on Brettell's overall testimony is that he holds the opinion that skipping the NIST thermometer step would

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[22] I do not suggest that "all requirements" should be taken literally. I am aware that there might be some requirements that are quite perfunctory or insignificant and not performing them would be of little consequence in potentially affecting scientific reliability.

undermine or call into question the scientific reliability of the calibration process and breath test results.

In this report, I have quoted a number of passages from Brettell's testimony that illustrate the point. He testified, for example, that the NIST thermometer step, along with other required steps in the calibration process, was made a part of a group of steps that were collectively necessary to ensure the scientific reliability of the process. (supra, 35-36). He further testified that, because the accuracy of the CU34 temperature is "extremely, extremely important," the NIST thermometer step was put into the process "to make sure that the calibrating unit was tested against the standards of NIST when — before we started anything." (supra, 84). He said, "I took every step I could to independently test as much as I could of this program independently of Draeger to make sure that if" there was "a bias or an error in Draeger's laboratory," we would "have a good chance of stopping it before it proliferated out," and that was "exactly why I added this step." (supra, 127).

In addressing the "necessity" of the NIST thermometer step, Brettell said:

> Draeger puts out a great instrument. The probes work fine. If you have the solutions calibrated and the probes are working and

> calibrated, the instruments are working, everything is fine.
>
> [supra, 139.]

In other testimony, he made clear that the only way to make sure that the Draeger probes are working correctly is by indirect means, which is reliant upon prior testing with the NIST thermometer. He explained:

> The only thing that gets checked with that [the NIST thermometer] is the calibrating unit. The [Draeger] probes do not. The probes are <u>indirectly</u> double checked once the calibrat[ing] unit is checked and working and up t[o] temperature. If you put the probe in there and the probe reads the temperature, then now you know the probe is also working.
>
> [8T116-14 to 20 (emphasis added).]

On another occasion, when asked what would be the consequence of skipping the NIST thermometer step, Brettell began his answer by saying if you went on with the calibration procedure "and everything's working properly," you would likely get a correct reading because of the many "checks and balances in there with the temperature probes," so that if that step is left out, "as long as everything else is working properly on the instrument, you're going to get accurate readings" (7T97). Once again, Brettell expressed the view that you would probably get a good reading because the 7110 is generally reliable, but that would be the case only if everything is working properly. And,

throughout his testimony, he reiterated that the only way to make sure all of the Draeger components are operating properly is by starting with the independent NIST-traceable step in the calibration procedure.

On another occasion, when pressed about the accuracy of results coming through the "Alcotest machine," Brettell said "the reason that you are doing this test with the calibration is to make sure that that's all working" (8T44). He then went on to say: "When you put a certified solution into the calibrating unit, and you set everything up properly and running and you get out the same concentration, you have verified that everything is working properly" (8T44). This reaffirms that "setting everything up properly" means complying with the calibration check procedure. In turn, with an accurate simulator solution, and the application of Henry's Law, obtaining a correct reading on the nominal ethanol concentration will verify that everything is working properly. Again, the verification of an accurate result is dependent upon complying with the procedure, including the NIST thermometer.

In another portion of his testimony, Brettell was questioned about what would happen if, hypothetically, a NIST-traceable thermometer was not used in the calibration process. He responded that "if the probes are working properly and the

solutions are certified properly and the calibrating unit is heating up properly, you're going to get an accurate reading on the Alcotest 7110 MKIII-C" (7T156-7T157). Once again, he conditions the likelihood of an accurate reading on the Draeger probes having worked properly in the calibration process. In turn, as his other testimony repeatedly establishes, the good working order of the Draeger probes cannot be directly determined through the Alcotest firmware, but must be indirectly verified by a prior temperature measurement with the NIST thermometer.

In August 2017, in lieu of furnishing an expert report in anticipation of his expert testimony, Brettell submitted to a Q&A statement conducted by a State Police detective and two attorneys from the Attorney General's Office representing the State in this case. In his testimony in this hearing, he confirmed that he was asked whether failing to use the NIST thermometer would undermine or call into question the scientific reliability of the breath test subsequently performed on that instrument and that he gave the following answer:

> My answer: <u>As long as all of the components of the instruments [and] black temperature probes were operating properly</u>, <u>no</u>.
>
> [8T37-24 to 8T38-1 (emphasis added).]

Once again, Brettell would expect an accurate reading but his expectation is qualified by the condition that all of the components, including the black key temperature probe, were operating properly.

From the totality of Brettell's testimony and in recognition of his high level of credibility and knowledge, I do not attribute these qualifying comments to hedging, lack of certainty, or evasiveness. I attribute them to his honest belief that the 7110 is a reliable breath testing instrument, but that reliability depends very substantially on the use of the NIST-traceable thermometer in the calibration process. Brettell's testimony, taken as a whole, supports the finding that failure to use the NIST thermometer in the calibration process does undermine or call into question the scientific reliability of the calibration process and of breath test results produced by that device.

G. Other states

The State asks me to find that "[t]he use of a NIST-traceable digital thermometer by a coordinator to test the temperature of the simulator solutions before beginning the 'Calibrate' function to calibrate the Alcotest instrument . . . is not done in any other state" (Pb77). It contends that there is "uncontroverted evidence that no other state or jurisdiction

that uses the Alcotest 7110 MK III-C, or a wet-bath simulator in its recalibration protocol, requires this pre-test temperature check to verify the temperature before beginning the calibration procedure" (Pb53). The fact that the NIST-thermometer step "is unique to New Jersey," the State argues, shows that "not doing" this step is generally accepted in the scientific community (Pb53).

I reject the State's proposed finding of fact on this point. The evidence is insufficient for any finding regarding the manner in which other states using the Alcotest 7110 have ensured the correct temperature of any wet bath simulators used in connection with calibrating or performing linearity tests on the instrument. Moreover, uncontroverted evidence established that the instrument was highly customized for each jurisdiction and that other jurisdictions had procedures and safeguards not in use in New Jersey, so the State's attempt to equate procedures in different jurisdictions creates a false comparison.

The State points to testimony by Shaffer and Baum as supporting the proposition that the NIST thermometer step "is unique to New Jersey," and it seeks a finding that "coordinator[s]" in other states do not "test the temperature of the simulator solutions before beginning the 'Calibrate'

function to calibrate the Alcotest instrument" with a NIST thermometer (Pb53;Pb77). The evidence falls far short of establishing this point.

Shaffer acknowledged that there is "a step in the New Jersey protocol, the calibration protocols, requiring the use of a Control Company NIST thermometer" and that this step was "specific to New Jersey" (10T34-10T35). However, Shaffer agreed on cross-examination that it was "[v]ery fair to say" that the states using the instrument each "had different requirements as to calibration" (10T93-10T94). For instruments sold to New Jersey, Draeger "customized the 7110 to be in compliance with" this state's specific calibration check procedures (9T19).

Shaffer testified that "[i]n its heyday," the Alcotest 7110 was used as the exclusive instrument in New Jersey, Massachusetts, and Alabama (10T93). He also testified that, by January 2018, only New Jersey, Alabama, and "a few counties in California" were still using the Alcotest 7110 (9T7). Shaffer gave no testimony regarding how any jurisdiction other than New Jersey calibrated its instruments, whether CU34s were used, or what those jurisdictions did to ensure the correct temperature of any CU34s used before performing the CALIBRATE function.

Shaffer did testify that, for the Alcotest 7110, "the software is highly customized for every customer," so the

instruments may look the same in different jurisdictions and "the internal hardware components may be mostly the same," but the instruments are different (9T10). He explained:

> For applications like this, there's no possibility of us being able to just take something off the shelf, as it were, and to be able to just sell it to any jurisdiction. It requires a lot of customization. And so much so that the software becomes the most expensive part of what we provide in a system to a jurisdiction.
>
> [9T10-19 to 25.]

Shaffer also testified that Alabama has "a very robust data analysis procedure and program in place" to review evidential breath tests and check the performance of its instruments (9T28-9T29).

Baum testified that he "believe[d] Alabama and Massachusetts" used a "wet bath process" but did not "use the separate NIST-traceable thermometer step which is specific in New Jersey" (12T231-12T232). However, on the second day of his testimony, Baum contradicted this and said he had no real knowledge regarding steps other states did or did not take. Baum said that he was "wasn't aware of what versions" of the Alcotest Alabama used, and he never spoke to his Alabama counterpart regarding the Alcotest program there (13T192-13T193).

Baum acknowledged that his earlier testimony was to the effect that Alabama used a wet bath simulator and the 7110 (13T210-13T211). When pressed on the discrepancy, Baum answered, "I said I believe. I didn't say I was positive. I said I believed. That's what I testified on Thursday." (13T212-13T213). Then, looking at Alabama's operator manual for the 7110, with a reference to a "Dry Gas Calibration Check," Baum conceded that "[i]t does appear that they did use the dry gas" (13T213;D-21).

On cross-examination, Baum was asked about the respective "calibration processes" of New Jersey, Alabama, and Massachusetts:

> Q. And that was it. And you also understand each one of those states had different requirements that they wanted to do in their respective calibration processes, correct?
>
> A. Correct.
>
> Q. Not all three states had the same calibration process, correct?
>
> A. Correct.
>
> Q. Each state had requirements that were — some were different from the other states, correct?
>
> A. Correct.
>
> Q. And some were different from what Draeger had — what Draeger does in the calibration process, correct?

A. Correct.

Q. So the fact that — so New Jersey had a couple of steps that some of the other states weren't using, correct?

A. Correct.

Q. And I'm sure the other states had steps that New Jersey weren't using, correct?

A. I don't know their —

Q. You don't know?

A. I don't know.

[13T56-17 to 13T57-21.]

I find that Baum offered no credible testimony regarding procedures in any other states.

The "Alabama Breath Alcohol Testing Program Operator Manual, Draeger Alcotest 7110 MK IIIC" and certain relevant portions of the Alabama Department of Forensic Sciences Administrative Code were admitted into evidence and further illustrate the impossibility of any meaningful comparison between New Jersey's calibration check procedures and the procedures used in Alabama (D-21;D-22). What Alabama terms a "calibration check" is not the periodic procedure by a coordinator including the CALIBRATE function and various tests, but rather part of the breath testing sequence itself and the functional equivalent of the control test performed in New

Jersey during an actual evidentiary breath test (D-21 at 8-9; D-22 at 1-1-3, 1-1-10). For its "calibration check," Alabama utilizes dry gas cylinders rather than wet bath simulators (D-21 at 19;D-22 at 1-1-3, 1-1-10).

Also, in Alabama each Alcotest instrument is sent to the Alabama Department of Forensic Sciences (ADFS) annually for a "battery of tests" to confirm its good working order (D-22 at A-1 to A-7). The ADFS performs a variety of tests and checks, including a linearity check with wet bath simulators (D-22 at A-3). It appears that the ADFS calibrates each instrument prior to running the tests, but this is not entirely clear from the record (D-22 at 1-1-3). Details of the annual evaluation by the ADFS were included in the code "to inform the public of the quality control or good laboratory practices" in place at the ADFS but "do[] not constitute a rule" (D-22 at A-1).

Thus, even the limited record regarding Alabama's procedures shows major differences from New Jersey's, one of the most significant being that Alabama does not send a coordinator into the field to either (1) calibrate the instrument, or (2) ensure that the simulator used by that agency is functioning properly. Plainly, Alabama procedures would not mandate a NIST thermometer be used to check the simulator solution temperature of the agency's dry gas cylinders that do not use a solution.

The ADFS calibrates each instrument in-house, and the record is silent as to the manner in which it ensures that its own wet bath simulators are heating to the correct temperature. The ADFS might very well check its own equipment routinely using a NIST thermometer. Certainly, nothing suggests that the ADFS simply allows the Alcotest 7110 probes to validate the simulator solution temperature when it calibrates instruments.

Nothing whatever was presented regarding calibration procedures in Massachusetts or the counties in California using the Alcotest 7110.

In addition, even assuming that the NIST thermometer step is "unique to New Jersey," no conclusions regarding general acceptance could legitimately be drawn, given (1) the small number of other jurisdictions using the instrument, and (2) the indication that New Jersey, purchasing more than twice as many instruments as Alabama, was possibly the most substantial user of the instrument. The State's argument suggests that New Jersey is an outlier, differing from a large and uniform block of "other states" that have affirmatively chosen to skip the NIST thermometer step. This inference is unsupported.

The evidence shows that relatively few jurisdictions have used the Alcotest 7110 for evidential breath testing and that those that have are in the process of replacing that instrument.

According to Shaffer, the Alcotest 7110 stopped being offered for sale in the United States "anywhere in the time frame from maybe 2012 to 2015" (10T74). Brettell testified that he was aware that "Alabama had a program" using the Alcotest 7110 and that "Massachusetts was evaluating it" at the time of the Chun hearings in 2006 (7T170-7T171). Alabama has evidently selected the Intoximeter Datamaster to replace the Alcotest 7110 (9T26-9T27). New Jersey has selected Draeger's Alcotest 9510 to replace the 7110 (14T84-14T89). That change has not yet been finalized or implemented.

Shaffer estimated that New Jersey purchased between 600 and 700 Alcotest 7110 instruments (10Tl95). He noted that Alabama has "around 280" Alcotest 7110s, and he gave no figures for how many instruments were purchased by Massachusetts or the four counties in California (9T27).

These facts suggest that, far from being an outlier, New Jersey was such a substantial user of the Alcotest 7110 that no valid conclusions regarding general acceptance of Alcotest 7110 calibration procedures could be made that excluded those used here.

H. Conforming products list

The State also argues that the general acceptance of "not doing" the NIST thermometer step is "further borne out by the

fact that the CU-34 simulator is on the Conforming Products List ('CPL')." Citing the King SMR in Chun, the State notes that the CU34 was "tested and evaluated by Volpe, a part of the Research and Innovative Technologies Administration of the U.S. Department of Transportation, to make sure that it meets the model specifications for a wet bath simulator as set forth by" the National Highway Traffic Safety Administration (NHTSA) (Pb53).

The presence of the CU34 on the CPL is merely an indication that the device is generally appropriate for purchase, but it does not inform the issue of whether, when, or how the performance of the device should be periodically checked with a NIST thermometer. Indeed, the fact that Draeger annually checks and certifies each CU34 for accuracy using its own NIST thermometer indicates a recognition that inclusion of the device on the CPL does nothing to ensure the continued performance of individual CU34s.

Moreover, the Chun hearing testimony of Edward Conde, the Volpe employee who performed various testing on the Alcotest 7110, undermines rather than supports the State's position regarding the use of the NIST thermometer.

At the time of the Chun hearings, Conde had worked at Volpe for twenty years (King SMR 131). He testified that Volpe tested

and evaluated both evidential breath testing instruments and calibrating units, and he noted that the evaluations are "for the benefit of States when they're making purchasing decisions. It's just a recommendation" (Chun 1T45). "In 1996, 2003, and 2006, Volpe tested different firmware versions of the Alcotest 7110 to determine if they met the model specifications recommended by NHTSA" (King SMR 130-31).

Conde was offered as an expert in the chemistry of breath testing (King SMR 131). Judge King found him to be "very credible and candid," and he "was quite impressed" with Conde's testimony (King SMR 137).

Conde testified in detail as to how Volpe tests breath-testing instruments and calibrating units (King SMR 28-30, 134-35). He explained that, when testing breath-testing instruments such as the Alcotest for precision and accuracy, Volpe used wet bath simulators manufactured by Guth and Repco "to introduce a certain concentration of alcohol into" the instrument (Chun 1T55-1T58). Then the following exchange occurred:

> Q. To check the simulator temperature, what piece of equipment is used?
>
> A. The Draeger device has a thermistor probe, but I independently will use a NIST thermometer to make sure that the temperature is what the probe said it was.
>
> Q. Would that thermometer also be traceable?

A. That's NIST traceable, yes.

[Chun 1T58-18 to 25.]

Thus, when evaluating the Alcotest 7110 and using Volpe's own wet bath simulators, Conde did not simply rely on either the good working order of Volpe's simulators or the Alcotest temperature probes. Rather, he independently verified the simulator solution temperature using a NIST thermometer.

In addition, the Chun testimony of Chappell, the former NIST employee who was qualified as an expert in legal metrology, contradicts the State's suggestion that inclusion on the CPL somehow eliminates the subsequent need for a NIST-traceable thermometer check.

Chappell testified in general regarding the principles of legal metrology. He said that "[i]n order to have confidence in the operation" of a "legal measuring instrument," "responsible officials" use a three-step process of "metrological control," specifically, (1) type evaluation or approval; (2) initial verification; and (3) subsequent verification (Chun 3T88; King SMR 153). By following this process, "the responsible officials could have some confidence that the instruments that are providing this evidence in the field or measurements in the field were under control or giving an accurate reading" (Chun 3T88).

Testing by the NHTSA and inclusion on the CPL is merely the first step, i.e., type evaluation or approval (Chun 3T89-3T94). "It is for information to – for the regulators and users of the instrument to indicate that . . . this manufacturer is capable of measuring – of manufacturing such an instrument and it meets these specifications" (Chun 3T93-3T94).

Regarding the Alcotest, Chappell said that, in New Jersey, the calibration check process is the initial verification step for new instruments and the subsequent verification step for instruments already in the field (Chun 3T116-3T118).

The temperature of the simulator solution "has to be correct in order to get a reference sample of known concentration" (Chun 3T143). Chappell testified, "In subsequent verification, of course, the instrument – the temperature measuring instrument associated with determining the temperature of the reference solution would be verified, would be calibrated or verified, meaning that it would be compared with a measuring device that has traceability to temperature measuring reference standards maintained by the national measuring institute or NIST" (Chun 3T137).

Chappell's testimony is consistent with the conclusion that inclusion of an instrument on the CPL is only the first step in the three-step process of "metrological control" and that a

NIST-traceable thermometer should be used to check the simulator solution during subsequent calibration procedures.

V. FINDINGS OF FACT AND CONCLUSIONS OF LAW

A. Findings of fact

1. Brettell included the NIST-traceable thermometer step in the calibration procedure (D-32) from the very beginning of New Jersey's use of the Alcotest 7110, approximately seventeen years ago.

2. He included this step for scientific reasons, to ensure the good working order of the CU34s by measuring the simulator solution temperatures at the beginning of the calibration process and establishing their in-tolerance accuracy to a NIST standard.

3. It is critical to the proper operation of the Alcotest instrument that the simulator-solution temperatures be within the correct range when performing the CALIBRATE function, running control and linearity tests, and performing a solution change.

4. This requirement was inserted into the calibration procedure as a mandatory part of the procedure.

5. As Brettell acknowledged, all of the steps in the calibration procedure are collectively scientifically necessary to the reliability of the calibration process.

6. This requirement was put into the procedure long before Chun; therefore, it was not mandated by a court but was voluntarily put in by the chief forensic scientist in New Jersey.

7. The requirement has remained part of the protocol continuously since its inception.

8. In the present litigation, the State has expressly stated that it has no intention of removing this step as a required part of the calibration procedure, and is not requesting court authorization to do so.

9. Prior to Chun, two Attorney General memos suggested the scientific importance of this step. DAG Stephen Monson, advised prosecutors in his August 23, 2005 memo (D-17) to provide certificates of accuracy of the NIST-traceable thermometer in discovery in DWI cases because that document, together with others, serves to "support" the calibration report and calibrating unit new standard solution report, which must be placed in evidence as one of the longstanding foundational documents to establish the good working of the device, which in turn renders the BAC reading admissible in evidence. In his April 3, 2006 memo (D-16), DAG Monson provided legal advice regarding temperature probe documentation in DWI cases. He stated that the NIST-traceable temperature measuring system

information should be recorded directly on the calibration record as part of the documentation "satisfying the foundational burden of proof of proper operation of the instrument."

10. Coordinators began handwriting the serial numbers on their reports after the issuance of the April 3, 2006 memo. When efforts to revise the firmware to capture the serial numbers on the printed reports proved unsuccessful, Alaouie issued a memo on March 12, 2013, establishing a procedure for writing the serial number of the NIST-traceable temperature measuring system on a pre-printed portion of the calibration report.

11. When Draeger informed the OFS that it would no longer perform annual calibrations and issue new certificates of accuracy for Ertco-Hart digital thermometers, the State did not choose to eliminate this step, nor is there any official record of any internal discussion or suggestion that consideration be given to deleting this step.

12. Instead, Baum issued a detailed memorandum on December 23, 2008 (S-10C), stating that calibration of an Alcotest 7110 requires the use of a NIST-traceable thermometer to assure an accurate temperature determination of the simulator solutions. He set forth five detailed criteria for a new NIST-traceable thermometer to replace the Ertco-Hart. He recommended the

Control Company digital thermometer, which he stated met the required criteria and would be "acceptable for temperature determination." His recommendation was accepted by ADTU officials, and the change from Ertco-Hart to Control Company was implemented. Notwithstanding any personal views that Baum may claim to have held to the contrary, his official position acting as a scientist and in his capacity as Director of the OFS was that a NIST-traceable thermometer should remain as a mandatory step in the calibration procedure.

13. The switch to Control Company generated the State v. Holland litigation, in which two Appellate Division decisions were issued in 2011. Holland I, 422 N.J. Super. at 185, and Holland II 423 N.J. Super. at 309. The defendants challenged the switch, urging the court to find that only the Ertco-Hart thermometer was authorized in Chun and that no substitute could be allowed. In that litigation, the State never asserted, either as its primary or alternative position, that use of a NIST-traceable thermometer was not scientifically necessary to assure reliability of results. Instead, it adhered to the position that a NIST-traceable thermometer was necessary for that purpose and the Control Company digital thermometer met the requirements of NIST traceability.

14. Putting aside verification during the calibration check process of the simulator solution temperatures, all other aspects of the calibration process include methods to repeatedly verify accuracy or steps that are more stringent than Draeger requires or recommends. These are: (a) all Alcotest 7110 instruments, when received in New Jersey from Draeger (either new or after being returned from a repair) are recalibrated following the New Jersey calibration protocol before being placed in service in the field, notwithstanding that Draeger had issued a certificate of accuracy for them; (b) the simulator solutions, after being received from Draeger, are retested for accuracy in the OFS (random samples) although they come with a certification of accuracy from the supplier; (c) although Draeger requires only thirty minutes heating time for the CU34s, New Jersey requires a minimum of one hour; and (d) although Draeger requires calibration every twelve months, New Jersey requires it every six months.

15. The temperature of a simulator solution is dependent upon the good working order of the CU34, a Draeger product. Measurement of that temperature through the Alcotest instrument during the calibration process is dependent upon the good working order of the black key temperature probe (also a Draeger product) and entry of the correct probe value assigned to that

probe by Draeger. Even if the assigned probe value is correctly inputted, it may be inaccurate due to probe value drift or probe failure. The probe does not measure temperature. It detects resistance, which is temperature dependent. The Alcotest 7110 instrument then calculates and reports temperature based on that resistance through a series of complex calculations utilizing algorithms imbedded in the instrument. (The agency temperature probe determines temperature in the same way.)

16. There is no scientifically reliable method to determine the required accuracy of the temperature of the simulator solutions, and thus verify the good working order of the CU34s, other than to measure the temperatures with an independent NIST-traceable thermometer.

17. Brettell deemed it necessary to verify the critically important temperature of the CU34s through an outside and independent NIST-traceable temperature measuring device. Such a device would be outside of the Alcotest 7110 algorithms and independent of the Draeger equipment. He deemed this necessary in the event there was some unknown "bias" in the Draeger lab, and because it is the only scientifically reliable way to directly measure the temperature of the simulator solutions.

18. If, after heating for at least one hour, any of the simulator solutions are determined to be out of range, based

upon testing them with the NIST-traceable thermometer, New Jersey protocol requires that the calibration not proceed. Thus, even if the black key or agency probe were to reveal an in-range temperature reading, New Jersey's protocol prohibits coordinators from performing the calibration if the NIST-traceable thermometer does not reveal correct temperatures.

19. Although the NIST thermometer step occurs before activating the CALIBRATE function, as it must to accomplish its purpose, it is not a mere pre-test or administrative convenience as argued by the State. The NIST-traceable thermometer step is an integral part of the calibration process, and it is necessary to ensure scientific reliability of the process.

20. As part of its argument in this litigation, the State acknowledges that using the NIST-traceable thermometer provides enhanced confidence in the scientific reliability of the calibration process and breath test results subsequently performed on that device. Enhanced confidence increases scientific reliability.

21. Brettell, the State's most knowledgeable and persuasive witness, credibly testified that documenting the use of a NIST-traceable thermometer is part of the documentation that "supports the good working order of the device" and that failure to use a NIST-traceable thermometer results in "some

reduced level of certainty" in the reliability of the device, although he was unable to quantify the amount of reduction.

22. The Draeger black key and agency temperature probes are not NIST traceable.

23. The Draeger temperature probes are not capable of directly measuring simulator solution temperatures to a NIST-traceable standard.

24. The Draeger temperature probes do not provide an acceptable substitute for the NIST-traceable probe required by the calibration procedure to accurately measure simulator solution temperatures.

25. Scientifically accurate temperature measurements of simulator solutions through the use of Draeger temperature probes can only be indirectly verified, based on a prior NIST-traceable measurement that was within tolerance, obtained by a NIST-traceable thermometer (in conjunction with the use of accurate NIST-traceable simulator solutions and application of Henry's Law).

26. The simulator solutions used in the New Jersey breath testing program are accurate. The OFS checks random samples from each lot produced by the supplier. The OFS conducts its check procedure in accordance with proper scientific practices

and determines accuracy by reference to NIST-traceable standards.

27. Contrary to the State's argument, if the NIST-traceable thermometer step is skipped, it is not necessary that ten separate things must malfunction in tandem in order for a calibration check to be successfully completed with an out-of-range simulator solution temperature.

28. A successful calibration check procedure can occur if the agency CU34 is producing a simulator solution temperature that is slightly out of range and the black key and agency temperature probes are malfunctioning to about the same extent in their reported temperature measurements, which could occur either because of the incorrect entry of a probe value, probe value drift that has developed, or probe failure. In such circumstances, the out-of-range temperature in the agency CU34 would go undetected but would not result in a SIM TEMP error. As a result of the out-of-range temperature, the alcohol concentration in the vapor used to calibrate the Alcotest would be incorrect and would "teach" the Alcotest instrument an incorrect standard by which to report alcohol concentration in vapor introduced into the device.

29. The potential for these three things to slightly malfunction in the manner stated would not be a common

occurrence, but would be far less unlikely than the ten things postulated by the State. These are plausible, evidence-based potential occurrences.

30. As a result of such a "miscalibration," the Alcotest instrument would erroneously yield incorrect BAC readings when breath tests are administered over the next six months, and the error would go undetected.

31. Such miscalibrations would effectively be prevented by use of the NIST-traceable thermometer.

32. Although the State admits, in accordance with the testimony of its own experts, that failure to use the NIST-traceable thermometer in the calibration process reduces the scientific reliability of the calibration process and the subsequent breath tests from that instrument, it has failed to quantify the magnitude of the reduced scientific reliability. Brettell suggested that it might have been possible to conduct studies for the determination of error rates or to make probability calculations, but this has not been done.

33. As a consequence of Henry's Law, major inaccuracies in the Draeger probes and the agency CU34s would be detected during the calibration process because, at some point, an out-of-range CU34 temperature would generate an out-of-tolerance ethanol headspace concentration. However, the State has failed to show

where this point could be established with scientific reliability.

B. Conclusions of law

The question posed by the Court in these proceedings is:

> Does the failure to test the simulator solutions with the NIST-traceable digital thermometer before calibrating an Alcotest machine undermine or call into question the scientific reliability of breath tests subsequently performed on the Alcotest machine?

In my view, the terms "undermine" and "call into question," describe similar but different concepts. To call something into question is to "raise doubts about" it. Webster's II New College Dictionary, 158 (1999). To undermine something, within the context of the issue presented here, is to "weaken, injure, or impair [it], often by degrees." Id. at 1201.

Based upon the findings of fact set forth immediately above, and as described and analyzed in more detail throughout the body of this report, I conclude that failure to perform the NIST-traceable step in the calibration process clearly calls into question the subsequent validity of breath test results derived from that device. The evidence raises substantial doubts about the scientific reliability of breath test results produced by Alcotest devices calibrated without the use of a NIST-traceable thermometer.

The State's own experts have opined that reliability is reduced and that it is better to leave the NIST-traceable step in the procedure. It has been in the procedure since the inception of use of the Alcotest 7110 in New Jersey. It has remained in the process since the discovery of the Dennis problem, which has given rise to this proceeding. There is no reason whatsoever to believe that, aside from Dennis, all coordinators have not been faithfully following this step over the years in the thousands of calibrations they have performed. The State does not ask in this proceeding for judicial authorization to delete the step. Instead, it has affirmatively stated its intention to continue to require the step as a mandatory part of the procedure.

The evidence clearly supports the finding that this step was put into the procedure to assure scientific reliability. In the course of the Holland proceedings seven years ago, the State "doubled down" on the necessity for the requirement and the importance of using a temperature measuring device that meets all of the strict criteria to qualify as "NIST traceable," in accordance with the gold standards applicable to the NIST criteria as well as the qualifications and accreditation of the laboratory that would certify its NIST traceability.

I find it extremely important and persuasive that for all of these years it has indisputably been a strict requirement within the calibration procedure that if the NIST-traceable thermometer temperature check of the simulator solutions in all four CU34s do not read within tolerance, the coordinator is not permitted to proceed with the calibration. In other words, based upon the mandatory provisions of the procedure, which continue to be in effect and which will continue to be in effect in the future, failure to achieve an in-tolerance NIST traceable temperature reading of these four solutions serves as a "manual SIM TEMP error," which prompts the coordinator to stop everything and not proceed to activate the CALIBRATE function. This should be treated no differently than a SIM TEMP error that is generated by the Alcotest device after the CALIBRATE function is activated, which automatically aborts the calibration process and prevents it from proceeding further. In either case, the detected error is of sufficient magnitude to require termination of the intended calibration. The only way to directly obtain a scientifically accurate and reliable temperature measurement of an aqueous solution is to insert a NIST-traceable thermometer into it and obtain a reading.

The Draeger probes are not NIST traceable. They cannot produce a NIST-traceable temperature measurement. Their

accurate functioning at the time of the calibration process can only be determined (or verified) by indirect means. Thus, if (1) the solution temperatures are first determined to be accurate by use of a NIST-traceable thermometer, (2) the simulator solution concentrations have been accurately determined by applying NIST-traceability standards (which is the case in New Jersey), and (3) the concentration of ethanol in the vapor is determined to match the nominal concentration of that solution (within allowable tolerances), then and only then can it be said that the Draeger temperature probes "must be working right" because of Henry's Law.

However, if the NIST-traceable thermometer is not first used to directly obtain a scientifically reliable temperature measurement of the simulator solutions, then the temperature of those solutions is unknown and Henry's Law does not compel the conclusion that the Draeger probes must be working right if a concentration result falling within the allowable tolerance is achieved. Of course, ascertaining a NSIT-traceable measurement in the agency CU34 is of the utmost importance in the CALIBRATE function, during which the Alcotest instrument is being adjusted to a concentration level given to it by the 0.10 simulator solution used in that function.

For the reasons stated in this report, the evidence supports the finding that miscalibrations can occur, which, in turn, will produce inaccurate breath test readings which will go undetected. Although the circumstances in which miscalibrations can occur are somewhat limited, they are indeed plausible and can easily be prevented by simply following all steps in the calibration procedure, as every coordinator is required to certify that he or she has performed, as one of the essential prerequisites to admissibility in evidence of the reading.

The State argues that the NIST-traceable thermometer step was only put into the process to increase confidence in results. It implies that any such increased confidence is slight and unimportant. This argument contains two serious flaws. First, as explained in this report, confidence and reliability are not mutually exclusive concepts. They are part of the same concept and part of a single continuum. As Brettell credibly explained, as more steps are utilized that increase confidence, the greater will be the level of reliability achieved. Second, the evidence clearly establishes that the NIST thermometer step was put in the calibration check procedure for the express purpose of assuring the good working order of the CU34s used in the calibration process, especially the agency CU34 which actually causes adjustments to be made in the Alcotest device, thus

calibrating it to the ethanol concentration in the vapor it produces during the CALIBRATE function. Accurate temperature in the CU34s is the foundation upon which the entire calibration process is built and it is necessary to ensure scientific reliability. This is not a slight confidence builder of little or no consequence. It is essential.

As stated in the body of this report, Conde testified accordingly in Chun. He explained that in testing instruments for Volpe, which was contracted by the NHTSA as part of the process of approving breath testing devices and simulators for inclusion on the conforming products list, he would not rely upon probes that come with the device but would always start with his own NIST-traceable thermometer to test simulator solution temperatures to assure their accuracy, and thus assure scientific reliability of the entire process.

In this litigation, it was established that Draeger itself, as explained by its employee, begins its calibration process of the CU34s and temperature probes in its service workshop by testing the wet bath to be utilized in the process with a NIST-traceable thermometer produced by an independent third-party company, Omega Engineering, Inc. Shaffer acknowledged that without this NIST-traceable starting point with a NIST-traceable thermometer, the scientific reliability of its entire

calibration process would be called into question and undermined. Baum agreed with Shaffer on this point.

And Brettell required the same starting point when he drafted the procedure for calibrating the Alcotest 7110. He continues to hold the opinion that NIST-traceability is "critically important" in determining temperature accuracy in the CU34s before proceeding with the calibration. This is the established scientifically accepted practice in such procedures.

All experts agreed that breath test results are less scientifically reliable without the NIST-traceable thermometer step. The State concedes this point. Therefore, the evidence clearly raises substantial doubts about the scientific reliability of breath test results without the NIST-traceable step, thus calling into question the scientific reliability of those results.

Concomitantly, because the scientific reliability is weakened or impaired by some degree, the literal dictionary definition of "undermine" is also met. However, as I have stated, I view the concepts of "calling into question" and "undermining" as having different meanings, and the difference requires an assessment of the degree by which scientific reliability is reduced.

As I perceive the ultimate question referred to me, it is whether the acknowledged reduction in scientific reliability of an Alcotest device, calibrated without using the NIST-traceable thermometer, is of sufficient magnitude or degree to deprive the device of sufficient scientific reliability such that its readings can be admitted in evidence. Of course, this is a special kind of evidence. It is evidence, produced by a machine, which, standing alone, proves guilt beyond a reasonable doubt, resulting in consequences of magnitude. It is not the kind of evidence to which weight can be ascribed depending upon the quality of the evidence. Nor can the machine be cross-examined. It is evidence which, under our law, establishes a per se violation.

For decades, since the inception of breath testing in New Jersey, proof of the good working order of the device has been required as mandatory foundational evidence to allow a breath test reading in evidence. That proof is established by the production of the coordinator's certification, attesting to the fact that he or she performed the calibration in accordance with all required procedures. Failure to have actually performed the NIST-traceable thermometer step in the procedure renders invalid a certification attesting that all steps were followed.

In Chun, the Court found the Alcotest device sufficiently scientifically reliable to allow its breath test readings to be admitted in evidence. The Court concluded as follows:

> We are confident, based on this far-reaching and searching inquiry, that the device is sufficiently reliable so that the rights of all defendants have been protected. We are satisfied that, with the directions we here adopt for pending and future matters, the confrontation rights of all defendants have been, and will continue to be, protected. We have no doubt that the device, with the safeguards we have required, is sufficiently scientifically reliable that its reports may be admitted in evidence. And we are confident that, in so concluding, all of defendants' rights have been advanced and considered.
>
> [Chun, 194 N.J. at 148.]

The question therefore comes down to this. Does skipping the use of the NIST-traceable thermometer, which the State's witnesses have acknowledged reduces the level of scientific reliability, reduce it to a level below that which the Court in Chun deemed "sufficiently" scientifically reliable to allow readings to be admitted in evidence.

Use of the NIST-traceable thermometer is one of the safeguards required to establish sufficient scientific reliability. It is not a trivial or unimportant safeguard. Nor is it merely important or advisable. It is the essential starting point of the calibration process, and failure to use it

can result in miscalibrations, which in turn, will cause incorrect breath test results. The State, bearing the burden of proof, has failed to quantify the likelihood that miscalibrations may occur without use of the NIST-traceable thermometer or the levels to which temperature inaccuracies would have to be off in order to trigger a SIM TEMP or ethanol concentration error generated by the Alcotest device, which would abort the calibration and prevent a miscalibration. The State insists that no quantification is necessary because there can never be an undetected miscalibration. This position is based on the ten-things-wrong theory posited by Shaffer, which I have rejected.

The evidence is of sufficient strength to persuade me that without the NIST-traceable step miscalibrations are not merely theoretical or speculative, nor so unlikely as to be such a slight possibility that the issue can be overlooked. The calibration of each device is good for six months, during which it is presumably used to perform breath tests on many individuals. Each of the approximately 600 instruments now in service in New Jersey is calibrated at least twice per year. Out of the 1200 or so annual calibration procedures, if the NIST-traceable thermometer is not used, it is reasonable to conclude that some number of undetected miscalibrations will

occur. I do reach this conclusion. This is not speculation. It is grounded in the evidcence.

The magnitude of the problem is quite evident in light of the premise upon which this special master proceeding was convened: The State informed the Court that the devices calibrated by a single coordinator, Dennis, over several years produced 20,667 evidential breath samples, the validity of which has now been thrown into doubt because of the State's inability to prove that Dennis used a NIST-traceable thermometer in those calibrations.

The State's argument turns the relevant science on its head. The State contends that the virtual infallibility of the machine in the calibration process serves as the safety net that assures scientific reliability, and that the use of the NIST-traceable thermometer only adds some measure of confidence that the safety net is working. The State implies that this measure of confidence, although unquantified, is insignificant.

The evidence persuades me that the opposite is the case. It is the NIST-traceable thermometer that is the safety net in the calibration procedure. It is the necessary beginning step from which the scientific reliability of everything done in the calibration process flows. It is the only temperature measuring device used in the process that produces NIST-traceable

measurement results. It is the sole source of determining a scientifically reliable temperature measurement in the CU34s. That measurement, in turn, is the only scientifically reliable basis to determine whether the CU34s are functioning properly. It is the only means by which the good working order, and thus the accuracy, of the Draeger black key and agency temperature probes can be indirectly verified.

The likelihood of an undetected miscalibration is not great, but it is reasonably plausible. Of course, that likelihood can be avoided simply by using the mandatorily required NIST-traceable thermometer in the calibration process. It might be that a miscalibration would only affect close cases. Both sides dispute this. The defense says that without the NIST-traceable thermometer, the temperature in the CU34s is unknown and has no known measure of uncertainty, as a result of which all breath test results will be unreliable. The State says miscalibrations will affect no cases because the built-in safeguards in the machine render the calibration process infallible, so even if the NIST-traceable thermometer is not used there will be no miscalibrations. As previously stated, I have rejected that assertion.

Applying the clear and convincing proof standard, the evidence presented by the State has failed to produce "a firm

belief or conviction" that the State's position, i.e. that failure to use the NIST thermometer does not undermine or call into question the scientific reliability of breath tests, is correct. Liberty Mut. Ins. Co., 186 N.J. at 169. The evidence does not persuade me that the State's position is "highly probable." In re Perskie, 207 N.J. at 290. On the contrary, I find that it is unsupported by the evidence. Most certainly the State's evidence is not "so clear, direct and weighty and convincing" to lead to a "clear conviction, without hesitancy" that the scientific reliability of breath test results without use of the NIST thermometer in the calibration process will not be undermined or called into question. Ibid.

Indeed, the testimony of one of the State's witnesses, Dr. Brettell, is a prime source of my analysis of the evidence, my determination of what the facts are based on that evidence, and my ultimate conclusions. His testimony, considered in its entirety, has been instrumental in the determinations I have made.

Based upon my findings of fact and my analysis of them, I conclude that the State has failed to clearly and convincingly prove that failure to perform the NIST thermometer step in the calibration process does not undermine and call into question the good working order of the Alcotest instrument. Skipping the

NIST thermometer step removes from the process a substantial and essential safeguard, the magnitude of which reduces the reliability of the device to a level that is less than sufficiently scientifically reliable to allow its reports to be admitted in evidence.

Respectfully submitted,

Joseph F. Lisa, P.J.A.D.
(retired and temporarily assigned
on recall)

Dated: May 4, 2018

APPENDIX I

SUPREME COURT OF NEW JERSEY
M-244/245/246 September Term 2016
078390

STATE OF NEW JERSEY,

Plaintiff-Movant,

v.

EILEEN CASSIDY,

Defendant-Respondent.

FILED
APR -7 2017
CLERK

ORDER

This matter having been opened on the State's motions, and good cause appearing; it is hereby

ORDERED that the motions for relaxation of the Rules of Court (M-244) and for direct certification (M-245) are granted, and the miscellaneous motion for a remand, appointment of a special master, and other relief (M-246) is granted, in part, as provided below; and it is further

ORDERED that the Court hereby appoints as the Special Master Judge Joseph F. Lisa, J.A.D., who is currently serving on recall as a member of Part D in the Superior Court, Appellate Division; and it is further

ORDERED that the matter is remanded to the Special Master who will consider and decide the following question, along with any other questions that the Special Master, in his discretion, deems relevant to the undertaking: "Does the failure to test the simulator solutions with the NIST-traceable digital

thermometer before calibrating an Alcotest machine undermine or call into question the scientific reliability of breath tests subsequently performed on the Alcotest machine?"; and it is further

ORDERED that the Special Master shall determine the extent of participation of any person or entity in addition to the State and defendant, Eileen Cassidy, provided that the Court hereby directs that all motions for participation in the remand must be served and filed with the Special Master on or before May 8, 2017; and it is further

ORDERED that the Special Master shall hear testimony, including expert testimony, hear the arguments of the parties, and make findings of fact and conclusions of law; and it is further

ORDERED that the State shall make arrangements to ensure that the Special Master receives transcripts of the remand proceedings conducted pursuant to this Order; and it is further

ORDERED that the Special Master shall complete and submit to the Court a written report of his findings on the question presented expeditiously following the completion of the hearing; and it is further

ORDERED that upon the filing of the Special Master's written report, the parties and other participants shall have thirty days to serve and file briefs with the Court and ten days

thereafter to file any responding briefs, and that no further submissions will be permitted unless requested by the Court; and it is further

ORDERED that upon completion of briefing, the matter shall be set down for oral argument at a date and time to be established by the Clerk of the Court; and it is further

ORDERED that jurisdiction is retained.

WITNESS, the Honorable Stuart Rabner, Chief Justice, at Trenton, this 6th day of April, 2017.

CLERK OF THE SUPREME COURT

APPENDIX II

STATE V. CASSIDY EXHIBIT LIST	
Exhibit No.	Description
S-1	Alcotest 7110 MKIII-C with Serial No. ARWC-0064
S-1A	Coordinator's bottle of 0.100% Simulator Solution
S-1B	Agency's CU34 Simulator: Serial No. DDRK S3-0017
S-1C	Agency's Alcotest 7110 Temperature Probe: Serial No. DDXK P2-301, Probe Value 103
S-1D	Coordinator's bottle of 0.040% Simulator Solution
S-1E	Coordinator's CU34 Simulator: Serial No. DDRK S3-0005 (used with 0.04% simulator solution)
S-1F	Coordinator's bottle of 0.080% Simulator Solution
S-1G	Coordinator's CU34 Simulator: Serial No. DDRF S3-0009 (used with 0.08% simulator solution)
S-1H	Coordinator's bottle of 0.160% Simulator Solution
S-1I	Coordinator's CU34 Simulator: Serial No. DDCN 0054 (used with 0.16% simulator solution)
S-1J	Black Key Temperature Probe: Serial No. DDWA P2-016, Probe Value 105
S-1K	Control Company digital thermometer (Serial No. 170428367)
S-1L	Agency's bottle of 0.100% simulator solution used for solution change
S-1M	Calibration Discovery Packet
S-1N	Card- Plug in from computer to Alcotest for data download
S-4	State of New Jersey Original Indictment of Marc Dennis dated 12/14/16 (SGJ693-16-24-S/Docket No. 16-12-00213-S)
S-4A	State of New Jersey Superseding Indictment of Marc Dennis dated 6/27/17 (SGJ702-17-17-S/ Docket No. 17-06-00118-S)

S-9B	Exhibit A from sworn statement of Dr. Thomas Brettell – Alcotest 7110 MKIII-C User Manual – Technical NJ v1.0
S-9C	Exhibit B from sworn statement of Dr. Thomas Brettell – Alcotest 7110 MKIII-C User Manual – Operator NJ v1.1
S-9D	Exhibit C from sworn statement of Dr. Thomas Brettell – Alcotest 7110 MKIII-C User Manual – Technical NJ v.1.2
S-9E	Exhibit D from sworn statement of Dr. Thomas Brettell – Report of Calibration for Ertco Hart Digital Temperature Measuring System
S-9F	Exhibit E from sworn statement of Dr. Thomas Brettell – Calibration Check Procedure for Alcotest 7110 MKIII-C
S-9G	Exhibit F from sworn statement of Dr. Thomas Brettell – Calibration Packet from Long Branch Police Department, calibration date 10/6/15 (Calibration documents, Certificates of Accuracy, Certifications of Analysis, Dennis' Coordinator Certification card)
S-9H	Exhibit G from sworn statement of Dr. Thomas Brettell – State v. Cassidy, 2017 N.J. Lexis 418 (2017)
S-9I	"Calibration Check Procedure for Alcotest 7110 MKIII-C" (a.k.a. S-32)
S-10C	Dr. Howard J. Baum, Ph.D. interoffice communication dated December 23, 2008
S-12	Verification and Adjustment of 34.00 C Water Tank (current)
S-12A	Verification and Adjustment of 34.00 C Water Tank (old)
S-12B	Simulator Temperature Probe Certification Process
S-12C	WI 19 Simulator Temperature Probe Calibration Procedure, Revision 02-2008
S-12D	WI 19 Simulator Temperature Probe Calibration Procedure, Revision 11-2015
S-13	Certificate of Calibration for Omega Digital Thermometer (Model No. HH41; Serial No. 308743) Cal Due Date 3/27/2015

S-13A	Certificate of Calibration for Omega Digital Thermometer (Model No. HH41; Serial No. 308743) Cal Due Date 2/27/2016
S-13B	Certificate of Calibration for Omega Digital Thermometer (Model No. HH41; Serial No. 301316)
S-13C	Certificate of Calibration for Omega Digital Thermometer (Model No. HH41; serial No. 308428)
S-13D	Certificate of Calibration for Fluke Multimeter (Model No. 87-5; Serial No. 99380042), dated 4/12/2014, Certificate #10475
S-13E	Certificate of Calibration for Fluke Multimeter (Model No. 87-5; Serial No. 99380042), dated 2/27/2015, Certificate #12123
S-15	Breath Alcohol Simulator Solution LOT #13I120, Date of Analysis 10/25/2013 – 0.040% simulator solution used in Spring Lake on 7/10/15
S-16	Breath Alcohol Simulator Solution LOT #13I121, Date of Analysis 10/31/2013 – 0.080% simulator solution used in Spring Lake on 7/10/15
S-17	Breath Alcohol Simulator Solution LOT #13I123, Date of Analysis 10/24/2013 – 0.100% simulator solution used in Calibration and Part I-Control Tests in Spring Lake on 7/10/15
S-18	Breath Alcohol Simulator Solution LOT #13K125, Date of Analysis 12/09/2013 – 0.100% simulator solution used in the solution change (see Calibrating Unit New Standard Solution Report) in Marlboro on 10/7/15
S-19	Breath Alcohol Simulator Solution LOT #14A126, Date of Analysis 02/18/2014 – 0.100% simulator solution used in the solution change (see Calibrating Unit New Standard Solution Report) in Long Branch on 10/6/15
S-20	Breath Alcohol Simulator LOT #14H131, Date of Analysis 08/14/2014 – 0.16% simulator solution used in Long Branch on 10/6/15 (Bottle No. 0871) and in Spring Lake on 7/10/15 (Bottle No. 1290)

S-21	Breath Alcohol Simulator Solution LOT #14L135, Date of Analysis 1/21/2015 – 0.100% simulator solution used in the solution change (see Calibrating Unit New Standard Solution Report) in Spring Lake on 7/10/15
S-22	Breath Alcohol Simulator Solution LOT #15H141, Date of Analysis 09/10/2015 – 0.040% simulator solution used in Long Branch on 10/6/15
S-23	Breath Alcohol Simulator Solution LOT #15H142, Date of Analysis 09/17/2015 – 0.080% simulator solution used in Long Branch on 10/6/15
S-24	Breath Alcohol Simulator Solution LOT #15H143, Date of Analysis 09/14/2015 – 0.100% simulator solution used in the Calibration and Part 1-Control Tests in Long Branch on 10/6/15 (Bottle No. 0320) and in Marlboro on 10/7/15 (Bottle No. 0318)
S-32	"Calibration Check Procedure for Alcotest 7110 MKIII-C"
S-33C	Certificate of Accuracy for Alcotest 7110 Temperature Probe (Serial No. DDXK P2-376, Certification date 9-2-14, Next Certification due 9-2-15) – Black Key Temperature Probe assigned to Sgt. Dennis
S-33J	Certificate of Accuracy for Alcotest 7110 Temperature Probe (Serial No. DDXK P2-376, Certification date 7-27-09, Next Certification due 7-27-10) – Black Key Temperature Probe assigned to Sgt. Dennis; Used for Spring Lake Calibration
S-34	Certificate of Accuracy for CU34 Serial No. DDXD S3-0186, Certification date 9-22-14, Re-Certification Due Date 9-22-15 (Used by Dennis in Spring Lake)
S-34A	Certificate of Accuracy for CU34 Serial No. DDXD S3-0188, Certification date 9-22-14, Re-Certification Due Date 9-22-15 (Used by Dennis in Spring Lake)
S-34B	Certificate of Accuracy for CU34 Serial No. DDXD S3-0191, Certification date 9-19-14, Re-Certification Due Date 9-19-15 (Used by Dennis in Spring Lake)
S-36	Spring Lake Police Department's Certificates of Accuracy for its CU34 (Serial No. DDYB S3-0002) & its Alcotest 7110 Temperature Probe (Serial No. DDXA P2-117)

S-36A	Certificates of Accuracy for CU34s used by Sgt. Dennis during calibration of Spring Lake's Alcotest (Serial Nos. DDXD S3-0186, DDXD S3-0188, DDXD S3-0191)
S-36B	Certificate of Accuracy for Black Key Temperature Probe used by Sgt. Dennis during calibration of Spring Lake's Alcotest (Serial No. DDXK P2-376)
S-37	Spring Lake Police Department – Alcotest 7110 Calibration Record dated 07/10/2015
S-37A	Spring Lake Police Department – Alcotest 7110 Calibration Certificate Part I – Control Tests dated 07/10/2015
S-37B	Spring Lake Police Department – Alcotest 7110 Calibration Certificate Part II – Linearity Tests dated 07/10/2015
S-37C	Spring Lake Police Department – Calibrating Unit New Standard Solution Report dated 07/10/2015
S-42	SIM Card for Video Camera Demonstration of 12/14/17 in Court Calibration (Disc)
S-44	Chun Court Order dated September 18, 2010
S-46	Chart Created by Brian Shaffer in court
S-51	Article Authored by Dr. Stolz, Ph.D.
S-53	State v. Chun dated February 13, 2007 Supreme Court finding
S-54	Federal Register vol. 82 No. 211 dated November 2, 2017
D-1	Calibration Check Procedure for Alcotest 7110 MK III-C
D-2	Interoffice Communication from Dr. Howard Baum, dated December 23, 2008
D-3	Draeger Temperature Probe
D-4	Draeger Simulator and Alcotest 7110 Temperature Probe Certificate of Accuracy, dated September 11, 2017

D-5	CU34 Simulator
D-6	Letter from Director Elie Honig to the Honorable Glenn Grant, J.A.D., dated September 19, 2016
D-7	Calibration Check Procedure for Alcotest 7110 MK III-C, marked by Brian Shaffer
D-8	Chart reflecting disagreement with State's witness, Brian Shaffer
D-9	Memorandum of Decision, Commonwealth of Massachusetts v. Evando Ananias, Christian Figueroa, and Others, Docket No. 1248 C.R. 1075 (February 16, 2017)
D-10	Control Company Traceable Certificate of Calibration for Digital Thermometer, Certification No. 4000-7019771
D-10A	Traceable Certificate of Calibration for Digital Thermometer, Certification No. 4000-7019771, marked by Brian Shaffer
D-12	The American Association for Laboratory Accreditation, P102-A2LA Policy on Measurement Traceability, dated October 22, 2008
D-13	Draeger Simulator and Alcotest 7110 Temperature Probe Certificate of Accuracy, dated September 11, 2017, marked by Howard Baum, Ph.D.
D-14	Calibration Check Procedure for Alcotest 7110 MK III-C, marked by Howard Baum, Ph.D.
D-15	Interoffice Communication from Ali Alaouie, Ph.D., dated March 13, 2013
D-16	Memorandum of Legal Advice; Alcotest 7110 MK III-C, Temperature Probe Documentation, from Deputy Attorney General Stephen H. Monson to Lt. Lou Errao, dated April 3, 2006
D-17	Supplemental Memorandum to the Alcotest 7110 MK III-C training, from DAG Monson to Alcotest 7110 MK III-C – County Prosecutor Contacts, dated August 23, 2005

D-20	Exhibit of Matthew W. Riesig, Esquire – State's Opposition to the Motion in Aid of Litigant's Rights and State's Motion in Aid of Litigant's Rights (State v. Jane H. Chun, et al.)
D-21	Exhibit of Matthew W. Reisig, Esquire – Alabama Breath Alcohol Testing Program, Operator Manual-Draeger Alcotest 7110 MK III-C
D-22	Exhibit of Matthew W. Reisig, Esquire – Alabama Department of Forensic Sciences Administrative Code, Chapter 370-1-1 Chemical Test for Intoxication
D-23	Control Company Digital Thermometer
D-24	Chart – Howard Baum's "Wrong" Exhibit
D-25	Traceable Certificate of Calibration for Digital Thermometer, Certification No. 4000-7019771, marked by Ali Alaouie, Ph.D.
D-26	Calibration Check Procedure for Alcotest 7110 MK III-C, marked by Ali Alaouie, Ph.D.
D-27	Chart reflecting Draeger Recommended Criteria versus New Jersey Required Criteria by Ali Alaouie, Ph.D.
D-33	Chart reflecting the New Jersey Supreme Court's Question
D-34	Chart reflecting Temperature Probe resistance, voltage, number, and value by Andreas Stolz, Ph.D.
D-35	Traceable Certificate of Calibration for Digital Thermometer, Certification No. 4000-7019771, marked by Andreas Stolz, Ph.D.
D-36	International Standard 17025, General Requirements for the Competence of Testing and Calibration Laboratories, Second Edition (2005)
D-37	Traceable Certificate of Calibration for Digital Thermometer, Certification No. 4000-7019771, marked by Andreas Stolz, Ph.D.
D-38	Chart reflecting software or hardware failure and temperature probe failure

A-1	NIST Policy – Supplementary Materials for NIST Policy Review
A-2	Control Company Traceable Certificate of Calibration for Digital Thermometer
A-3	Draeger CU34 and temperature probe Certificate of Accuracy exemplars

APPENDIX III

APPENDIX III

1T = transcript of July 13, 2017 case management conference

2T = transcript of August 17, 2017 case management conference

3T = transcript of September 19, 2017 case management conference

4T = transcript of October 12, 2017 case management conference

5T = transcript of November 2, 2017 case management conference

6T = transcript of December 14, 2017 demonstration (Klimik)

7T = transcript of January 3, 2018 hearing (Brettell)

8T = transcript of January 5, 2018 hearing (Brettell)

9T = transcript of January 8, 2018 hearing (Shaffer)

10T = transcript of January 9, 2018 hearing (Shaffer)

11T = transcript of January 10, 2018 hearing (Shaffer)

12T = transcript of January 11, 2018 hearing (Baum)

13T = transcript of January 16, 2018 hearing (Baum)

14T = transcript of January 17, 2018 hearing (Baum)

15T = transcript of January 18, 2018 hearing (Alaouie)

16T = transcript of January 22, 2018 hearing (Alaouie)

17T = transcript of January 24, 2018 hearing (Stolz)

18T = transcript of January 30, 2018 hearing on exhibits

19T = transcript of March 22, 2018 oral argument

APPENDIX IV

CHRISTOPHER S. PORRINO
ATTORNEY GENERAL OF NEW JERSEY
ATTORNEY FOR PLAINTIFF-MOVANT
BY: ROBERT CZEPIEL, JR.
SUPERVISING DEPUTY ATTORNEY GENERAL
PROSECUTORS SUPERVISION AND TRAINING BUREAU
DIVISION OF CRIMINAL JUSTICE
P.O. BOX 085
TRENTON, NEW JERSEY 08625
(609) 984-0941

SUPREME COURT OF NEW JERSEY
DOCKET NO. M-244/245/246
SEPTEMBER TERM 2016
078390

STATE OF NEW JERSEY,	
Plaintiff-Movant,	CRIMINAL ACTION
v.	STIPULATIONS OF FACT
EILEEN CASSIDY,	
Defendant-Respondent.	

The State hereby stipulates that for purposes of the hearing before the Special Master, the following facts are true:

1. On December 3, 2015, defendant Eileen Cassidy was arrested for DWI in Spring Lake Borough.

2. Prior to being charged with DWI, defendant provided a breath sample on Spring Lake Borough's Alcotest instrument with Serial Number ARXB 0076.

3. Spring Lake Borough's Alcotest 7110 MKIII C with Serial Number ARXB 0076 was recalibrated by Sgt. Marc Dennis on July 10, 2015.

4. Calibration records indicate that Sgt. Dennis prepared four CU 34 simulators with simulator solution prior to recalibrating Alcotest instrument with Serial Number ARXB 0076. The calibration records further indicate that one simulator contained simulator solution with an ethanol concentration of .04%; one simulator contained simulator solution with an ethanol concentration of .08%; one simulator contained simulator solution with an ethanol

concentration of .10%; and one simulator contained simulator solution with an ethanol concentration of .16%.

5. Calibration records indicate that Sgt. Dennis allowed the four simulators to heat to the required temperature of 34°C ± .2°C.

6. It cannot be corroborated whether Sgt. Dennis checked the temperature of the simulator solutions with the Control Company NIST-traceable digital thermometer after allowing the simulators to heat to the required temperature prior to beginning the recalibration of Spring Lake Borough's Alcotest instrument with Serial Number ARXB 0076 as is required by the Calibration Protocol.

7. Calibration records indicate that Sgt. Dennis performed all other required steps in the Calibration Protocol when recalibrating Spring Lake Borough's Alcotest with Serial Number ARXB 0076.

8. Calibration records demonstrate that Sgt. Dennis signed an Alcotest 7110 Calibration Record for Spring Lake Borough's Alcotest with Serial Number ARXB-0076 certifying that he performed all of the steps in the calibration protocol consistent with the Calibration Procedures established by the Chief Forensic Scientist.

9. Calibration records indicate that Sgt. Dennis signed an Alcotest 7110 Calibration Certificate for Spring Lake Borough's Alcotest with Serial Number ARXB 0076 certifying that he performed all of the steps in the calibration protocol consistent with the Calibration Procedures established by the Chief Forensic Scientist.

CHRISTOPHER S. PORRINO
ATTORNEY GENERAL OF NEW JERSEY
ATTORNEY FOR PLAINTIFF-MOVANT
BY: ROBERT CZEPIEL, JR.
SUPERVISING DEPUTY ATTORNEY GENERAL
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SUPREME COURT OF NEW JERSEY
DOCKET NO. M 244/245/246
SEPTEMBER TERM 2016
078390

STATE OF NEW JERSEY,	:	
Plaintiff-Movant,	:	CRIMINAL ACTION
v.	:	AFFIDAVIT OF SERVICE
EILEEN CASSIDY,	:	
Defendant Respondent.	:	

STATE OF NEW JERSEY :
: SS
COUNTY OF MERCER :

ROBYN B. MITCHELL, of full age, being duly sworn according to law upon her oath deposes and says:

1. I am a Deputy Attorney General in the employ of the State of New Jersey, Division of Criminal Justice, Prosecutors Supervision and Training Bureau.

2. On August 21, 2017, I did mail via Electronic Mail and Regular U.S. Mail, Stipulation of Facts, to:

Hon. Joseph F. Lisa, P.J.A.D. (retired and t/a on recall)
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Robyn Mitchell
Robyn B. Mitchell

Sworn to and subscribed
before me this 21st day
of August, 2017.

Analisa Holmes
An Attorney-At-Law of New Jersey